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JOURNAL

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SYMBOLS AND ABBREVIATIONS USED IN TEXT.

A.	Ångström units.
abs.	absolute.
a.c.	alternating current(s).
amp.	ampère(s).
amp.-hr.	ampère-hour(s).
A.W.G.	American wire-gauge.
Bé.	Baumé.
B. & S.	Brown & Sharpe (gauge).
B.H.P.	brake horse-power.
B.O.T.	Board of Trade.
B.th.u.	British thermal units.
B.T.U.	Board of Trade unit.
B.W.G.	Birmingham wire-gauge.
C.	centigrade.
cal.	calorie(s).
c.c.	cubic centimetre(s).
cg.	centigramme(s).
c.g.s.	centimetre-gramme-second.
cm.	centimetre(s).
cm.^{2}	square centimetre(s).
cm.^{3}	cubic centimetre(s).
coeff.	coefficient(s).
const.	constant(s).
c.p.	candle-power.
C.T.U.	centigrade thermal units.
cwt.	hundredweight(s).
d.	density.
d.c.	direct current(s).
dg.	decigramme(s).
diam.	diameter(s).
dm.	decimetre(s).
dm.^{2}	square decimetre(s).
dm.^{3}	cubic decimetre(s).
e.m.f.	electromotive force(s)
F.	Fahrenheit.
ft.	foot; feet.
ft.^{2}	square foot.
ft.^{3}	cubic foot.
ft.-lb.	foot-pound(s).
gall.	gallon(s).
grm.	gramme(s).
H.-F.	high-frequency.
H-ion.	hydrogen ion.
H.P.	horse-power.
H.P.-hr.	horse-power hour(s).
hr.	hour.
hrs.	hours.
in.	inch; inches.
in.^{2}	square inch.
in.^{3}	cubic inch.
in.-lb.	inch-pound(s).
I.S.W.G.	Imperial standard wire-gauge.
K.	absolute temperature (scale).
K.C.U.	kilogramme-degree-centigrade heat unit (= 3·97 B.th.u.).
kg.	kilogramme(s).
kg.m.	kilogramme-metre(s).
km.	kilometre(s).
km.^{2}	square kilometre.
kv.	kilovolt(s).
kva.	kilovolt-ampère(s).
kw.	kilowatt(s).
kw.-hr.	kilowatt-hour(s).
l.	litre(s).
lb.	pound(s).
L.-F.	low-frequency.
m.	metre(s).
m.^{2}	square metre(s).
m.^{3}	cubic metre(s).
m.amp.	milliampère(s).
max.	maximum.
mg.	milligramme(s).
mm.	millimetre(s).
mm.^{2}	square millimetre(s).
mm.^{3}	cubic millimetre(s).
m.m.f.	magnetomotive force(s).
mμ	millimicron.
m.v.	millivolt(s).
N.	normal.
N.T.P.	normal temperature and pressure.
oz.	ounce(s).
P.C.E.	pyrometric cone equivalent.
p.d.	potential difference.
p.p.m.	parts per million.
R.	Réaumur.
r.p.m.	revolutions per minute.
sp. gr.	specific gravity.
sq.	square.
v.	volt(s).
va.	volt-ampère(s).
w.	watt(s).
w.-hr.	watt-hour(s).
w.p.c.	watts per candle.
$^\circ$	degree(s) (arc or temperature).
%	per cent.
λ	wave-length.
μ	micron.
$\mu\mu$	1 millionth micron = 0·1 A.
Ω	ohm.
$'$	minute of the arc.
$''$	second of the arc.
$<$	$A < B$ denotes that A is less than B.
$>$	$A > B$ denotes that A is greater than B.
$\nless$	negative of $<$; $A \nless B$ denotes that A is not less than B.
$\leq$	combination of $<$ and $=$; $A \leq B$ denotes that A is equal to or less than B.
$\neq$	is not equal to.
$\equiv$	identically equal to.
$\simeq$	approximately (or essentially) equal to.

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METALLURGICAL ABSTRACTS

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,,	644,	,,	1.	*For* " Hervey " *read* " Harvey."
,,	650,	,,	23.*	*For* " 600° C." *read* " 800° C."
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METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

1933 JANUARY Part 1

I.—PROPERTIES OF METALS

A Unique Electrode Potential Characteristic of a Metal, and a Theory for the Mechanism of Electrode Potential [Cadmium]. A. L. McAulay and E. C. R. Spooner (*Proc. Roy. Soc.*, 1932, [A], **138**, 494–501).—For concentrations less than a definite limit, experimental results indicate that the potential of a cadmium electrode in an aqueous solution is independent of all changes in the character and constitution of the solution. It is concluded that the electrode potential must originate in interaction between the metal and water only. A theory of this result and three consequences of the theory are briefly discussed. The theory contemplates the formation of a layer of ions of thickness about 5×10^{-5} cm. surrounding the metal, the total concentration therein being about 4×10^{-5} grm.-mol. per litre. The electrode potential of cadmium in air-free dilute solutions of any sort is 0·787 v. against the saturated calomel electrode at 18° C. When an electrode is exposed to air, the potential becomes positive and unreproducible. The layer of positive ions surrounding the electrode is more concentrated in this case, and to this, and not to the formation of an impervious film, the change of potential is attributable.—J. S. G. T.

The Relaxation Time of Annealed Copper and Aluminium Wires Subjected to Torsional Oscillations. Dankwart Schenk (*Z. Physik*, 1932, **78**, 470–478).—[*Note by Abstractor:* The relaxation time of a material, *e.g.* of a wire, is related to the damping of vibration in the material. If torsional oscillations of respective frequencies N_1 and N_2 are characterized by logarithmic decrements D_1 and D_2 for equal strains, then the relaxation time, $1/R$, is given by $1/R = \pi(D_1 - D_2)/2(N_1D_1 - N_2D_2)$. The relaxation time of brass is about 1/1500 second; its value for Duralumin is about 1/750 second, for Elektron, about 1/100 second.] The relaxation times of copper and aluminium wires subjected, after annealing, to torsional oscillations are found to depend on the amplitude of the oscillations and on the annealing temperature. Values of $1/R$ for copper range from 1/220 to 1/140 second. Results with aluminium wires were not so reproducible as in the case of copper wires. This result is probably associated with irregularity of the recrystallization process in aluminium, and with the presence of impurities. The results are interpreted in terms of structural changes occurring in the wires. Torsional oscillations are accompanied by motion within single crystals and motion of the crystals themselves. R depends on the relative importance of these two modes of motion.—J. S. G. T.

Null-Point for Charges on Copper and Silver. M. A. Proskurnin (*Zhurnal Fizicheskoy Khimii* (*Journal of Physical Chemistry*), 1932, [W], **3**, (1), 91–96).—[In Russian.] Two methods are described, based on the observation of the e.m.f. generated by the change in ionic concentration in solution due to adsorption on the clean surface of the metal. Copper is found to have a null-point at − 0·32 v., and silver at + 0·23 v. against the N-calomel electrode. These values differ markedly from that found for mercury (− 0·50 v.) by the electrocapillary method. The method of treatment of the surface has an important influence on the null-point.—N. A.

The Passivity of Gold. William James Shutt and Arthur Walton (*Trans. Faraday Soc.*, 1932, **28**, 740–752).—The time required for the potential of a passivated gold anode to fall to normal during spontaneous reactivation in acid chloride solutions has been determined under conditions which preclude the possibility of direct electrical polarization. The high temperature coeff. of the rate of recovery suggests that the process of recovery is not controlled by simple solution of the film and diffusion of the products, but by a chemical reaction. Assuming that the film is a peroxide, to which assumption all the evidence points, this reaction would appear to be the formation of chlorine and auric oxide from hydrochloric acid and the peroxide and the subsequent dissolution of the auric oxide in the acid.—A. R. P.

Thermal Expansion of Lead. Peter Hidnert and W. T. Sweeney (*U.S. Bur. Stand. J. Research*, 1932, **9**, 703–709; *Research Paper* No. 500).—Measurements have been made on the linear thermal expansion of 3 samples of cast lead between room temperature and 300° C. and the results have been correlated with data obtained by other investigators between the years 1740 and 1931. A curve has been derived which shows the linear thermal expansion of lead between – 253° C. and + 300° C. Average coeff. of expansion for various temperature ranges between –250° C. and +300° C. as derived from the expansion curve are as follow ($\times 10^{-6}$): – 250° to + 20° C., 25·1; – 200° to + 20° C., 26·5; – 100° to 20° C., 28·3; + 20° to 60° C., 28·8; 20° to 100° C., 29·1; 20° to 200° C., 30·0; 20° to 300° C., 31·3. A comparison of the indirect results obtained by Kopp and Matthiessen with the direct data obtained by other observers indicates that lead expands the same in all directions.—S. G.

The Chamber Process. XXIII.—Physical and Mechanical Tests of Sheet Lead. Mototarō Matsui and Hirondo Katō (*Kōgyō Kwagaku Zasshi* (*J. Soc. Chem. Ind., Japan*), 1932, **35**, (7), 304B–306B).—[In Japanese, with English summary in supplemental binding.] The lead sheets tested were the following (trade names): (1) Tadanac (Canada), technically pure, 99·99%; (2) B.M. (Burma), technically pure; (3) Selby (U.S.A.) technically pure, 99·98 + %; (4) Selby (U.S.A.), lead 95, antimony 5%; (5) unknown origin, lead 99·299, zinc 0·188%, trace of arsenic, bismuth, aluminium, iron, etc.; (6) Tadanac (Canada), bismuth 4–5, copper 1%; (7) Tadanac (Canada), lead 99·987%. The samples had $d =$ (1) 11·36, (2, 3, 6) 11·38, (4) 11·21, (5) 11·35, and (7) 11·37 and a Brinell hardness of (1) 2·88, (2) 2·71, (3) 3·03, (4) 4·76, (5, 6) 3·20. The tensile strengths in kg./cm.^{2} were 152, 152, 155, 249, 160, and 183 and the elongations 40, 58, 66, 75·5, 57·5, and 52·5% for samples nos. 1–6, respectively. The melting points of samples 1–7 were 328·1, 327·5, 327·6, 308·9, 327·6, 324·7, and 328·1° C. and the flash points in sulphuric acid 273, 287, 252, 270, 292, 300, and 270° C.—A. R. P.

Study of the Absorption of Gases by Metallic Magnesium and Calcium. V. P. Saraev (*Zhurnal Tehnicheskoy Fiziki* (*Journal of Technical Physics*), 1932, [B], **2**, (5), 442–449).—[In Russian.] The absorption of the residual gas in electric bulbs by powdered metals has for long been a common industrial practice, but a detailed study of the mechanism of gas absorption has not yet been made. In the present work the absorption of gases by magnesium and calcium, of various degrees of fineness, has been investigated. Absorption is intensified by ionization, in the absence of which nitrogen and hydrogen are not absorbed by magnesium. In the case of calcium the rate of disappearance of the neutral molecules of nitrogen increases with increase in the rate of pulverization of the metal. With rise in temperature magnesium gives up the absorbed gas, but with calcium the rate of absorption is greatly increased.
—N. A.

The Electrical Resistance and the Critical Point of Mercury. Francis Birch (*Phys. Rev.*, 1932, [ii], **41**, 640–648).—The relative resistance of liquid mercury compared with its value at 0° C. and 1 atm. pressure has been measured between 0° C. and 1200° C., and 1 and 4000 atm.; values are also given for the instantaneous pressure and temperature coeff. of resistance, and a few measurements were made at higher pressures. All these quantities increase with rising temperature, and decrease with rising pressure. By assuming that below the liquid–vapour critical point the passage through the boiling point will be accompanied by a discontinuous change in resistance whilst above the critical point the curve will be continuous, it is estimated that the critical point is at 1460 ± 20° C. and 1640 ± 50 kg./cm.^{2}. A bibliography of the literature concerning the critical constants of mercury is given.—W. H.-R.

The Effect of Strain on Magnetostriction and Magnetization in Nickel. C. W. Heaps (*Phys. Rev.*, 1932, [ii], **42**, 108–118).—Magnetic and magnetostrictive hysteresis loops have been obtained for pure annealed nickel wire by a heterodyne beat method. The magnetostrictive contraction $\frac{dL}{L}$ for both tensions 6·82 and 3·70 kg./mm.^{2} is given accurately by the same equation $dL/L = -1{\cdot}93 \times 10^{-10} I^2$ where I is the intensity of magnetization. For a tension of 0·72 kg./mm.^{2}, the equation $dL/L = 1{\cdot}30 \times 10^{-10} I^2$ holds less accurately. The curves for different tensions cross at large values of the magnetic field H, so that tension decreases the magnetostriction in small fields, but increases it in large fields. The fact that the same equation holds for both the larger tensions is explained by theories (Becker and Kersten, *Z. Physik*, 1930, **64**, 665) which suppose that tension tends to orientate the atomic magnets across the axis of tension; tensions of 3·70 and 6·82 kg./mm.^{2} produce complete transverse orientation, whilst one of 0·72 kg./mm.^{2} leaves the atomic magnets essentially at random orientation. Experiments with commercial nickel wire bent into a circular arc are also described. This gives one half of the wire in tension and the other in compression, and at certain field strengths the magnetization becomes very unstable. It is shown that this explains both the large discontinuities in the magnetization curves of Forrer (*J. Physique*, 1926, **7**, 109; 1929, **10**, 247) and the smaller Barkhausen effects.—W. H.-R.

The Relative Permeability of Iron, Nickel, and Permalloy in High-Frequency Electromagnetic Fields. Edwin Michael Guyer (*J. Franklin Inst.*, 1932, **213**, 75–88).—Based on the experimental measurements described in the paper, it is concluded that there is no anomalous variation in the relative permeability of iron, nickel, and Permalloy at frequencies corresponding with the band of wave-lengths from 70 to 200 m. The results are contrary to those of certain other workers.—S. V. W.

The Exact Measurement of the Specific Heats of Solid Substances at High Temperatures. VI.—Metals in Stabilized and Non-Stabilized Condition: Platinum and Silver. F. M. Jaeger, E. Rosenbohm, and J. A. Bottema (*Proc. K. Akad. Wet. Amsterdam*, 1932, **35**, 763–771).—[In English.] Irreproducible results are obtained for the sp. heat of platinum unless the metal is first heated to 1600° C. and slowly cooled. This treatment has the effect of bringing the metal into a stable condition, but bears no relation to any allotropic change. The true sp. heat of stable platinum between 0° and 1400° C. can be calculated from the relation $c_p = 0{\cdot}031678 + 0{\cdot}630574 \times 10^{-5}t - 0{\cdot}1624878 \times 10^{-9}t^2$, and that of hammered platinum (0°–1100° C.) from $c_p = 0{\cdot}031509 + 0{\cdot}719102 \times 10^{-5}t - 0{\cdot}94672 \times 10^{-9}t^2$. The true sp. heat (0°–800° C.) of cast silver is given by $c_p = 0{\cdot}055614 + 0{\cdot}1600766 \times 10^{-4}t - 0{\cdot}47223 \times 10^{-8}t^2$, and that of cold-plated silver by $c_p = 0{\cdot}055936 + 0{\cdot}105607 \times 10^{-4}t + 0{\cdot}18165 \times 10^{-8}t^2$. Comparison with values recorded in the literature shows that the divergent results are due to working with non-stabilized metals.—E. S. H.

The Exact Measurement of the Specific Heats of Solid Substances at High Temperatures. VII.—Metals in Stabilized and Non-Stabilized Condition: Copper and Gold. F. M. Jaeger, E. Rosenbohm, and J. A. Bottema (*Proc. K. Akad. Wet. Amsterdam*, 1932, **35**, 772–779).—[In English.] Cf. preceding abstract. Stabilized, cast copper has a true sp. heat given by $c_p = 0{\cdot}092597 + 0{\cdot}20832 \times 10^{-4}t$, whilst the unstabilized, cold-rolled metal has $c_p = 0{\cdot}093835 + 0{\cdot}20684 \times 10^{-4}t$. After heating in a vacuum at 1050° C.

for 5 hrs. and cooling slowly, the rolled copper gives a value corresponding with that of stabilized copper. Gold which has been melted and then cooled gives $c_p = 0{\cdot}03123 + 0{\cdot}16635 \times 10^{-5}t + 0{\cdot}46558 \times 10^{-8}t^2$, whilst cold-plated gold gives $c_p = 0{\cdot}031341 + 0{\cdot}93886 \times 10^{-6}t + 0{\cdot}5127 \times 10^{-8}t^2$. It is inferred that no general prediction can be made as to the direction in which the sp. heats of worked and annealed metals will be changed.—E. S. H.

On the Behaviour of Polonium During the Crystallization of Metals. G. Tammann and A. v. Löwis of Menar (*Z. anorg. Chem.*, 1932, **205**, 145–162).—Even minute quantities of radioactive elements may be detected in metals by the aid of the photographic plate. Polonium during the crystallization of a metal collects in the polyeutectic, and with it is displaced towards the grain boundaries in which it finally collects. No polonium is ever found along the boundaries of recrystallization grains. From the width of the blackened areas on the plate it is deduced that the polonium occurs in monomolecular layers. The solid solubility of polonium in silver, tin, bismuth, zinc, cadmium, copper, antimony, and tellurium is of the order of $2{\cdot}31 - 5{\cdot}28 \times 10^{-11}$ %. In contrast to tellurium, polonium forms no intermetallic compounds; it is also practically insoluble in tellurides. In the crystallization of metals containing polonium, separation of this element begins at temperatures considerably higher than the melting point of the polyeutectic.—B. Bl.

On the Degassing of Tantalum. N. S. Ivanov (*Zhurnal eksperimentalnoy i teoreticheskoy Fiziki* (*Journal of Experimental and Theoretical Physics*), 1932, [A], **2**, (3), 162–170).—[In Russian.] Hydrogen on the surface of red-hot tantalum undergoes dissociation. As the result of this, the hydrogen which is given off is adsorbed up to a limit of $2{\cdot}4$–$3{\cdot}6 \times 10^{15}$ atoms/cm.^{2} on the surfaces of cold, clean glass vessels. If these are heated to 250° C. they no longer adsorb hydrogen.—N. A.

On the Change of the Specific Heat of Tin when Becoming Supra-Conductive. W. H. Keesom and J. A. Kok (*Proc. K. Akad. Wet. Amsterdam*, 1932, **35**, 743–748).—[In English.] Between 3·70 and 3·72° K. the atomic heat of tin decreases from 0·0078 to 0·0054. The exact temperature at which the change occurs agrees to within 0·01° C. with the transition to the superconducting state. That the specific heat change is connected with the phenomenon of superconductivity is shown by the fact that a magnetic field which impedes the occurrence of superconductivity also prevents the change in specific heat. There is no heat of transformation connected with the change to the superconducting state.—E. S. H.

Behaviour of Vanadium and Vanadium–Iron Alloys towards Hydrogen. L. Kirschfeld and A. Sieverts (*Z. Elektrochem.*, 1930, **36**, 123–129; *C. Abs.*, 1930, **24**, 2093).—Absorption of hydrogen by vanadium (99%) at 1 atm. decreases with temperature from about 150 c.c. per grm. at 18° C. sharply to 38·3 c.c. at 400° C. and then more slowly to 2·7 c.c. at 1000° C. Impurities lower the values. This indicates 946 volumes of hydrogen per atom of vanadium, values similar to palladium–hydrogen. The saturated metal is yellow and darkens in the air. The hydrogen pressure curves by absorption and evolution are given for various temperatures and follow $m = k\sqrt{P}$ at 400° C., 600° C., and 800° C. A 9·1% ferro-vanadium goes through a minimum at 700° C. and above that the curve is similar to that of iron–hydrogen. A 22% ferro-vanadium remains much higher, has a minimum at 900° C. and above that parallels iron–hydrogen. A 70% ferro-vanadium does not saturate readily but parallels the vanadium curve. The curves show a two-component character and the higher the temperature the more closely the curve approaches a sum of the properties of the iron and vanadium present.—S. G.

The Photo-Electric Properties of Alkali Metal Films as a Function of their Thickness. James J. Brady (*Phys. Rev.*, 1932, [ii], **41**, 613–626).—Thin films of alkali metals were deposited upon a silver surface in a high vacuum by means of a molecular beam under conditions in which the thickness of the film could be estimated. The effect of the thickness of the film upon the photo-electric properties was then examined. With cæsium, rubidium, and potassium the general effect is that a maximum threshold wave-length occurs at a thickness of a few (1·5 to 3) molecular layers, and a maximum total photo-electric emission in thicker (5 to 12) molecular layers, whilst final stable conditions are reached at a thickness of the order 12–20 molecular layers, the exact values varying with the metal. Sodium behaved quite anomalously. The results are discussed in terms of the Sommerfeld theory, the adsorbed alkali metal affecting the potential wall at the surface. It is concluded that the first few alkali atoms are adsorbed as ions and the later ones as neutral atoms.—W. H.-R.

Plasticity and Creep in Metals. Harold Jeffreys (*Proc. Roy. Soc.*, 1932, [A], **138**, 283–297).—The equations of plastic flow are derived mathematically; a theory of creep and its relation to experimental results are discussed.—J. T.

Mechanism of Plasticity (Preliminary Communication). N. Seljakov (*Zhurnal eksperimentalnoy i teoreticheskoy Fiziki* (*Journal of Experimental and Theoretical Physics*), 1932, [A], **2**, (2), 140).—[In Russian.] Cf. this *J.*, 1932, **50**, 597. In plastic deformation, the regions adjoining the planes along which slip has occurred show a change in the symmetry of the crystal lattice which, in the case of cubic lattices, is associated with a lowering of the symmetry of the lattice, due to elastic slip along the planes in the direction of the deformation.—N. A.

Cold Deformation, Crystal Recovery, and Recrystallization [of Metals]. H. Reischauer and F. Sauerwald (*Metallwirtschaft*, 1932, **11**, 579–581, 591–593, 604–607).—A review, with lengthy bibliography, of the deformation of metal crystals, the effect of temperature and purity on the deformation process, the change in physical properties on deforming single and poly-crystals, internal stress, crystal recovery, the formation of nuclei, and grain growth in recrystallization, and the structure of deformed and recrystallized metals.—v. G.

On the Dependence of the Endurance Strength on the Crystal Orientation. W. Fahrenhorst, K. Matthaes, and E. Schmidt (*Z.V.d.I.*, 1932, **76**, 797).—Fatigue tests in the alternating bending machine of the DVL have been made on specimens cut in different directions from a sheet of electrolytic copper recrystallized by annealing, so that the crystallites are oriented parallel to one another with a cube plane parallel to the surface of the sheet and a cube direction parallel to the direction of rolling. The endurance limit (10^6 alternations) follows closely the tensile strength, *i.e.* it is the same in directions at 0° and 90° to the cube direction, reaches a maximum at 45° and a minimum at 15° and 75° thereto. Edge deformation is a minimum at 45°. The elastic anisotropy of this type of sheet corresponds completely with the anisotropy of single copper crystals. Rolled but unannealed sheets show at least a qualitative agreement with the behaviour of single crystals.—v. G.

On the Indefiniteness of the Tensile Limits. Adolf Smekal (*Metallwirtschaft*, 1932, **11**, 551–554, 565–567).—The yield-point of sodium chloride crystals is a sharply defined constant of the crystal, whilst the tensile strength has a distribution function the course of which depends on the state of the material. In applying these results to metal crystals, the effect of heat movement must be taken into consideration.—v. G.

On the Change of Hardness of a Plate, Caused by Bending. Sadajirô Kokubo (*Kinzoku no Kenkyu*, 1932, **9**, (10), 447–456).—[In Japanese.] The change of hardness of a plate caused by bending, was measured by means of the Vickers hardness tester. The materials used were Armco iron, 0·2 and 0·7% carbon-steels, copper, brass, aluminium, Duralumin, and magnesium. The hardness-bending curves show that, in cold-rolled specimens, the hardness on the convex side of the plate decreases decidedly at first and then somewhat slowly with increasing bending of the specimen, while on the concave side it increases only slightly. In annealed specimens the hardness on the convex side decreases at first, and then, after passing through a minimum, it increases slightly with increased bending of the specimen; on the concave side the hardness increases gradually with an increased degree of bending. These changes of hardness are satisfactorily explained as the combined effect of the applied stress and the work-hardening caused by the bending of the specimens. —S. G.

On the Effect of Torsion on the Density, the Dimensions, and the Electrical Resistance of Metals. Tarô Uéda (*Kinzoku no Kenkyu*), 1932, **9**, (10), 417–446).—[In Japanese.] The change of the density, dimensions, and electrical resistance in Armco iron, Swedish steels, brass, nickel, and copper when twisted in a torsion machine were measured. The densities of iron and steel decrease with twisting and their rate of decrease is considerable up to the yield-point. The length of the specimens increases slightly with the angle of twist, but beyond the yield-point the elongation becomes greater and greater. The electrical resistance increases as the angle of twist increases, and up to the yield-point its rate of increase is very large, this change being quite similar to that of the shear stress. In the case of copper and brass, these changes are in general similar to those for iron and steel, but for brass the rate of change is very large and for copper very small. They increase continuously from the beginning of torsion, and no such abrupt change is observed as in iron and steel. For nickel the change is very large at the beginning of torsion, but from this point it increases only slowly.—S. G.

Micrometal Trees. Walther Haas (*Wiss. Mitt. Österr. Heilmittelstelle*, **1930**, (10), 10–12; *Chem. Zentr.*, 1931, **102**, II, 1109; *C. Abs.*, 1932, **26**, 4259).—The phenomena to be observed when salt solutions are electrolyzed between platinum wires are described. Photographs of trees of lead, thallium, silver and copper are shown.—S. G.

The Diffusion of Metals in the Solid State. G. Grube and A. Jedele (*Z. Elektrochem.*, 1932, **38**, 799–807).—Cast cylinders of pure nickel and of nickel containing manganese 0·5% were drawn to 5·5 mm. diam. and copper-plated. After various periods of time at 1000°–1025° C. in a hydrogen atmosphere, thin layers were removed and analyzed electrolytically for copper and nickel. The diffusion coeff., D, is given by $\frac{C_0 - c}{c} = \phi\left(\frac{z}{2\sqrt{Dt}}\right)$, where C_0 = initial concentration (50%), c = result of analysis, t = time in days, z = depth of penetration, in cm., and ϕ = Gauss's error integral. The diffusion of nickel into copper in the solid state is more rapid than that of copper into nickel. In copper–nickel solid solutions, the diffusion rate is constant with increasing copper content. In the nickel-rich alloys, D = about 1×10^{-5} cm.^{2}/day, and in the copper-rich alloys about 4×10^{-5} cm.^{2}/day. With manganiferous nickel, the diffusion rate of copper is lower, being about $0{\cdot}3 \times 10^{-5}$ cm.^{2}/day at the above temperatures. The diffusion rate is greater the nearer the temperature is to the solidification temperature of the alloy. The greatest resistance to corrosion in ammonium carbonate solutions containing hydrogen peroxide occurs with the alloy containing 30 atomic-% nickel. Both components are attacked by sulphuric acid solutions containing potassium chlorate. Corrosion cracks increase with increasing nickel content up to 75–80 atomic-% nickel, owing to the fact that the magnetic α-phase is less attacked than the non-magnetic β.—J. H. W.

Diffusion. W. Rosenhain (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 125–126).—Theories of diffusion are briefly reviewed. The simple kinetic theory does not appear tenable in view of knowledge of the behaviour of atoms on close-packed lattices, and the "slip theory" is accordingly again put forward as a working hypothesis which explains the outstanding facts.—R. G.

On the Heats of Formation of Nitrides. III.—The Heats of Solution of Some Metals and Metal Nitrides in Acids. B. Neumann, C. Kröger, and H. Kunz (*Z. anorg. Chem.*, 1932, **207**, 133–144).—The heats of solution of chromium, magnesium, cerium, lanthanum, magnesium nitride Mg_3N_2, cerium nitride CeN, and lanthanum nitride LaN in 1 : 20 hydrochloric acid and of manganese nitride Mn_5N_2 in 1 : 12·7 sulphuric acid were determined.—M. H.

A Method of Measuring Very Small Vapour Pressures with the Torsion Balance. Kurt Neumann and Ernst Völker (*Z. physikal. Chem.*, 1932, [*A*], **161**, 33–45).—The vapour pressure of mercury between 16° and 70° C. and of potassium between 145° and 200° C. has been determined.—B. Bl.

Tribo-Electricity and Friction. VII.—Quantitative Results for Metals and Other Solid Elements with Silica. P. E. Shaw and E. W. L. Leavey (*Proc. Roy. Soc.*, 1932, [A], **138**, 502–514).—The development of electrification by rubbing pure metals (purity greater than 99·7%) including gold, platinum, silver, copper, iron, nickel, aluminium, tin, cadmium, antimony, chromium, and metals of commercial purity, including lead, zinc, bismuth, cobalt, thallium, and selenium against silica, is investigated experimentally and a theory of the phenomenon is developed. Ten factors are involved, and of these, a group of two, associated with the generation of the Volta contact effect, is paramount for most elements but not for all.—J. S. G. T.

The Theory of Metals.—I. A. H. Wilson (*Proc. Roy. Soc.*, 1932, [A], **138**, 594–606).—Interaction between electronic motions and nuclear vibrations in a metal is discussed theoretically. The " mean free path " of the electrons is evaluated, and existing theories of conduction are critically examined. The refinements introduced by Peierls are considered unnecessary; their omission simplifies the theory.—J. S. G. T.

The [Electrical] Resistivity of Polycrystalline Wires in Relation to Plastic Deformation, and the Mechanism of Plastic Flow. E. N. da C. Andrade and B. Chalmers (*Proc. Roy. Soc.*, 1932, [A], **138**, 348–374).—The specific electrical resistance of certain typical metals, including cadmium, copper, aluminium, and tin, has been determined at various stages of plastic flow under large stresses, and it has been shown that the resistance of metals which crystallize in the cubic system is unaffected by the flow. The specific resistance of metals which crystallize with a unique axis of symmetry does not change during two of the three stages into which the flow can be analyzed, viz. during the initial immediate extension and the final flow at constant rate. During the intermediate stage of flow at diminishing rate, called the β-flow, the specific resistance changes by about 2% in extreme cases. The results are interpreted on the assumption that the crystallites slip, with consequent rotation of the unique axis, during the β-flow. On this hypothesis, an increase of specific resistance with extension is to be anticipated in the case of metals the crystals of which have slip planes parallel to the unique axis. In the case of crystallites having slip planes normal to the unique axis, there should occur a decrease of specific resistance on extension, in those cases where the resistance is greatest along the unique axis. The theory is supported by results obtained at low temperatures when marked immediate stretch occurs but no β-stretch. In these circumstances an increase of resistance is obtained with cadmium while a decrease occurs at ordinary temperatures. This increase is attributable to extensive twinning.—J. S. G. T.

On the Electrical Properties of the Group of So-Called " Semi-Conductors." A. Schulze (*Helios* (*Fachzeit.*), 1932, **38**, 201–204, 211–213).—The electrical behaviour of the semi-conductors, silicon, graphite, titanium, zirconium, hafnium, thorium, germanium, boron, arsenic, and tellurium are discussed with reference to the literature. It is pointed out that, so far as investigations have been made, single crystals of these substances have a metallic conductivity, so that the negative temperature coeff. of polycrystalline material is to be attributed to a grain boundary effect.—v. G.

Barkhausen Effect. III.—Nature of Change of Magnetization in Elementary Domains. Richard M. Bozorth and Joy F. Dillinger (*Phys. Rev.*, 1932, [ii], **41**, 345–355).—The small sudden changes in magnetic moment which occur when a metal is magnetized have components both parallel and perpendicular to the direction of the magnetic field. The latter effect is detected for the first time with annealed and hard-worked iron, and annealed Perminvar containing iron 30, cobalt 25, nickel 45%, with 0·1% silicon as impurity. The relative importance of the two effects depends on the material, and on the degree of magnetization of the specimen as a whole. The new transverse effect is relatively small when the magnetizing field H is less than the coercive force, and may be equal to or greater than the longitudinal effect when the magnetization of the material approaches saturation. The data are interpreted in terms of the domain theory, and suggest that magnetic materials are divided into small domains, each of which is magnetized to saturation, the magnetization being controlled in some domains by strain, and in others by the crystal lattice, the relative effect of strain being increased by cold-work. Perminvar shows peculiarities, and may be a mixture of two magnetic materials.—W. H.-R.

On Ferromagnetism and Related Problems of the Theory of Electrons. Paul S. Epstein (*Phys. Rev.*, 1932, [ii], **41**, 91–109).—Theoretical. Starting with the theory of Slater (this *J.*, 1930, **44**, 468) concerning cohesion in metals, the electronic theory of homopolar bonds in metallic crystals is developed for both magnetic and non-magnetic elements. As suggested by Heisenberg, the Pauli exclusion principle influences the orientation of the spins of the valency electrons, and the deciding factor is the sign of the Heitler–London interchange integral J_1. Materials with large negative values of J_1 are non-magnetic, those with small values (either + or —) of J_1 are paramagnetic, and those with large positive values may be ferromagnetic. The theory of Bloch (*Z. Physik*, 1928, **52**, 555; 1930, **59**, 208; **61**, 206; 1932, **74**, 295) is confirmed for non-magnetic metals, but E.'s results for magnetic metals are different and new. The new theory demands the existence of a block structure in ferromagnetic metals, the blocks being in a state of permanent spontaneous magnetization, the polarity of which changes frequently, its direction being related to the crystallographic axes, although this relation is ignored in the calculations. At low temperatures the sp. heat of a magnetic metal is given by $c = 0{\cdot}208sR(T/\theta)^{3/2}$, where R is the gas constant, s the number of valency electrons per atom, and θ is closely related to the Curie point.—W. H.-R.

The Ferromagnetic Moments of the Elements and the Periodic System. Charles Sadron (*Ann. Physique*, 1932, [x], **17**, 371–452).—The magnetic properties of binary alloys of nickel and of cobalt have been examined as a function of the percentage composition; only those alloys in which simple solid solutions are formed have been studied. The behaviour of manganese–nickel and manganese–cobalt alloys suggests that the atoms of manganese are oriented in a direction parallel to that of the surrounding ferromagnetic atoms, and on the basis of this hypothesis a moment of 15·0 magnetons is attributed to the manganese atom. By extension of the hypothesis the atomic moments of 15 other metals have been determined. For the elements in any one column of the periodic table the atomic moment is constant. For the metals from copper to vanadium in the first long period, the atomic moment increases with increasing atomic number according to a linear law, the increment being 5·25 magnetons, whilst for those from vanadium to nickel the rate of change is linear but negative, and amounts to — 4·0 magnetons.—H. F. G.

Experiments on the Nature of Ferromagnetism. Francis Bitter (*Phys. Rev.*, 1932, [ii], **41**, 507–515).—The presence of irregularities in ferromagnetic crystals has been detected by allowing a fine suspension of ferric oxide particles in ethyl acetate to settle on the surface of carefully prepared crystals. Experiments were made both with and without an applied field on crystals of iron, cobalt, nickel, and of alloys of iron with silicon or nickel. On crystals of cobalt straight lines are obtained on some crystals, whilst others give spotty patterns in which the spots tend [to form a hexagonal array. The general tendency is to form line patterns in which the lines can appear in 3 directions in each crystal of iron, 4 in nickel, but only 1 in cobalt. It is suggested that the patterns are somehow related to the three (100) axes in iron, the four (111) axes in nickel, and the single (0001) axis in cobalt, and it is significant that in each case the axis mentioned is the direction of easiest magnetization. The patterns are readily destroyed by surface strains.—W. H.-R.

II.—PROPERTIES OF ALLOYS

Preparation of Single Crystals of Duralumin, Tin–Bronze and " Aluminium–Bronze " and the Study of their Properties. M. P. Slavinsky and A. P. Belaiev (*Metallurg* (*The Metallurgist*), 1931, 7, (1), 3–19).—[In Russian.] Former work on the production and properties of single crystals of aluminium and its alloys is summarized. Owing to the inconclusive nature of existing data and the possibility of practical value resulting from changes in properties (*e.g.* electrical conductivity), single crystals of pure aluminium and Duralumin were prepared and investigated. The specimens were obtained both by very slow cooling of castings and also by repeated work-hardening and normalizing. With Duralumin the first method gave a structure showing large inclusions of $CuAl_2$, only a very small proportion of the copper remaining in the solid solution. The mechanical properties were poor and showed nothing of note. The second method did not give a single crystal and had no marked influence on the properties. Slow cooling of tin–bronze (with or without additions of zinc and phosphorus) and "aluminium–bronze" produced a dendritic structure, which, nevertheless, was monocrystalline in type, except when liquation phenomena could take place. Specimens of these alloys obtained by rapid cooling and consisting of several crystal grains were converted into a condition approximating to single crystals by annealing, with a resulting decrease in mechanical properties as is sometimes observed on annealing castings which have been made under certain conditions of cooling. Finally, the process of recrystallization by work-hardening and annealing gives these alloys a single crystal structure which is, however, not identical with that obtained by very slow cooling from the molten condition.—M. Z.

Strength Tests on Thin-Walled Duralumin Cylinders in Torsion. Eugene E. Lundquist (*U.S. Nat. Advis. Cttee. Aeronautics, Tech. Note* No. **427**, 1932, 1–8, and appended plates and diagrams).—Torsion tests on Duralumin cylinders of specified dimensions are described. The influence of the ratios length/radius and radius/thickness on the type of failure is discussed, and an equation for calculating the shearing stress at failure is given, in the form: $S_s = K_sE\Big/\left(\frac{r}{t}\right)n$, where n is a constant for any given material, K_s varies with the length/radius ratio $\frac{l}{r}$, E is the modulus of elasticity, r the radius, and t the thickness of the cylinder. In this case, the tentative value of 1·35 is assumed for n, and corresponding values of K_s and r are given. The formation, direction, and number of shearing wrinkles and the influence of slight imperfections are discussed.—P. M. C. R.

Hardening of Non-Ferrous Alloys. V. Christiansen (*Teknisk Tids.*, Uppl. C, *Bergsvetenskap.* **61**, 1931, 39–43, 47–53; *C. Abs.*, 1932, **26**, 5285).—The principles and courses of the hardening processes for non-ferrous alloys on annealing are described. The theory of the "critical dispersion" of $CuAl_2$ crystals in Duralumin during its after-hardening at room temperature is discussed and criticized. Such a separation of crystals could not be detected microscopically or by X-ray methods, neither could changes in the solid solution parameter be observed nor indications of new interferences originating from new kinds of crystals. A series of new observations also offers difficulties in applying the simple explanation of the dispersion theory. In a solid solution of two metals, as, for example, of copper and aluminium in Duralumin, the electrical resistance should decrease if a separation in one form or another takes place, because the main constituent is thereby rendered purer. During the process of hardening Duralumin at room temperature the electrical resistance generally increases. It is difficult to explain the fact that when Duralumin and other alloys are first permitted to harden at room temperature for a certain time after quenching and later at higher temperatures, a decrease in hardness will first take place, after which the hardness increases faster and to a higher degree than before. The mechanical properties of alloys of the Duralumin type and the changes in these resulting from different hardening processes are described. The effects of the presence of magnesium, lithium, manganese, and silicon in such alloys are discussed. A series of alloys with copper as the main constituent, such as copper–beryllium alloys and Corson and Heusler alloys; their hardening processes; mechanical, electrical, and chemical properties, are described. A number of "noble" metal alloys capable of being hardened are also discussed.—S. G.

Contribution to the Study of Aluminium–Iron–Chromium Alloys.—II. Ch. Taillander (*Rev. Mét.*, 1932, **29**, 348–356).—Cf. this *J.*, 1932, **50**, 600. Metallographic investigations and mechanical tests are described. The latter include tensile tests, notched-bar tests, and hardness tests at normal and at elevated temperatures. The alloys contained up to 2·29% of chromium and 4·18% of iron. Thermal analysis and micrographic analysis indicate a ternary eutectic at 2% of chromium and 1% of iron. Dilatation tests indicate diminution by iron and chromium. 2 to 2·5% of iron and chromium may be introduced into aluminium without rendering it very brittle. The maximum tensile stress and notched-bar values are improved. In this range of composition the alloys retain the white colour of aluminium.—H. S.

Binary Aluminium–Manganese Alloys. M. Bosshard (*Light Metals Research*, 1932, **2**, (11), 9–10).—The tensile strength, elongation, and electrical conductivity of aluminium–manganese alloys containing 0·5–3·5% of manganese have been determined. Values are tabulated for sheet 1 mm. and 2 mm. thick. The sheet was reduced 80–90% by cold-rolling after an intermediate anneal at 420° C. The tensile strength was increased by the addition of manganese up to 1·4%, after which further additions had little effect. The conductivity was reduced by manganese, the effect being less pronounced after the addition of 1·4% manganese. The behaviour of the alloys during hot- and cold-rolling was similar to that of aluminium. The corrosion-resistance of those with more than 1% manganese was found to be superior to that of 99·5% aluminium when tested by both Mylius's tests.—J. C. C.

Aluminium–Silicon Alloys.—I. —— Broniewski and —— Smialowski (*Rev. Mét.*, 1932, **29**, 542–552).—The methods of investigation employed include thermal analysis, electrical resistivity, thermoelectric force, solution potential, dilatation, hardness tests, and micrography. The aluminium used was of 99·7% purity, and the silicon 97·3%, the latter containing 1·2% of iron and 1·5% of aluminium as impurities. B. and S. conclude from their results that the Al–Si eutectic occurs at 11·5 atomic % silicon and melts at 575° C. The silicon-rich solid solution contains 96% of silicon at the solidus temperature and 97% at room temperature. The alloys containing about 94% of silicon have a specific resistance of 0·07 ohms/cm.^{3} and a temperature coeff. of about zero. A thermoelectric couple composed of alloys of 96 and 97% of silicon gives a thermoelectric force $E\,10^6 = 656\,t + 0{\cdot}98\,t^2$, the couple being one of the most powerful known up to the present. The hyper-eutectic alloys may be used as light antifriction alloys provided that the steel journals have a Brinell hardness above 500° C., *e.g.* are nitrogen-hardened. In a general way the indirect methods of investigation employed in establishing the structure of aluminium–silicon alloys gave normal results in spite of the rather peculiar properties of silicon.—H. S.

Characteristics of Cast Aluminium Alloys as Influenced by their Composition and Structure. C. Panseri (*Alluminio*, 1932, **1**, 279–307).—The technique of casting pistons for internal combustion engines is described, and the macrostructure and compositions are correlated with the casting properties. The problem of stresses derived from thermal treatment, and the effects of various treatments on certain alloys have been studied. The equilibrium diagrams of the silicon–magnesium–aluminium and nickel–copper–magnesium silicide–aluminium systems have been fully investigated. A description is given of a new alloy—Duralite—containing copper 3, silicon 0·7, nickel 0·5, magnesium 0·5, iron 1·5, titanium 0·2%. It is one of a series of alloys which attempts to combine the good technical properties of "Y" alloy with the good casting properties of alloys containing large quantities of copper. Certain other properties of various piston alloys are discussed, and it is concluded that the best alloys are those of the Duralite type.—G. G.

Special [Proprietary] Aluminium Alloys. Edmund Richard Thews (*Metallbörse*, 1932, **22**, 545–546, 577–578).—An alphabetical list of proprietory alloys with notes of their composition where published.—A. R. P.

On the Magnetostriction of Iron–Cobalt Alloys. Yosio Masiyama (*Sci. Rep. Tôhoku Imp. Univ.*, 1932, [i], **21**, 394–410).—[In English.] The whole series of alloys has been studied. The longitudinal and transverse effects are in opposite senses and the change of volume is a differential effect. A marked discontinuity was observed in the expansion–concentration curve in both the longitudinal and transverse effects at about 80% of cobalt. This corresponds with the phase change from α- to γ-solid solution.—E. S. H.

On the Grain-Refinement of Copper-Rich Alloys by Peritectic Reaction. Ju-n Asato (*Kinzoku no Kenkyu*, 1932, **9**, (9), 392–416).—[In Japanese.] It is well known that the crystal grains of "aluminium–bronze" become very fine when iron is added, but there has been no clear explanation for this. A. has found that this grain-refinement is closely related to the peritectic reaction between copper and iron, from experiments with copper–iron, copper–zinc–iron, copper–tin–iron, copper–manganese–iron, and copper–aluminium–iron alloys. A. has also found that in the above series of alloys iron may be replaced by cobalt as the latter is similar to iron in its behaviour towards copper.—S. G.

The Reaction Capacity of Alloys and its Dependence on Melting or on Transformations in the Solid State. I.—Chemical Reactions of Copper–Tin Alloys with Lime or Quartz in Oxygen. J. Arvid Hedvall and F. Ilander (*Z. anorg. Chem.*, 1932, **203**, 373–389).—Intermetallic compounds react with alkaline-earth oxides in the presence of oxygen on heating, especially at transformation temperatures or at temperatures at which break-up of the lattice occurs. The reactions between CuSn and lime and between CuSn or Cu_3Sn and SiO_2 have been investigated. They are of importance in respect of their effect on the stability of melting crucibles.—B. Bl.

Analyses of Old Bronzes. J. Sebelien (*Avh. Norske Vid.-Akad. Oslo*, **1931**, (3), 3–9; *C. Abs.*, 1932, **26**, 4575).—Cf. this *J.*, 1932, **50**, 349. A bronze nail from the gates of the palace of Shalmanesir II contained copper 81·1, tin 11·4, lead 0·47, iron 0·51, zinc 0·19, and arsenic 0·12%. Old Chinese bronzes generally contain a high proportion of lead with little or no zinc.

Knife coins of the Ming series contained copper 47, tin 1·5, zinc 1, lead 43·5, and arsenic 1%. Analyses of many old Norwegian bronzes gave tin 3–17%, and no evidence was found of a Copper Age preceding the Bronze Age. The compositions of 10 bronze coins of various countries minted between 90 B.C. and A.D. 1828 are tabulated.—S. G.

Properties and Uses of Lead–Rich Bearing Bronzes. Anon. (*Metallbörse*, 1932, **22**, 483).—The composition and mechanical properties of some leaded bearing bronzes for special purposes are tabulated. The information given is taken chiefly from the work of Clamer (*J. Franklin Inst.*, 1903, **156**, 49) and from publications of the A.S.T.M. (see *Met. Ind.* (*N.Y.*), 1931, **29**, 517). —A. R. P.

The Equilibrium Diagram of Lead–Tin Bronzes. József Veszelka (*Bányászati ès Kohászati Lapok*, 1932, **65**, 212–220, 237–244; *Chem. Zentr.*, 1932, **103**, II, 1504).—The mechanism of crystallization of copper–tin alloys with constant lead content of 2 and 5% is described. Similar effects have been observed to those found by Bauer and Hansen in the copper–zinc–lead system. Sectional diagrams for the 2 and 5% lead alloys have been constructed based on micrographic examination. Giolitti and Marantonio's observations (*Gazz. chim. ital.*, 1910, **40**, 51) on the distribution of lead in the constituents of cast bronze are shown to be erroneous.—A. R. P.

The Technological Properties of Nickel–Bronzes. Anon. (*Metallbörse*, 1932, **22**, 1134–1135).—A review of recent work on the effect of additions of 1–3% of nickel on the mechanical properties of bronze with up to 12% tin or tin + zinc.—A. R. P.

The Separation of the α-Phase in β-Brass. M. Straumanis and J. Weerts (*Z. Physik*, 1932, **78**, 1–16).—The process of separation of the cubic face-centred α-phase from the copper-rich cubic space-centred β-phase of the copper–zinc alloys has been investigated by X-ray and microscopic examination of single-crystals of the alloys. The α-crystallites are found to be preferentially oriented in 24 different strata independently of the nature of the heat-treatment. The accompanying lattice transformation can be interpreted in terms of slip processes and is crystallographically reversible. The mechanism involved in the orientation and transformation appears to be the reverse of that suggested by Kurdjumow and Sachs for the austenite–martensite transformation. Under conditions of considerable super-cooling and marked supersaturation, the character and arrangement of the α-crystallites are controlled by the slip mechanism in accordance with the symmetry of the β-lattice, with the resulting production of considerable regions of laminar precipitation. Rod-like precipitation characterizes higher annealing temperatures.—J. T.

The α- and β-Solid Solutions of the Copper–Zinc Alloys and the Corresponding Liquid Solutions in Equilibrium with Them Examined Thermodynamically. F. H. Jeffery (*Trans. Faraday Soc.*, 1932, **28**, 452–455).—Thermodynamic analysis of the equilibria in the copper–zinc systems indicates that the liquid solutions in equilibrium with the α- and β-solid solutions consist of $CuZn_4$ dissolved in monatomic molecules of copper, that the α-solid solution consists of $CuZn_4$ dissolved in monatomic copper, and that the β-solid solution consists of $CuZn_2$ dissolved in monatomic copper. The complex nature of these liquid and solid solutions seems to be consistent with the formation of metastable states. As the corresponding copper–tin solid solutions consist of Cu_4Sn and tin in copper, respectively, the analogy found between the α- and β-phases in the copper–tin and copper–zinc systems by X-rays is not in accordance with the laws of thermodynamics, assuming J.'s premises to be correct.—A. R. P.

On Transformation Processes in β-Brass and β-Silver–Zinc Alloys. J. Weerts (*Z. Metallkunde*, 1932, **24**, 265–270; discussion, 270).—The separation of cubic face-centred α from cubic body-centred β in brass and the transformation of cubic body-centred β into hexagonal ζ in silver–zinc alloys have been studied by röntgenographic and micrographic examination and by measurements of the electrical resistance and hardness during ageing of quenched specimens. Both transformations are governed by strict crystallographic lattice relations, the former being characterized by a gliding of the atoms similar to that of the martensite transformation, and the latter, by growth from a constant number of nuclei with a constant linear velocity of crystal growth.—M. H.

Alloys of Gallium. W. Kroll (*Metallwirtschaft*, 1932, **11**, 435–437).—Alloys of gallium with iron, nickel, copper, zinc, magnesium, bismuth, aluminium, lead, cadmium, and tin have been investigated. Those with the first three metals do not age-harden. Alloying copper with gallium produces only a very small hardening effect. More than 0·5% gallium in zinc spoils the mechanical properties, especially at high temperatures. Magnesium dissolves a maximum of about 4–6% gallium, but the alloys can be age-hardened only slightly. Low-melting-point binary and polynary alloys of gallium with cadmium, bismuth, lead, tin, and zinc contain eutectics; the alloy of gallium with 12% tin melts at 15° C. The eutectic arrest point can be detected in alloys with very high percentages of the second and third metals. Lead with 0·2% gallium is as brittle as 12% antimonial lead. Binary aluminium alloys with small percentages of gallium cannot be age-hardened, but can be readily rolled, addition of gallium increasing the hardness of aluminium only slightly. Ternary gallium–magnesium–aluminium alloys age-harden in a similar way to zinc–magnesium–aluminium alloys, a small effect being observed at room temperature and a maximum hardness of 112 being obtained on ageing above 100° C. Lithium–gallium–aluminium alloys behave similarly. The 4% gallium–aluminium alloy slowly disintegrates in moist air.—v. G.

Coloured Gold Alloys. E. Vincke (*Mitt. Forschungsinst. Edelmetalle*, 1932, **6**, 1–8).—Formulæ, melting points, and colour of so-called red, yellow, and white gold alloys of various carats are tabulated and the melting and working conditions are discussed.—A. R. P.

The Super-Conductivity of Gold–Bismuth [Alloys]. W. J. de Haas and T. Jurriaanse (*Proc. K. Akad. Wet. Amsterdam*, 1932, **35**, 748–750).—[In English.] Cf. this *J.*, 1932, **50**, 16. X-ray analysis has shown that gold–bismuth alloys containing 10, 20, or 40% of bismuth contain a phase of the composition Au_2Bi, which can be separated by washing out the bismuth with nitric acid. The compound Au_2Bi becomes superconducting in liquid helium at the same temperature as the gold–bismuth alloys, and is therefore held to account for the superconductivity of this series of alloys. The crystals of Au_2Bi are cubic, having an edge of 7·94 A. The density determined by X-ray analysis is 15·70, agreeing with the pyknometric value 15·46.—E. S. H.

On the Law of Additive Atomic Heats in Intermetallic Compounds. IX.—Compounds of Tin and Gold, and of Gold and Antimony. J. A. Bottema and F. M. Jaeger (*Proc. K. Akad. Wet. Amsterdam*, 1932, **35**, 916–928).—[In English.] The existence of pure, hexagonal AuSn has been confirmed by X-ray examination and chemical analysis. Its structure is analogous to that of PtSn. The sp. volume is about 12% smaller than the sum of the sp. volumes of its components. The true sp. heat of AuSn can be calculated at any temperature t from the relation $c_p = 0{\cdot}039649 - 0{\cdot}3358 \times 10^{-6}\,t + 2{\cdot}9337 \times 10^{-8}\,t^2$. The molecular heat of the compound is shown to be less than the sum of the atomic heats of the components (as with PtSn). The sp. heat of Sn in AuSn is, however, different from that of Sn in PtSn. The compound $AuSb_2$ was produced by melting the constituents together in hydrogen and tempering and re-melting the mass until a homogeneous product was obtained. It possesses a pyrite structure. At 355° C. the γ form is transformed into a β form, which is converted into an α form at about 405° C. The true sp. heats of these modifications are given by $\gamma c_p = 0{\cdot}043626 -$

$0{\cdot}189064 \times 10^{-4} t + 0{\cdot}79563 \times 10^{-7} t^2$, $\beta c_p = -0{\cdot}169785 + 0{\cdot}22014 \times 10^{-2} t - 0{\cdot}42252 \times 10^{-5} t^2$, $\alpha c_p = 0{\cdot}45389 - 0{\cdot}39127 \times 10^{-2} t + 0{\cdot}70257 \times 10^{-5} t^2$. The sp. heat of antimony has also been determined. There is a transformation point $\alpha \rightleftharpoons \beta$ at about 413° C. The results are expressed by the formulæ $\beta c_p = 0{\cdot}0535656 - 0{\cdot}46635 \times 10^{-4} t + 0{\cdot}15497 \times 10^{-6} t^2$, $\alpha c_p = 0{\cdot}534496 - 0{\cdot}4522 \times 10^{-2} t + 0{\cdot}7944 \times 10^{-5} t^2$. The rule of additive atomic heats is again not valid, but the deviation is in the opposite direction; the molecular heat of $AuSb_2$ is greater than the sum of the atomic heats of the constituents.—E. S. H.

On the Law of Additive Atomic Heats in the Case of Intermetallic Mixed Crystals. X.—Silver and Gold. J. A. Bottema and F. M. Jaeger (*Proc. K. Akad. Wet. Amsterdam*, 1932, **35**, 929–931).—[In English.] An alloy containing gold 25·56 and silver 74·44 atoms % has a true specific heat given by $c_p = 0{\cdot}04561 + 0{\cdot}1118 \times 10^{-4} t$. Comparison with the values for pure gold and silver shows that there are small deviations from the rule of additive atomic heats even in mixed crystals and that the deviations increase with rising temperature. The deviations are not considerable, except above 600° C.
—E. S. H.

The Lead-Rich Alloys of the System Lead–Antimony Examined Thermodynamically. F. H. Jeffery (*Trans. Faraday Soc.*, 1932, **28**, 567–569).—The equilibria at the lead end of the lead–antimony system can be explained thermodynamically only on the assumption that the compound Pb_2Sb exists in the liquid and solid solutions dissolved in monatomic molecules of lead. The formation of this compound in solid solution accounts for the hardening effect of small quantities of antimony on lead. It is pointed out that X-ray analysis fails to detect the presence of a compound in the lead–antimony alloys.—A. R. P.

Manganese–Nickel Alloys.—I.–II. A. Dourdine (*Rev. Mét.*, 1932, **29**, 507–518, 565–573).—(I) Thermal analysis indicated solid solution on the nickel side up to 38% of manganese, and on the manganese side up to about 59%. At intermediate concentrations (38–59% manganese) a new constituent is formed in the last stages of crystallization. At concentrations between 32 and 68% of manganese, a series of thermal effects in the solid state is observed, and special attention has been paid to these by D. (II) The manganese–nickel alloys crystallize partly in a stable condition and partly in an unstable condition on cooling at the usual rates. The unstable condition occurs between 43·2% and 58·5% manganese. In the unstable condition the alloys form an unbroken series of solid solutions except, perhaps, at concentrations in the vicinity of pure manganese. The change to the stable condition occurs completely when the alloys are maintained for a more or less prolonged time in the vicinity of the solidus. In the stable condition, the range of solid solutions is broken by two heterogeneous regions between 43·2 and 48·37% and 49 and 58·5% of manganese respectively. In these heterogeneous regions three phases are distinguished: β solid solution of manganese in nickel; γ solid solution of nickel in γ-manganese, and the δ-phase. The compound MnNi is responsible for the δ-phase, and the compounds Mn_3Ni_2 and Mn_3Ni_4 (ε phase) probably occur. Cobalt and iron additions reduce considerably the degree of instability of the unstable system. Silicon accelerates the $\gamma \longrightarrow \delta$ transformation, which in these alloys proceeds slowly and only in a narrow interval of temperature.—H. S.

Kanthal. J. H. Russell (*Metallurgia*, 1932, **6**, 195–196).—A new electrical resistance material in which aluminium, chromium, and nickel are alloyed, and which is produced in 3 grades in which the permissible temperatures of heating elements made from them are 1325°, 1250°, and 1050° C., respectively. These alloys have a higher sp. resistance, and a lower sp. gr., than nickel–chromium alloys, and in the presence of sulphur are attacked only to a very small degree.

Kanthal alloys have also high oxidation-resisting qualities, and are produced in strips, castings, and wires. Elements made from these alloys have been used successfully in furnaces for hardening high-speed steel, glass-melting, heat-treating of stainless steel, case-hardening, enamelling, and sintering tungsten carbide.—J. W. D.

Investigation of the Magnetostriction and Magnetization of Single Crystals of the Iron–Nickel Series. Fritz Lichtenberger (*Ann. Physik*, 1932, [v], **15**, 45–71).—Single crystals of iron–nickel alloys with 30–100% nickel have been prepared in a vacuum furnace by Bridgman's method and their magnetostriction and magnetization measured. The direction in which the alloys are most readily magnetized is (100) for 30–70% nickel and (111) for 71–100% nickel.—v. G.

On the Equilibrium Diagram of the Nickel–Zinc System. Kanzi Tamaru (*Sci. Rep. Tôhoku Imp. Univ.*, 1932, [i], **21**, 344–363).—[In English.] The equilibrium diagram of the nickel–zinc system has been constructed from thermal analyses and dilatometric and electrical resistance measurements. The effect of zinc on the magnetic transformation of nickel has also been studied. The α solid solution extends to 61·61% nickel at 1403° C. The β solid solution on the zinc-rich side reaches 37·5% nickel at the eutectic temperature. The eutectoid transformation of the β solid solution occurs in alloys containing 45·1–24·4% nickel at a mean temperature of 675° C. The compound NiZn forms a δ solid solution which is homogeneous between 49 and 45·1% nickel. The reaction $\alpha + \beta \longrightarrow \delta$ occurs at 804° C. The compound $NiZn_3$ has a solubility of 1·4% nickel on the nickel side. The liquidus and eutectic horizontal near $NiZn_3$, found by differential thermal analysis, invalidate the view of Bauer and Hansen regarding the peritectic reaction. X-ray analysis shows that the structure of the α solid solution is face-centred cubic, that of β and δ hexagonal, and that of γ cubic.—E. S. H.

Magnetic Susceptibility and Electrical Resistance of the Palladium–Silver and Palladium–Copper Solid Solutions. Börje Svensson (*Ann. Physik*, 1932, [v], **14**, 699–711).—In the binary solid solution system silver–palladium the susceptibility falls from that of pure paramagnetic palladium to zero at 50 atomic-% silver and approximates to that of pure diamagnetic silver at 60 atomic-% silver. Copper–palladium solid solutions behave similarly. For the oriented compounds CuPd and Cu_3Pd the diamagnetic susceptibility is 50–100% greater than that for the unoriented solid solutions of the same composition.—v. G.

Electrical Properties of Dilute Solid Solution Alloys. II.—Resistance of Silver Alloys. J. O. Linde (*Ann. Physik*, 1932, [v], **14**, 353–366).—Cf. this *J.*, 1932, **50**, 15. The electrical conductivities of silver alloys with elements of atomic number 29–33, 46–51, and 78–83 have been determined. Solid solutions in silver of metals which do not belong to the transitional group follow Norbury's rule, which can be more precisely stated as follows: the atomic rise in resistance is proportional to the square of the distance (difference between the group numbers) of the element in the periodic system from the silver group.—v. G.

Mechanical Properties of White Bearing Metals at Various Temperatures. Anon. (*Metallbörse*, 1932, **22**, 1006–1007).—Tests on the resistance to wear of various types of bearing metal at 20–200° C. have been made in heavy motor lorries; the results show the great superiority of the tin–rich alloys. Cadmium–zinc and barium–calcium alloys are superior to the usual lead–rich alloys.—A. R. P.

High-Percentage Tungsten Carbide Alloys and their Technical Application. Sven G. Lind (*Teknisk Tids.*, Uppl. C., *Bergsvetenskap.* **62**, 1932, 9–14; *C Abs.*, 1932, **26**, 5532).—The manufacture of alloys of cemented tungsten carbide and cobalt and their mechanical properties are described. The practical application of such alloys for cutting tools, dies for wire-drawing, and sand-blasting nozzles is discussed.—S. G.

On the Silicides of the Alkaline Earth Metals. Lothar Wöhler and W. Schuff (*Z. anorg. Chem.*, 1932, **209**, 33–59).—The preparation, identification, and properties of the compounds Sr_2Si_2, Ba_2Si_2, $SrSi_2$, $BaSi_2$, and $BaSi_3$ are described.—M. H.

Strength and Ductility of the Alloys of the "Noble" Metals. L. Sterner-Rainer (*Deut. Goldschmied.-Zeit.*, 1931, **34**, 114–115; *Chem. Zentr.*, 1931, **102**, I, 2667; *C. Abs.*, 1932, **26**, 4286).—The changes in properties which metals undergo in the process of working up are discussed. The relation of strength and ductility to the degree of stretching is especially noted, numerical expression of which has previously been considered unnecessary. This relation is of importance in judging the economy of working up of the metal.—S. G.

General Rules of the Changes of Structure and Properties During Transformation Processes. G. Sachs (*Z. Metallkunde*, 1932, **24**, 241–247; discussion, 247–248).—Read before the Deutsche Gesellschaft für Metallkunde. A transformation in alloys generally consists of two partial processes, viz., change of lattice structure and rearrangement of the atoms, and both of these can be studied separately by X-ray investigation and determination of the change of physical properties during ageing after quenching. Transformations are discussed involving (*a*) the change from random to regular distribution of the atoms in solid solutions ($AuCu_3$, $\beta \longrightarrow \beta'$ transformation in brass); (*b*) sudden change in lattice structure produced by gliding or slip (martensite transformation, $\beta \longrightarrow \alpha$ transformation in brass, $\beta \longrightarrow \alpha$ transformation of cobalt, $\beta' \longrightarrow \zeta$ transformation in silver–zinc alloys, formation of AuCu). The kinetics of lattice transformation are governed by one of three possibilities, viz., (1) thermal formation of nuclei and crystal growth (at high temperatures); (2) regular change of the lattice and crystal growth (at moderate temperatures); (3) regular change of the lattice alone (at lower temperatures). Numerous references are given.—M. H.

Transformation in Homogeneous Substances. G. Tammann (*Z. anorg. Chem.*, 1932, **209**, 204–212).—The nature of the reversible transformations in metals and alloys which take place in homogeneous phases (*i.e.* without recrystallization) is discussed with particular reference to: the magnetic transformations of iron, nickel, and solid solutions rich in these metals, the $\beta \rightleftharpoons \beta'$ transformation in copper–zinc alloys, and the transformation of the alloy Cu_3Au.—M. H.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

Structure of Polished Solids. L. Hamburger (*Nature*, 1932, **130**, 435–436).—A review of recent literature leads to the view that polishing should be considered primarily as a process of abrasion, accompanied by levelling of surface lamellæ. It is considered that the first step in this direction has already been made during the grinding of the specimen. Delicate polishing involves a dragging of minute particles (containing from 3 to 40 atoms in most common, hard metals) along the surface and filling up existing pits. Thus, a surface film, differing from the underlying material, is produced.—E. S. H.

On the Theory of Recrystallization. E. F. Bachmetew, A. A. Botchvar, G. S. Zhdanov, and Y. S. Umansky (*Zhurnal Tehnicheskoy Fiziki* (*Journal of Technical Physics*), 1932, [B], 2, (2), 161–172).—[In Russian.] The phenomenon of recrystallization of metals is examined in the light of modern scientific conceptions of atomic structure. Recrystallization of a deformed single crystal is considered in detail. The hypothesis of different types of "nuclei" is discussed as well as of two types of "recovery." The typical elements of recrystallization, irregularities in the distribution of internal stress, and changes in structure are systematized. The recrystallization of a true polycrystalline aggregate is analyzed.—N. A.

On the Corrections for Debye-Scherrer X-Ray Photographs. Zenji Nishiyama (*Sci. Rep. Tôhoku Imp. Univ.*, 1932, [i], **21**, 364–384).—[In English.] Different correction formulæ for the thickness of the specimen have been applied to experiments with Armco iron and aluminium (99·95%); the formula proposed by N. appears to be the most satisfactory. The *lattice constant for aluminium* is determined as 4·041 A.—E. S. H.

The Crystal Structure of AuCd. Arne Ölander (*Z. Krist.*, 1932, **83**, 145–148).—[In English.] The dimensions of the elementary cell of AuCd, as determined by X-ray analysis, are as follows: a 3·144, b 4·851, c 4·745 A. The density of the alloy is 14·5. At temperatures above 267° C. (the transition temperature) the alloy has the same structure as the corresponding phases in the gold–zinc and copper–zinc systems.—E. S. H.

Crystal Structure of Electrodeposits from Copper Acetate Solutions. S. J. M. Allen, H. Kersten, and Joseph Maas (*Physics*, 1932, **3**, 169–171).—Electrodeposits from copper acetate solutions are shown, by X-ray analysis, to consist principally of a mixture of crystals of copper and cuprous oxide. The proportion of the latter increases with decrease of acidity of the bath. Rectifying or photo-electric properties are not possessed by the deposits.—J. T.

On the Lattice Dimensions of Niobium (Columbium), Tantalum, and Some Niobates and Tantalates. Laurence L. Quill (*Z. anorg. Chem.*, 1932, **208**, 257–272).—The crystal structure of niobium (columbium) of spectroscopic purity and tantalum (99·9%) has been determined by the powder method. Both metals have a cubic body-centred lattice with $a = 3{\cdot}299 \pm 0{\cdot}001$ A., $d_{\text{calc.}} = 8{\cdot}575$, atomic radius (8 = co-ordination) = 1·429 A. for niobium, and $a = 3{\cdot}298 \pm 0{\cdot}002$ A., $d_{\text{calc.}} = 16{\cdot}69$, atomic radius = 1·428 A. for tantalum.—M. H.

X-Ray Investigations of Metallic Lanthanum, Cerium, and Neodymium. Laurence L. Quill (*Z. anorg. Chem.*, 1932, **208**, 273–281).—Lanthanum has a hexagonal lattice, $a = 3{\cdot}57_4 \pm 0{\cdot}010$ A., $c = 6{\cdot}06_3 \pm 0{\cdot}030$ A., $c/a = 1{\cdot}613$, $d_{\text{calc.}} = 6{\cdot}194$, atomic radius = 1·870 A., cerium a cubic face-centred lattice $a = 5{\cdot}143 \pm 0{\cdot}004$ A., $d_{\text{calc.}} = 6{\cdot}799$, and neodymium a hexagonal close-packed lattice, $a = 3{\cdot}65_7 \pm 0{\cdot}010$ A., $c = 5{\cdot}88_0 \pm 0{\cdot}030$ A., $c/a = 1{\cdot}608$, $d_{\text{calc.}} = 6{\cdot}991$.—M. H.

X-Ray Study of the Plastic Working of Magnesium Alloys. L. G. Morell and J. D. Hanawalt (*Physics*, 1932, **3**, 161–168).—The structure of Dowmetal (alloys containing various proportions of aluminium, zinc, manganese, and other elements together with magnesium of purity 99·9%) worked by various processes, *e.g.* forging, rolling, extruding, and drawing, has been investigated by X-ray analysis. Three distinct structures are found, *viz.*, (1) a [210] fibre structure at ordinary temperatures and (2) a [110] fibre structure at temperatures above 450° C. with the fibre axis in both cases in the direction of drawing or extrusion, and (3) a [001] fibre structure with the fibre axis in the direction of forging. The difference in the structure of metal extruded at low and high temperatures is discussed in terms of the glide systems of magnesium.
—J. S. G. T.

Crystal Structure of Black Nickel. H. Kersten and Joseph Maas (*Physics*, 1932, **3**, 137–138).—X-ray analysis shows that electrodeposited black nickel has an amorphous structure which changes to a crystalline structure when the deposit is heated.—J. S. G. T.

The Structure of Nickel–Zinc Alloys.—I. W. Heike, J. Schramm, and O. Vaupel (*Metallwirtschaft*, 1932, **11**, 525–530, 539–542).—Vacuum-melted alloys with 44–100% nickel have been examined röntgenographically, thermally, and micrographically. The solubility of zinc in nickel is 44% at 1050° C., 36% at 800° C., and 34% at 500° C. and lower. The β_1-phase with 50–54·2% zinc is tetragonal, a = 2·754 A., c = 3·214 A.; the structure consists of two simple tetragonal lattices based on nickel at (000) and zinc at ($\frac{1}{2}\,\frac{1}{2}\,\frac{1}{2}$). β_1 is converted into cubic β (a = 4·112 A.) over the range 810° C. (50% nickel) to 640° C. (54% nickel); this phase has a sodium chloride type of lattice and exists in alloys up to 60% nickel, but cannot be supercooled. The microstructure of the alloys can be varied very considerably according to the composition and heat-treatment in agreement with complex equilibrium diagrams.—v. G.

On the System Tungsten–Cobalt. Curt Agte, Karl Becker, and (Frhr.) von Göler (*Metallwirtschaft*, 1932, 11, 447–450).—Cobalt is soluble in tungsten to the extent of about 10 atomic-% and tungsten in cobalt to about 8 atomic-%. The system contains only one intermediate phase with 52–63 atomic-% cobalt, which is non-magnetic on the tungsten side, but becomes magnetic with increasing cobalt content; its crystal structure has not been elucidated, but is certainly not cubic.—v. G.

The Crystal Structure of Yttrium. Laurence L. Quill (*Z. anorg. Chem.*, 1932, 208, 59–64).—Yttrium (>99·5%) has a close-packed hexagonal lattice with two atoms in the elementary cell, a = 3·663 ± 0·008 A., c = 5·814 ± 0·012 A., c/a = 1·588; atomic radius = 1·814 A., $d_{\text{calc.}}$ = 4·34.—M. H.

X-Ray Determination of the Solubility of Cadmium in Zinc. W. Boas (*Metallwirtschaft*, 1932, 11, 603–604).—Determinations made on specimens homogenized for 8–14 days gave the following values for the solubility of cadmium in zinc: 1·8% at 250°, 1·1% at 218°, 0·35% at 156°, and less than 0·1% at 100° C.—v. G.

On Variations of Interatomic Distances with the Change from the Cubic Face-Centred Arrangement to the Cubic Body-Centred or to the Hexagonal Close-Packed Lattice. H. Perlitz (*Trans. Faraday Soc.*, 1932, 28, 514–518).—Existing data on the interatomic distances at the transition from the cubic face-centred to the cubic body-centred lattice indicate that there is a decrease of 2·25% in the distance between the atoms during the change. In the change from cubic to close-packed hexagonal lattice the change in interatomic distances decreases to zero as the axial ratio of the hexagonal lattice approaches 1·633. —A. R. P.

Concerning the Structure Factor. W. Neskutchaev (*Zhurnal eksperimentalnoy i teoreticheskoy Fiziki* (*Journal of Experimental and Theoretical Physics*), 1932, [A], 2, (3), 171–178).—[In Russian.] A simple vector method is described for determining the distribution of the atoms within the space lattice by means of the intensity of the X-ray spectral lines reflected from the crystal surface.—N. A.

Diffraction of X-Rays by Liquid Metals. J. T. Randall and H. P. Rooksby (*Nature*, 1932, 130, 473–474).—Liquid sodium, potassium, rubidium, and cæsium at temperatures slightly above the melting point give X-ray diffraction spectra consisting of a single, sharply-defined, narrow band, the position of which is approximately the same as that of the strongest line of the corresponding solid metal. The result suggests that the liquids contain groups of molecules which tend to become oriented in a way resembling the crystalline space-lattice.—E. S. H.

On the Importance of X-Ray Interference Lines in the Study of Metals. E. Schmid (*Naturwiss.*, 1932, 20, 530–536).—The value of X-rays in elucidating the atomic and crystallographic structure of metals and alloys and the effect thereon of heat and mechanical treatment is reviewed.—J. W.

Lattice Forces and X-Ray Spectrum. R. Glocker (*Naturwiss.*, 1932, 20, 536–539).—The position of the K-absorption edges of a given kind of atom is somewhat changed by the action of several factors during transformation into another kind of lattice structure. With the same type of lattice in different alloys the wave-length of the K-edge is a linear function of the lattice energy.

With the same lattice energy but different types of lattice the K-edge in ionic lattices and their transition forms has a wave-length which is shorter the larger the co-ordination number. If the valence, lattice energy, and co-ordination number are the same the K-edge is displaced towards longer wave-lengths in the transition from heteropolar to homopolar or metallic linkages. Furthermore, the occurrence of discontinuities in the short-wave portion of the absorption spectrum is attributed to the action of lattice linkages even in metals; they have not been observed in the spectrum of the vapour. Some observations on the displacement of lines of the emission spectrum during change of the lattice linkages are discussed on the basis of recent research. —J. W.

The Interaction of Lattice Vibrations and Free Electrons in Metals. H. Jones (*Proc. Cambridge Phil. Soc.*, 1932, 28, 367–385).—A mathematical treatment.—E. S. H.

X-Ray Scattering and Atomic Structure. E. O. Wollan (*Rev. Modern Physics*, 1922, 4, 205–258).—From the point of view of this *Journal* this paper is of importance in so far as the structure factor is required for the interpretation of the intensities of reflection of X-rays by crystals. A general review is given of previous theoretical and experimental investigations of the intensity of scattered X-rays as related to the determination of the structure factors, and the electron distribution of atoms. W. deals essentially with existing knowledge, which does not call for abstraction, but gives a very clear account of the subject together with a comprehensive bibliography.—W. H.-R.

IV.—CORROSION

Corrosion Researches on Pure Aluminium and Aluminium Alloys in Contact with Different Heavy Metals in 3% NaCl Solution. —— Zurbrügg (*Light Metals Research*, 1932, 2, (13), 13).—Tests carried out for 3, 6, and 9 months on pairs of plates, made by riveting together various combinations of light metals among themselves and with heavy metals, and immersed in 3% solution of sodium chloride, gave no positive results. The electro-negative metals corroded only at the points at which they came in contact with the electro-positive metals, the remaining surface of the electro-negative metals being covered with a dense oxide protective film.—J. C. C.

Properties of Aluminium in Apparatus. T. Hoffmann (*Korrosion* (Suppt. to *Chem. Apparatur*), 1931, 6, 13; *C. Abs.*, 1932, 26, 5047).—Copper salts, even in dilute solution, cause corrosion in aluminium vessels. Agar-agar or gum arabic affords better protection than sodium silicate against sodium hydroxide, but the reverse is true with sodium carbonate. Bleaching liquor is rendered inactive by the addition of hydrogen peroxide. Duralumin particles which get in during rolling cause corrosion.—S. G.

Occurrence and Determination of Aluminium in Foods. II.—Aluminium Content of Foodstuffs Cooked in Glass and in Aluminium. George D. Beal, Richard B. Unangst, Helen B. Wigman, and Gerald J. Cox (*Indust. and Eng. Chem.*, 1932, 24, 405–407).—The results of other investigations of the corrosion of aluminium by foodstuffs are reviewed, and alternative methods considered. The authors adopt the method of analyzing foods for aluminium rather than that of carrying out corrosion tests on metal samples: analyses of foods cooked in aluminium vessels are compared with those obtained using Pyrex utensils. The amount of aluminium dissolved is negligible with foods of neutral reaction, somewhat higher with acid foods, but in no case does it approximate to the amount required to interfere with phosphorus absorption. If all foods are cooked in aluminium vessels, the amount of aluminium ingested daily is about 12 mg., and of this only about 5 mg. is derived from cooking utensils.—P. M. C. R.

Corrosion Fatigue [of Aluminium Alloys] and Anodic Oxidation. Kurt Matthaes (*Light Metals Research*, 1932, **2**, (10), 2–5).—A translation of an extract dealing with the effect of anodic oxidation on the corrosion fatigue of Duralumin "681 ZB" from Report No. 250 of the Deutsche Versuchsanstalt für Luftfahrt E.V.—J. C. C.

Corrosion [of Aldrey and Avional D] under Prolonged Load. —— Irmann and W. Müller (*Light Metals Research*, 1932, **2**, (14), 18).—The residual elongations of wires of Aldrey and Avional D were found to be reduced after corrosion in 3% sodium chloride and to be still more reduced after corrosion under a prolonged load. The elastic limits are thus apparently raised by these treatments.—J. C. C.

Corrosion Tests on Coloured Cadmium Deposits. H. Krause (*Mitt. Forschungsinst. Edelmetalle*, 1932, **6**, 50–54).—Dark deposits obtained by immersion in a bath containing copper salts are rapidly and completely destroyed in the salt-spray test, whereas those produced in permanganate–cadmium nitrate baths are much more resistant. The former type of deposit owing to its copper content tends to reduce the rust-protecting power of cadmium-plate, whereas the latter type is without effect thereon. Lacquering or impregnating the coloured deposits with wax does not improve their resistance to weathering. —A. R. P.

Corrosion of [Cadmium–Zinc] Alloys. Johan Gørrissen (*Kgl. Norske Videnskab. Selskab. Forh.* 4, 1931, 169–171; *C. Abs.*, 1932, **26**, 4577).—The corrodibility of various cadmium–zinc alloys by *N*-sodium hydroxide was investigated. So long as the zinc is present as a eutectic, the cadmium protects well. If zinc is increased until primary zinc crystals are present, the cadmium accelerates corrosion. The oxygen concentration was found to be of great importance. Investigations carried out on the corrosion of cadmium–magnesium alloys in 0·01*N*-hydrochloric acid appear to bear out the correctness of Tammann's theory of the resistance limits. Three distinct types of corrosion were shown, corresponding to: (1) alloys with more than 50 atomic % cadmium; (2) alloys with 20–50 atomic % cadmium, and (3) alloys with less than 20 atomic % cadmium.—S. G.

Recent Investigations on the Atmospheric Corrosion of Copper. W. H. J. Vernon (*Korrosion u Metallschutz*, 1932, **8**, 141–147).—A review of the recent work of the author and his collaborators.—A. R. P.

Corrosion of Copper. Oxide Protective Films in Salt Solutions. W. Haase (*Metallwirtschaft*, 1932, **11**, 516, 530–531, 556–557).—The behaviour of copper in solutions of alkali salts under electrochemical attack has been investigated with especial reference to the conditions under which homogeneous, non-porous, adherent protective oxide films can be produced by aeration. The best results are obtained in solutions of sodium salts in which the current rapidly falls to zero. The colour of the film is yellow at the beginning of the treatment, but rapidly turns to black. In solutions of potassium salts, other than the nitrite and nitrate, film formation is much slower. Ammonium salts form films very slowly, and the process is complicated by the formation of complex salts.—v. G.

Turbine Blade Deterioration. D. G. McNair (*Marine Eng. Officers' Mag.*, 1932, **13**, 188–190).—Satisfactory turbine blading should, under modern service conditions, which may include a steam pressure of 550 lb./in.^{2} and a temperature of 750° F. (400° C.), retain a correct contour, strongly defined inlet and outlet angles, and smooth surface. These properties must be combined with easy manufacture and cheap production. After consideration of the service conditions resulting in corrosion and erosion, the relative advantages of special steels, brass, phosphor–bronze, nickel–bronze, mild steel, and Monel metal are considered. It is stated that their performance and durability under superheat conditions justifies the extra cost of Monel metal blades.—P. M. C. R.

The Chamber Process. XXIV.—Corrosion Test of Sheet Lead by Sulphuric Acid. Mototarō Matsui and Hirondo Katō (*Kogyo Kwagaku Zasshi* (*J. Soc. Chem. Ind., Japan*), 1932, **35**, (7)).—[In Japanese, with English summary in supplemental binding.] Determinations were made, on the samples described in Part XXIII (see *J.*, this volume, p. 2), of the rate of corrosion at 52° C. in 74·24% sulphuric acid and in similar acid containing 1·66% of nitrogen trioxide. The presence of the trioxide increased the rate of corrosion owing to its solvent effect on the lead sulphate film which forms on the surface of the metal. Antimonial lead was much more seriously attacked than any of the other samples in nitrous sulphuric acid and in the gases in the flue joining the last chamber to the Gay-Lussac tower. Annealing at 100° C. increased the rate of corrosion of all the samples.—A. R. P.

Electrolytic Corrosion of Lead Cable Sheathing. M. Horioka and T. Kyōgoku (*Res. Electrotech. Lab. Tokyo*, No. **323**, 1931, 1–49; *Sci. Abs.*, 1931, [B], **35**, 182).—[In Japanese, with English synopsis.] The corrosion of lead and alloys used for cable sheathing was studied for a number of electrolytes and at different current densities. It was shown that the formation of lead peroxide took place when the density of the corrosive currents and the concentration of the electrolytes were beyond a certain limit. The formation of lead peroxide caused some slight protection against further action. Electrolytic corrosion was specially noticeable in solutions of acetic acid and calcium hydroxide. It is considered that this is due to intercrystalline corrosion followed by mechanical disintegration of the crystal grains. In view of this, special caution is necessary in ageing concrete ducts prior to use.—S. G.

On the Kinetics of the Dissolution of Magnesium and other Metals in Aqueous Solutions. B. F. Ormont (*Zhurnal Fizicheskoy Khimii* (*Journal of Physical Chemistry*), 1932, [W], **3**, (1), 108–120).—[In Russian.] The rate of dissolution of magnesium in solutions of hydrochloric acid and ammonium salts has been investigated. It is shown that the Noyes-Nernst equation for the case of a metal dissolving in water and aqueous solutions does not apply. The passivity of magnesium in distilled water is probably explained, not by the formation of the sparingly soluble hydroxide on the metal surface, but by the extremely strong bond between this layer of hydroxide and the metal. The mechanism of the ionic reaction between magnesium and solutions is also examined.—N. A.

Cause and Prevention of Some Black Spots which Appeared on Cloth after Kier Boiling. Albert H. Grimshaw (*Textile Colorist*, 1932, **54**, 466; *C. Abs.*, 1932, **26**, 5211).—Black spots of stannous oxide are attributed to tin rust on the tin rollers of the looms. During the Kier boiling, the stannic anhydride is reduced to stannous oxide.—S. G.

The Kinetics of the Conversion of Ions of Metals into Neutral Atoms under the Influence of Metallic Zinc. M. Centnerszwer and W. Heller (*Z. physikal. Chem.*, 1932, [A], **161**, 113–128).—In the dissolution of zinc in copper sulphate solution the velocity constant K increases with the rate of stirring between 50 and 400 revolutions/minute, and is independent thereof at 400–700 revolutions/minute, as the rate of diffusion is then equal to the rate of reaction. Between 0° and 50° C. K increases proportionally with the temperature to the same extent as the diffusion coeff., from which it follows that the thickness of the adherent copper sulphate solution film is independent of the temperature. The above facts indicate that the dissolution of zinc in copper sulphate solution is purely a diffusion process. The anions CNS', Cl', and SO_4'' accelerate, and the anion NO_3' retards, the reaction strongly. Organic acids and colloids slow down the reaction, the latter because they adsorb the metal precipitate on the zinc. Amalgamated zinc dissolves somewhat more rapidly than ordinary zinc. Practically no zinc dissolves in nickel sulphate solutions, but the zinc plate becomes covered with a precipitate. The rate of dissolution of zinc in silver sulphate solution is greater than that in copper sulphate solution, whilst that in silver nitrate solution decreases with time. There is only a qualitative relationship between the mutual replacement velocities of metals and their position in the electrochemical series.—B. Bl.

Corrosion of Metals by Tan Liquors. III.—Corrosion of Submerged Metals in Movement. M. P. Balfe and H. Phillips (*J. Internat. Soc. Leather Trades Chem.*, 1932, **16**, 345–353; *C. Abs.*, 1932, **26**, 4576).—Cf. this *J.*, 1932, **50**, 547. Tan liquors of various types were stirred mechanically for 160 hrs. with test-pieces of iron, copper, aluminium, nickel and numerous brasses, bronzes, and ferrous alloys. The liquors were examined for change in colour and dissolved metals, and the test-pieces were examined for pitting. Iron–chromium–nickel alloys (" stainless " steels) were practically unattacked; all other metals and alloys tested were appreciably attacked, especially in liquors containing sulphur dioxide.—S. G.

Corrosion in a Pacific Coast Groundwood Mill System. I. H. Andrews (*Pacific Pulp Paper Ind.*, 1932, **6**, (6), 16–17; *C. Abs.*, 1932, **26**, 4713).—Closed-in white-water systems apparently build up an acidity, which in turn introduces a corrosion problem. Corrosion may be combated by partial neutralization, but when the p_H is brought above 5·5 with sodium carbonate there is danger of discoloration of the pulp. Corrosion tests carried out by subjecting test-specimens of various materials to the splashing of hot spruce pulp at the grinder showed that wrought-iron pipe is much more resistant than wrought-steel pipe, and that certain acid-resisting metals (particularly when polished) have a satisfactory resistance. Use of wood stave piping and copper fittings has practically eliminated corrosion and iron pick-up in one 100-ton groundwood mill.—S. G.

Notes on Some Chemical and Physical Phenomena [of Interest to the Brewing Industries]. —— Bourgeois (*Bull. assoc. élèves inst. sup. fermentations Gand*, 1932, **32**, 119–127; *C. Abs.*, 1932, **26**, 4409).—An address discussing briefly, especially from the physical point of view, the influence of hardness of water, metal corrosion, &c., as they affect the brewing industry. —S. G.

Chemical and Micro-Biological Action of Sea-Water in Causing Alterations of Metals. H. Masseille (*Peintures, pigments, vernis*, 1932, **9**, 117–118; *C. Abs.*, 1932, **26**, 5057).—Although near the shore bacteria are a more or less important factor in the decomposition of protective coatings and the corrosion of metallic objects, the water of the ocean is so nearly sterile that on the high seas corrosion is due almost entirely to strictly chemical action.—S. G.

The Prevention of Corrosion-Fatigue by [Surface Consolidation under] Pressure. A. Thum and H. Ochs (*Z.V.d.I.*, 1932, **76**, 915–916).—The deleterious effect of corrosion on the endurance strength of metals under alternating stresses is accounted for on the supposition that the alternating loads continuously open and close minute cracks in the surface of the metal, thus allowing the corrosive liquid to penetrate readily into the interior. By closing up the surface cracks of specimens under pressure between rolls, an improvement of 50% has been made in the endurance bending strength of steels.—v. G.

A Modern Soil Survey with Shepard Rods. Arthur B. Allyne (*Gas Age-Record*, 1931, **68**, 269–272, 282).—The use of Shepard electrodes, recently developed by the [U.S.] Bureau of Standards in a survey of soil corroding properties over an extensive area in south-western U.S.A. is described. The electrodes have been found suitable for use in alkaline soils. Their use makes it possible to predict the life of buried steel pipe and to predetermine the necessary protection.—J. S. G. T.

V.—PROTECTION

(Other than Electrodeposition.)

Protection of Aluminium or Its Alloys. [Ch. Boulanger] (*Usine*, 1931, **40**, (3), 33).—Abstract of a paper read at the Congrès International de Sécurité Aérienne, 1930. The method recommended is to immerse the sample in a boiling, feebly alkaline, solution of metallic salts such as vanadates, molybdates, tungstates, titanates, uranates, manganates, chromates, either singly or mixed. The time of immersion does not exceed half an hour.—H. H.

Anodic Oxidation of Aluminium. Anon. (*Aluminium Broadcast*, 1932, **3**, (37), 10–16; and *Met. Ind.* (*Lond.*), 1932, **41**, 395–396).—A memorandum issued by the Intelligence Department of the British Aluminium Company, Ltd., describing the so-called Bengough process for protecting aluminium and its alloys by anodic oxidation.—J. H. W.

The Chemical Oxidation of Aluminium and its Alloys. W. L. (*Light Metals Research*, 1932, **2**, (4), 8 pp.).—Chemical processes for thickening the oxide film on aluminium are complex in character and in general depend on the hydrolysis of a salt, usually with the help of a catalyst. The films so formed are slightly hygroscopic, and their hardness and dielectric strength are much less than for anodic films. The properties may be modified by oxides, salts, or mordants and basic dyes, which are readily adsorbed. The films are chiefly used for decoration (after colouring), corrosion protection, and heat insulation. Brief details with full patent references of eight immersion processes are tabulated, and there is a short bibliography.—J. C. C.

Oxidized Aluminium. Anon. (*Woch. Brau.*, 1932, **49**, 253; *J. Inst. Brewing*, 1932, **38**, 481).—A protective oxide film is produced on the surface of aluminium by the "Eloxal" process. This film consists of a very finely crystallized form of alumina which has nearly the hardness of carborundum and is not attacked by boiling water. On pure aluminium, it has a straw-yellow colour, but any required tint can be given by means of oil-soluble colours. The resistance to corrosion can be further increased by a mechanical after-treatment which closes any pores in the film. The film is an electrical insulator and has ten times the heat-radiating power of ordinary aluminium. The process has already been applied for various electrical and thermo-technical purposes.—H. W. G. H.

Investigation of the Process of Saturation of Iron and Steel by Aluminium in Liquid Alloys of Aluminium and Iron in order to make them Heat-Resistant. F. T. Nikonov (*Niimash Izvestia Nauchno-issledovatelskogo Instituta Mashinostroenia i Metalloobrabotki* (*Bulletin of the Scientific Research Institute of Machine Building and Metal Treatment*), **1932**, (4), 181–201).—[In Russian.] The alloy which must be used for the process of calorizing has an iron content of 6–8%. The maximum rate of diffusion of aluminium into iron occurs in this alloy at temperatures between 750° and 800° C. Aluminium diffuses more easily into ferrite than into austenite at the same temperature, the carbon impeding diffusion in the latter case. The optimum duration of treatment is 45–60 minutes. On conclusion of the process, annealing at 1100°–1150° C. is necessary.—N. A.

Determination of the Thickness and Quality of Protective Coatings on Galvanized Iron. R. Vondracek (*Congrès internat. mines, Liège*, **1930**, June 22–28; and *Métallurgie*, **1930**, 547–554; *Chim. et Ind.*, 1932, **27**, 1077; *C. Abs.*, 1932, **26**, 4284).—Preece's method, consisting in determining the time required to dissolve the coating in a neutral saturated solution of copper sulphate frequently does not give consistent results. V. suggests determining the rate of solution of the coating by measuring the volume of hydrogen evolved in dilute acid solution. In a few minutes it is possible to establish solution curves that determine the structure of the coating with an accuracy that frequently exceeds that of micrographic examination. V. describes a series of experiments carried out on galvanized irons under varying conditions of temperature, concentration, etc. Wires 10 cm. long were immersed in N-sulphuric acid and the volume of hydrogen evolved was measured at 1 minute intervals. The quality of the coating can thus be gauged by means of: (*a*) the total volume of hydrogen evolved with 100 c.c. of acid; (*b*) the total time and the mean rate of evolution of gas; (*c*) the maximum rate of evolution of hydrogen and its position on the curve; (*d*) the ratio of maximum to average rate of evolution; (*e*) the fraction of the total time required for evolution of 50% of the gas. Total time of evolution is defined as the time required for evolution of 95% of the total gas. It was observed that the ratio of maximum to average rate of evolution and the relative time for evolution of 50% of the gas do not vary appreciably with change in temperature.—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Specifications for Zinc-Coated (Galvanized) Iron or Steel Telephone and Telegraph Line Wire (A 111–30). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1128).—A revision in the form of separate tentative specifications (see following abstract) is intended to replace, when adopted, the present standard specifications.—S. G.

Tentative Specifications for Zinc-Coated (Galvanized) Iron or Steel Telephone and Telegraph Line Wire (A 111–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 136–141).—Cover galvanized iron or steel wire suitable for use in telephone, telegraph, and signal transmission where electrical characteristics of the wire are important. The zinc used for the coating must be any grade of zinc conforming to "Standard Specifications for Slab Zinc (Spelter)" (B 6). The weight of zinc coating for wires 0·109 in. in diam. and larger must not be less than 0·8 oz./ft.^{2} of uncoated wire surface. The weight of coating for wire 0·083 in. in diam. shall not be less than 0·7 oz./ft.^{2}. The zinc coating must be tested for weight by a stripping test in accordance with "Standard Methods of Determining Weight of Coating on Zinc-Coated Articles" (A 90). The uniformity of the zinc coating is to be determined by the Preece test as described in the appendix to the last-mentioned specification (A 90). A wrapping test is specified for the determination of the adherence of the coating. The requirements as to base metal, joints, sampling, and the tensile strength, elongation, twists, electrical resistivity, size and permissible variations, of the galvanized wire, workmanship and finish, &c., are set forth.—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Specifications for Zinc-Coated (Galvanized) Iron or Steel Tie Wires (A 112–30). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1128).—A revision in the form of separate tentative specifications (see following abstract) is intended to replace, when adopted, the present standard specifications.—S. G.

Tentative Specifications for Zinc-Coated (Galvanized) Iron or Steel Tie Wires (A 112–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 142–145).—Cover the wire used for tying galvanized telephone and telegraph wire to insulators. The requirements as to zinc used, weight of coating, uniformity of coating, adherence of coating, are as for Tentative Specification No. A 111–32 T) (see abstract above).—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Specifications for Zinc-Coated (Galvanized) Iron or Steel Farm-Field and Railroad Right-of-Way Wire Fencing (A 116–30). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1128).—A revision in the form of separate tentative specifications (see following abstract) is intended to replace, when adopted, the present standard specifications.—S. G.

Tentative Specifications for Zinc-Coated (Galvanized) Iron or Steel Farm-Field and Railroad Right-of-Way Wire Fencing (A 116–32 T). —— (*Amer.

Soc. Test. Mat. Tentative Standards, 1932, 146–149).—The zinc used must be any grade conforming to the requirements of "Standard Specification for Slab Zinc (Spelter)" (B 6). The weight of zinc coating must not be less than that specified by the purchaser; the weight of coating commercially available on the various gauges of wire used is indicated. The zinc coating is to be tested for weight by a stripping test in accordance with "Standard Methods of Determining Weight of Coating on Zinc-Coated Articles" (A 90). The uniformity of zinc coating is to be determined by the Preece test as described in the appendix to the last-mentioned specification (A 90). The number of dips that commercially available weights of coatings on wires of various diameters will stand without failure are set forth for both types of fencing.—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Specifications for Zinc-Coated Iron or Steel Chain-Link Fence Fabric Galvanized After Weaving (A 117–30). —— (*Amer. Soc. Test. Mat. Tentative Standards,* 1932, 1128).—A revision in the form of separate tentative specifications (see following abstract) is intended to replace, when adopted, the present standard specifications.—S. G.

Tentative Specifications for Zinc-Coated Iron or Steel Chain-Link Fence Fabric Galvanized After Weaving (A 117–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards,* 1932, 150–152).—Covers zinc-coated chain-link fence fabric, galvanized after weaving, in which the individual pickets are helically wound and interwoven in the form of a continuous link fabric without knots or ties. The zinc used for the coating must be any grade conforming to "Standard Specifications for Slab Zinc (Spelter)" (B 6). The weight of coating on the wire is not to be less than 1·2 oz./ft.^{2} of uncoated wire surface. The zinc coating is to be tested for weight by a stripping test in accordance with "Standard Methods of Determining Weight of Coating on Zinc-Coated Articles" (A 90). The uniformity of the coating is to be determined by the Preece test as described in the appendix to the last-mentioned specification (A 90). Coatings must stand without failure 5 dips of 1 minute each.—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Specifications for Zinc-Coated (Galvanized) Iron or Steel Barb Wire (A 121–30). —— (*Amer. Soc. Test. Mat. Tentative Standards,* 1932, 1128).—A revision in the form of separate tentative specifications (see following abstract) is intended to replace, when adopted, the present standard specifications.—S. G.

Tentative Specifications for Zinc-Coated (Galvanized) Iron or Steel Barb Wire (A 121–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards,* 1932, 153–155).—Cover galvanized iron or steel barb wire in which the wire is zinc coated before or after fabrication. The zinc used must be any grade of zinc conforming to "Standard Specifications for Slab Zinc (Spelter)" (B 6). The weight of zinc coating on any individual wire shall not be less than specified by the purchaser; the weight of coating commercially available on the following wire is 0·30 oz. (min.)/ft.^{2} of uncoated wire surface: 0·1055 in diam., 12 gauge; 0·0985 in. diam., 12½ gauge; 0·080 in. diam., 14 gauge. The zinc coating is to be tested by a stripping test in accordance with "Standard Methods of Determining Weight of Coating on Zinc-Coated Articles" (A 90), and the uniformity of the coating is to be determined by the Preece test as described in the appendix to the same specifications (A 90). Coatings for the 3 sizes of wire above-mentioned shall stand without failure 1 dip of 1 minute and 1 dip of 20 seconds.—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Specifications for Zinc-Coated (Galvanized) Iron or Steel Wire Strand (A 122–30). —— (*Amer. Soc. Test. Mat. Tentative Standards,* 1932, 1129).—A revision in the form of separate tentative specifications (see following abstract) is intended to replace, when adopted, the present standard specifications.—S. G.

Tentative Specifications for Zinc-Coated (Galvanized) Iron or Steel Wire Strand (Cable) (A 122–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards,* 1932, 156–161).—Cover galvanized iron or steel wire strand, composed of a multiplicity of wires, and suitable for use as guy wires, messenger wires, span wires, electrical conductors, overhead ground wires, &c. The zinc used for the coating must be any grade conforming to "Standard Specifications for Slab Zinc (Spelter)" (B 6). The nominal diameters and minimum weights of coating for galvanized steel wires are set forth in a table. The zinc coating is to be tested for weight by a stripping test in accordance with "Standard Methods of Determining Weight of Coating on Zinc-Coated Articles" (A 90), and the uniformity of the coating is to be determined by the Preece test as described in the appendix to the same specifications (A 90). The number of dips that "galvanized" and "extra-galvanized" or "double galvanized" wires of various diameters shall stand without failure are given for wires of 5 diameters. A wrapping test is specified for determining the adherence of the coating, and a table sets forth the requirements as to physical properties of the galvanized wire strand.—S. G.

Metal Spraying. Walter Hahn (*Z.V.d. Kupferschmied.*, 1932, **44**, 139–140, 154–156).—A general review.—M. H.

[Metal Spraying.] Machine-Gun Bullets of Peace. L. E. Kunkler (*Welding Eng.*, 1932, **17**, (6), 24–25).—Brief non-technical description of the metal spraying process.—H. W. G. H.

Metal Foil Lacquers and their Commercial Uses. —— Stühlinger (*Ind. Lack. Betr.*, **1931**, (14), 203; *Nitrocellulose*, 1932, **3**, 85; *C. Abs.*, 1932, **26**, 4485).—Satisfactory results have been obtained with nitrocellulose lacquers for metal foil, instead of alcoholic shellac solutions. Oil must be removed before lacquering. Metal pressure rolls are generally used, because the solvents attack rubber rolls. 1 kg. of lacquer is sufficient for 3–4 kg. of 0·009 mm. foil.—S. G.

A Chemical De-Scaler. Anon. (*Colliery Eng.*, 1932, 9, 276).—An account is given of Starit, a scale solvent containing mineral acid, the action of the latter on metals being almost entirely inhibited by organic additions. The normal time required for scale removal is stated to be 6 hrs., but it is claimed that in less than 48 hrs. the action on aluminium, solder, and other readily attacked metals is inappreciable.—P. M. C. R.

Rubber-Lined Centrifugal Pumps. Anon. (*Indian Eng.*, 1932, **92**, 193).—Crude latex, first treated with chemical "fillers" and then vulcanized, is found to give an almost non-corrodible lining for use in pumps treating acid and corrosive liquids, or fluids containing suspended abrasive solids. The lining can easily be attached to gun-metal, cast iron, or other metals, and its exact properties can be modified over a wide range. The material may be applied to the impeller only, or its use can be extended to the cover or the whole interior of the casing.—P. M. C. R.

Rust Preventers and Slushing Materials. E. E. Halls (*Amer. Machinist (Eur. Edn.)*, 1932, **76**, 491–493).—"Temporary" rust preventers must be selected with a view to: (1) the conditions of storage, service, and exposure; (2) contamination by other surfaces; (3) effect of bi-metallic junctions, and (4) time period. The properties to be considered are: (1) adherence and tenacity; (2) continuity and non-porosity; (3) chemical characteristics; (4) ease of application and removal; (5) type of film, and (6) regularity and cost of supply. Cleaning has to be effected by removal of dirt and grease with solvents or detergents and of oxide, scale, and rust either mechanically or chemically. The manner in which various protectors act and their suitability for rust prevention are discussed. The results of corrosion tests of samples of copper and brass covered by dipping them in various lacquers, varnishes, and oils are tabulated. —J. H. W.

S-D-O, New Corrosion-Resisting Coating. O. M. Hayden (*Indust. and Eng. Chem.*, 1932, **24**, 563–564).—S-D-O is a synthetic drying oil discovered during the course of research on synthetic rubber. The only chemicals that attack S-D-O are strong oxidizing agents, such as concentrated hydrogen peroxide, chromic acid, nitric acid, and hot, concentrated sulphuric acid. Hydrofluoric acid penetrates S-D-O films, but does not destroy them. With these exceptions no chemicals have been found against which S-D-O does not give exceptional protection. It is best applied to a metal surface after sand-blasting. Scratch-brushing or pickling is inferior to sand-blasting.—F. J.

VI.—ELECTRODEPOSITION

Discoloration of Cadmium Plate and its Prevention. Gustav Soderberg (*Electrochem. Soc. Preprint*, **1932**, Sept., 315–322).—Cadmium plates from cyanide solutions discolour when stored without air circulation, particularly in warm and humid weather. The discoloration is greatly accelerated when a nitric acid bright dip has been used. The discoloration is probably caused by the action of moist ammonia fumes, formed by the disintegration of cyanide or ammonium salt residues on the surface of the plate. Discoloration can be avoided by means of immersion of the plate in an oxidizing solution prior to the final rinsing and drying. The oxidizing solution should not in itself cause staining of the plate. Known bright dips for cadmium plate are acidic, and dissolve cadmium without gas evolution. The nature of their action appears to be specific. A suitable bright dip which also prevents tarnishing consists of a chromic acid solution containing active acid radicals.—S. G.

Cadmium Plating by the Udylite Process. J. Bary (*Usine*, 1931, **40**, (21), 33).—The main features of the process are the facility of precise control, economical anodes, and the addition to the bath of colloidal starchy bodies.—H. H.

Theory and Practice of Electrolytic Chromium Plating of Metals. V. I. Leiner (*Zvetnye Metally* (*The Non-Ferrous Metals*), 1930, **5**, 1324–1342; *C. Abs.* 1931, **25**, 3920).—[In Russian.] Deposition of chromium by electrolysis of chromium trioxide is not a direct reduction but is the result of a series of successive reactions. The current density must be raised concurrently with temperature. The current efficiency increases with the current density and decreases as the temperature rises. Satisfactory results are obtained with an electrolyte containing chromium trioxide 25, chromic sulphate 0·5, and sulphuric acid 0·3%, the different ingredients being dissolved separately and the solutions then mixed. Up to current densities of 0·5–0·7 amp./cm.^{2} and a temperature of 10° C., the chromium deposit is bright, but the efficiency is low. For the electrolysis of chromium trioxide it is preferable to use lead anodes, and the area should be 0·5–0·67 that of the cathodes. Chromium anodes are difficult to machine and they dissolve much more rapidly than the chromium is deposited at the cathode; moreover, the valency of the chromium dissolved from chromium anodes varies according to the conditions of electrolysis. —S. G.

Chromium Plating on Zinc. M. de Kay Thompson and F. C. Jelen (*Electrochem. Soc. Preprint*, **1932**, May, 1–8).—Samples of sheet zinc 98·5% pure and of the dimensions 0·046 × 17·8 × 2·5 cm. (0·018 × 7 × 1 in.) were plated with different thicknesses of nickel, then with different thicknesses of chromium, and were tested by immersion in 20% sodium chloride and in 5% sodium sulphate solutions. The time required for the sample to lose its pleasing appearance was considered its life. It was found that the life of a sample prepared in this way is proportional to the thickness of the underlying nickel and independent of the thickness of the chromium up to a thickness corresponding with a 15-minute plate, which is 0·00034 cm. (0·00014 in.). The protection afforded by the underlying nickel depends on the solution from which it is plated. Chromium plated on copper separated from zinc by a thin layer of nickel (to prevent its diffusion into the zinc) does not last so long as when the chromium is plated on nickel of the same thickness as copper. With copper as an underlying metal the life does depend on the thickness of the chromium deposit because of the difference in colour between chromium and copper. As a preparation of zinc for chromium plating, a composite deposit of nickel and copper is 2 to 3 times as efficient as nickel alone with the same thickness as that of the composite deposit. Intermediate layers of tin and of cadmium followed by chromium did not give good protection, and chromium deposited directly on zinc gave poor protection. Difficulty was found in chromium plating deposits of nickel on zinc unless the nickel plate were heated in boiling water for 30 minutes. This trouble did not occur with die-castings.—S. G.

Working Directions for Rational Chromium Plating. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 273–276).—Practical hints in the form of questions and answers.—A. R. P.

The Influence of Temperature on the Conductivity of Chromium Baths. Paul Hentschel (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 316).—The conductivity of chromium-plating baths is considerably reduced by boiling. The "Kr" bath (see this *J.*, 1932, **50**, 449) remains stable almost indefinitely if not heated above 60° C. and can be operated satisfactorily at 25° C., at which temperature there is a range of 9 amp./dm.^{2} in current density within which bright deposits are obtained.—A. R. P.

High Throwing Power and Bright Plating Limits in the Chromium Bath. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 375–376).—The "Kr" chromium plating will give bright deposits with current densities as low as 2 amp./dm.^{2} at 25°–45° C. The upper limit for bright deposits rises from 9 amp./dm.^{2} to above 35 amp./dm.^{2} at 35° C. Within the above ranges the throwing power is much higher than that of other chromium baths.—A. R. P.

The Correction of the Sulphate Content of Chromium Baths. E. Raub (*Mitt. Forschungsinst. Edelmetalle*, 1932, **6**, 41–50).—To reduce the sulphate content of chromium-plating baths part of the excess sulphate may be removed by adding barium oxide, hydroxide, or carbonate to the bath. The hydroxide gives a good precipitate of barium sulphate only when the bath is previously heated to 60° C., and should preferably be added as a solution. Solid barium carbonate seems to be the best reagent to use, as 85–95% of the amount added is converted into sulphate, the precipitate is dense and settles well, and the carbon dioxide evolved stirs the solution; for every 1 grm. of sulphuric acid to be removed 2·3–2·4 grm. of barium carbonate are strewn over the surface of the bath, and, after gas evolution ceases, the bath is thoroughly stirred and the barium sulphate allowed to settle for a few hours.—A. R. P.

Sulphate Control in Chromium Plating. R. J. Piersol (*Metal Cleaning and Finishing*, 1932, **4**, 397–400, 414; *C. Abs.*, 1932, **26**, 5262).—A discussion of the necessity for maintaining a close sulphate control in chromium plating and the methods for effecting this.—S. G.

Current Control in Chromium Plating. R. J. Piersol (*Metal Cleaning and Finishing*, 1932, **4**, 277–280; *C. Abs.*, 1932, **26**, 4541).—A discussion of a typical power unit employed in chromium plating and the methods used to control the current.—S. G.

Temperature Control in Chromium Plating. R. J. Piersol (*Metal Cleaning and Finishing*, 1932, **4**, 329–332, 342; *C. Abs.*, 1932, **26**, 4541).—The principles of temperature control and heat transfer and the application of automatic control and recording equipment are discussed.—S. G.

Trivalent-Chromium Control in Chromium Plating. R. J. Piersol (*Metal Cleaning and Finishing*, 1932, **4**, 451–454, 462; *C. Abs.*, 1932, **26**, 5262).—A discussion of the formation and control of trivalent chromium in plating solutions and its effect on the plating range.—S. G.

Iron in the Chromium Bath. Paul Hopper (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 377).—Relatively large quantities of iron in the chromium-plating bath have little or no effect on the throwing power or on the character of the deposits.—A. R. P.

Study of Base Metals Used in Industrial Chromium-Plating Applications. Arthur Willink (*Quart. Rev. Amer. Electroplaters' Soc.*, 1932, **19**, (8), 12–15; discussion, 15–19).—The effect of heat and mechanical treatment of the base metal on the adherence of chromium plate is briefly reviewed. The discussion ranges round the difficulties associated with chromium-plating screws and dies.—A. R. P.

New Anodes for Chromium-Plating Baths. Heinr. Rüttermann (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 318–319).—Lead anodes require frequent cleaning to remove the passive film of lead chromate which readily forms. To avoid this unpleasant operation, new chromium anodes (exact nature not stated) have recently been prepared which remain active and increase the throwing power of the bath.—A. R. P.

Mist Removal from Chromium-Plating Baths With and Without Exhausters. A. Butziger (*Metallwaren-Ind. u. Galvano-Tech.*, 1931, **29**, 192–195; *C. Abs.*, 1931, **25**, 3921).—The advantages and disadvantages of eliminating "misting" from chromium plating baths by means of exhausters and by means of protecting layers are discussed. Although large exhausters are very efficient, the initial cost and the noise are undesirable. B. prefers protecting layers and suggests an apparatus which spreads the layer on the bath after the articles have been immersed, and sucks the layer back when the articles are to be removed.—S. G.

Chromium Plating Finds Increased Use in Textile Industry. E. R. Granger (*Textile World*, 1930, **77**, 3653; *C. Abs.*, 1930, **24**, 4937).—Chromium is particularly adapted for use in the textile industry because: the coeff. of friction of chromium is 30% lower than that of any other metal; it withstands corrosion; it does not crack or chip like porcelain; it resists oxidation to 1350° F. (732° C.); it is easy to clean, and it is less expensive than many other non-corrosive metals. It is applicable to printing rolls, Schreiner rolls, drying equipment, tensions, guides, and miscellaneous equipment.—S. G.

The Electro-Deposition of Iron–Cobalt Alloys.—I. S. Glasstone and J. C. Speakman (*Trans. Faraday Soc.*, 1932, **28**, 733–740).—The composition of the alloys deposited at current densities up to 7 amp./dm.^{2} from solutions containing various proportions of ferrous and cobalt sulphates has been determined at p_H 3·2, 4·0, and 5·2. The deposition potentials increase with increasing proportion of iron to total metal in the electrolyte from $-$ 0·56 v. for pure cobalt to $-$ 0·64 v. for 50% iron and $-$ 0·68 v. for 100% iron. The proportion of iron in the deposit increases with increasing current density to a maximum which is constant up to high current densities, when a slight decrease occurs. The alloy of maximum iron content obtained from a solution containing a given iron : cobalt ratio is independent of the p_H, and invariably contains a larger iron : cobalt ratio than the solution, but its actual composition is influenced slightly by stirring and by the total metal concentration of the solution. Deposits obtained at very low current density have a lower iron : cobalt ratio than the solution. The theoretical aspects of the deposition of iron–cobalt, iron–nickel, and cobalt–nickel alloys are discussed briefly.—A. R. P.

On the Production of Brass Plating Containing Cadmium. Robert J. Snelling (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 395–396).—Zinc–cadmium brass deposits with 60–63% copper, 16–18% zinc, and 20–23% cadmium can be obtained from baths containing 40 grm. of copper cyanide, 35 grm. of zinc cyanide, 3 grm. of cadmium cyanide, and 5 grm. of excess cyanide per litre, using a current density of 0·3 amp./dm.^{2} at 25° C. The nature and composition of the deposits may be varied within wide limits by varying the current density, the bath temperature, and the rate of agitation, and by addition of sodium hydroxide, sodium bisulphite, and a larger proportion of free cyanide. The copper content of the deposits is reduced by increasing the free cyanide (with sufficient excess copper-free deposits may be obtained), by addition of free alkali, and by addition of bisulphite in excess. Small quantities of bisulphite increase the copper content, whilst free alkali tends to make the deposits coarsely crystalline. Examples are given of the composition of deposits obtained from the bath under various conditions.—A. R. P.

Protection of Steel Against Outdoor Corrosion by Electrodeposits of Nickel, Chromium, or Nickel-Chromium. Pierre Jacquet (*Bull. Soc. Franç. Elect.*, 1932, [v], 2, 631–656).—Uniform samples of mild steel were cleaned, prepared, and plated under standardized conditions, and examined during and after 9 months' exposure. The coatings, deposited under fully described conditions, included chromium, chromium over nickel, and nickel; supplementary observations were made on nickel–cadmium–chromium, cadmium–nickel–chromium, nickel–copper–chromium, and nickel–cadmium–nickel–chromium coatings. Deposits of nickel less than 0·008 mm. thick afforded little protection; above this thickness the protective effect was good, although a chromium coating over the nickel, and of a thickness varying with that of the undercoat, gave even better results, and was superior from the point of view of appearance. Chromium alone afforded little or no protection up to 0·005 mm. thickness. Nickel–copper–chromium gave the best results as a protective coating; the bad appearance after weathering can be obviated by a light outer coat of chromium. Both nickel–cadmium–chromium and nickel–cadmium–nickel–chromium give good protection, but are liable to scaling of the chromium coat.—P. M. C. R.

Methods for the Pre-Treatment of [Tungsten Steel and] other Difficultly Workable Metals Prior to Coating Them with Corrosion-Resistant Materials [Nickel Plating]. A. Stein (*Korrosion u. Metallschutz*, 1932, 8, 89–91).—Good nickel plate can be deposited on hardened tungsten–steel only after pickling the metal in an acid solution of ferric chloride and nitrate.—A. R. P.

Importance of the Ferricyanide Test [for Nickel-Plated Steel]. Eugen Werner (*Oberflächentechnik*, 1932, 9, 31–32).—The value of the test for detecting pores, cracks, and other faults in nickel plating on iron and steel is illustrated.—A. R. P.

Platinum Plating. G. W. Lamotte (*Elect. Rev.*, 1932, **111**, 387).—A process for plating platinum direct on to base metals on a commercial scale has recently been perfected in Great Britain. With an electrolyte containing 3 oz. troy of plating salt per gall. of solution, and using a current density of 7·5 amp./ft.^{2} a plate 0·00003 in. thick is obtained in 6 minutes.—S. V. W.

Electrolytic Rhodium, Platinum, and Palladium Deposits. Paul Haas (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 315–316).—A brief review of the properties of rhodium, platinum, and palladium plate.—A. R. P.

Commercial Rhodium Plating. Lionel Cinamon (*Brass World*, 1932, 28, 97).—Short abstract of a lecture given before the Providence Branch, American Electroplaters' Society, and the American Chemical Society. A comparison of sulphate and phosphate baths, voltages, and methods of control is given. A copper, nickel, or precious metal undercoat is usually necessary.—J. H. W.

Electrodeposition of Tin from Solutions of Sodium Stannate. D. T. Ewing and Alfred Clark (*Univ. Mich. Eng. Exper. Sta. Bull.* No. 43, 1932, 1–16; *C. Abs.*, 1932, 26, 3442).—A temperature of 60° C. and a concentration of 140 grm./litre gave the highest current efficiency and a good deposit. The addition of sodium hydroxide lowered the current efficiency but produced a more dense deposit.—S. G.

The Electrodeposition of Tin. Possibilities of the Sulphocresylic Acid Bath. Anon. (*Chem. Trade J.*, 1932, 91, 397).—The bath is prepared by the anodic dissolution of tin in a solution containing 1 lb./gall. of sulphocresylic acid using a current of 40–50 amp./ft.^{2} at 2 v. and an iron cathode. The anodes should be bagged or separated from the cathode by a porous diaphragm. For plating the bath is operated at room temperature using tin anodes and a current density of 15–20 amp./ft.². The cathode current efficiency is 100%. Bright deposits are obtained directly; any deterioration in the nature of the deposit indicates depletion of soluble tin owing to too rapid deposition or too small an anode area. The bath should be replenished, to allow for drag-out, with a stock solution made as above and kept in reserve. To determine the thickness of the deposit a weighed quantity of the metal is stripped in a 10–20% solution of sodium plumbite (for iron) or in a mixture of 63% sulphuric acid, 12% nitric acid, and 25% water at 75° C. (for brass and copper). —A. R. P.

The Electrodeposition of Alloys. Lawrence E. Stout (*Washington Univ. Studies Sci. Tech.*, No. **6**, [N. S.], 1932, 9–37; *C. Abs.*, 1932, **26**, 5263).—A general review is given and previous work on zinc–cadmium, silver–cadmium, copper–nickel, iron–nickel, and copper–nickel–iron alloys is discussed. The conditions for the plating of the copper–iron system are given in detail. It is concluded that: (1) the composition of the deposits depends on the bath composition; (2) the percentage of iron in the deposit is independent of the current density, temperature, and tartrate content of the bath; (3) the presence of free cyanide in the bath prevents the deposition of iron; and (4) copper–iron alloys of good physical form may be obtained from the cyanide bath in the presence of potassium tartrate.—S. G.

The Adhesion of Metallic Electrodeposits. M. de Kay Thompson (*Metal Cleaning and Finishing*, 1932, **4**, 385–388; *C. Abs.*, 1932, **26**, 5262).—A discussion of the forces which make electrodeposits adhere to the base metal and also of the inherent causes for the lack of such adhesion.—S. G.

The Galvanic Treatment of Aluminium. J. Fischer (*Metallwirtschaft*, 1932, **11**, 473–474).—After reviewing various methods of producing protective metallic films on aluminium, a recent process developed by Siemens and Halske is described. The aluminium is oxidized in a chromic acid bath with direct current or in a soda bath with alternating current, then reduced in an alkaline bath containing a suitable metal, which is deposited on the aluminium in a thin film, on which a thin nickel film is applied. Finally the metal is plated with copper, chromium, or cadmium in the usual way.—v. G.

The Life of Plated Zinc as Affected by the Thickness of the Coating. E. A. Anderson (*Quart. Rev. Amer. Electroplaters' Soc.*, 1932, **19**, (8), 19–26; discussion, 26–31).—A thickness of 0·0003 in. of nickel and 0·00002 in. of chromium has been found sufficient to protect zinc from atmospheric corrosion for more than 2 years. Thinner nickel coats fail more rapidly.—A. R. P.

Plating of Zinc-Base Die-Castings. R. J. Wirshing (*Quart. Rev. Amer. Electroplaters' Soc.*, 1932, **19**, (8), 9–12).—For long life at least 0·001 in. of plating is necessary; this should consist preferably of 0·0005 in. of copper followed by the same thickness of nickel and a flash chromium plate.—A. R. P.

Preparation of Seamless Metal Tubes by Electrical Methods. Anon. (*Oberflächentechnik*, 1932, **9**, 1–2).—The cathode consists of a rotating mandrel of Thermisilid or chromium steel covered at the top end with a thin tube of the metal to be deposited. As the electrolysis proceeds, this tube is drawn slowly off the mandrel, so that a continuous tube of metal is gradually formed. Fusible metal cathodes can also be used and the metal then melted out. The process is described in detail with references to illustrations of the necessary apparatus. Very pure copper, zinc, and iron tubes are readily obtained, but the rate of manufacture is slow.—A. R. P.

Electro-Plating Rheostats. Frank Peasgood (*Met. Ind.* (*Lond.*), 1932, **41**, 327–329).—Describes 3 types of rheostat for electroplating work with currents up to 300 amp. The frequently rapid deterioration of these resistances is usually due to the operation of the plant and not to the design of the apparatus. —J. H. W.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-refining.)

Potential Gradients in Anodic Films. Frank W. Godsey, Jr. (*Electrochem. Soc. Preprint,* **1932**, Sept., 347–357).—The gas-oxide, solid oxide, and adsorbed liquid theories of the operation of electrolytic condensers using aluminium and tantalum electrodes are critically discussed.—A. R. P.

The Transport Number of Gold in Gold Amalgam. Karl Schwarz (*Z. physikal. Chem.*, 1932, [A], **161**, 231–232).—In the electrolysis of gold amalgam the gold migrates to the cathode. The transport number at 25° C. is $2·78 \times 10^{-7}$.—B. Bl.

The Influence of High-Frequency Currents on Polarized Electrodes.—I. S. Glasstone and J. D. Reynolds (*Trans. Faraday Soc.*, 1932, **28**, 582–596).—Superimposed high-frequency currents decrease the polarization of a platinum or lead cathode to an extent which is approximately proportional to the current density of the high-frequency current. This effect is small at high polarizing current density, almost independent of the dissolved gas in the electrolyte, and at constant frequency, proportional to the e.m.f. of the high-frequency current; on the other hand, the effect is large at low polarizing current density in solutions saturated with air or oxygen. These and other effects of superimposed high-frequency currents are attributed to an increase in the rate of diffusion of depolarizing agents to the electrode brought about by the high-frequency current.—A. R. P.

The Time Factor in Anodic Passivation of Metals. Remarks on the Paper of W. J. Shutt and V. J. Stirrup. W. J. Müller (*Trans. Faraday Soc.*, 1932, **28**, 471–473).—The results of S. and S. (see this *J.*, 1931, **47**, 165, and 1932, **50**, 252) are shown to be in accord with M.'s surface layer theory of passivation. —A. R. P.

Note on the Theory of the Hydrogen Overvoltage. A. Frumkin (*Z. physikal. Chem.*, 1932, [A], **160**, 116–118).—The logarithmic law connecting hydrogen over-voltage with current density and the relations between the catalytic activity and the affinity constants of weak acids and bases depend on the same basic principles.—B. Bl.

Chrom–Selenium Photovoltaic Cells. Colin G. Fink and Dwight K. Alpern (*Electrochem. Soc. Preprint,* **1932**, Sept., 305–313).—Electrodeposited films of a chromium–selenium combination have been obtained (details not given) which have a sensitivity of 150 microamp. per lumen. Photovoltaic cells made with this film appear to conform to the requirements of a true photoelectric effect in that the current is directly proportional to the absorbed illumination and the response is without detectable lag even with rapid variations of light. The maximum response of the cell is at 5100 A.—A. R. P.

VIII.—REFINING

(Including Electro-refining.)

On the Refining of Nickel. E. T. Richards (*Metallbörse,* 1932, **22**, 673–674).—Most deleterious impurities are removed by melting the metal in the air; sulphur and oxygen are then removed by covering the molten metal with a calcium silicate slag and adding wood charcoal or manganese followed by magnesium.—A. R. P.

Remelting of Nickel for the Production of Compact Pure Nickel Plates for Anodes. Leo Schmal (*Z. ges. Giesserei-Praxis*: *Das Metall,* 1931, **52**, 61–64; *Chem. Zentr.*, 1931, **102**, II, 304; *C. Abs.*, 1932, **26**, 4280).—Crude nickel in cubes, bars, or granular form is furnished by the smelter 98–99% pure, the particularly injurious impurities being iron, arsenic, sulphur, and carbon. Because of its high melting point, nickel readily forms the oxide which dissolves in the metal with the inclusion of gases. As a deoxidizer 0·05% magnesium, magnesium–aluminium alloy or magnesium–nickel alloy is used; magnesium–manganese–phosphorus alloy in the proportion 5 : 3 : 2 is very good; phosphorus alone in slight excess makes the nickel brittle. During remelting, the surface of the bath must be protected, by a glass cover, from oxidation and gas absorption. Nickel readily absorbs carbon from the melting pots, with the formation of fine pores which render the metal useless. The melting pots or crucibles must, therefore, have linings rich in clay. Casting moulds are best made of hematite pig iron, covered inside with graphite and linseed oil. Fine-pored crucibles lined with chamotte are placed in the founding moulds. Shaft crucible furnaces are used, oil furnaces are not suitable, and electric furnaces are too expensive to operate.—S. G.

Refining Platinum Metals.—I.—II. Martin Schwitter (*Brass World*, 1932, 28, 179–180, 205–206).—Reprinted from *Metal and Mineral Markets*. (I) The process of extracting platinum as an ammonium chloroplatinate precipitate from the products of cupellation is briefly described. This precipitate is further refined either by: (1) the sulphur dioxide method, in which it is reduced with sulphur dioxide and oxidized with sodium chlorate, the resulting sponge containing more than 99% platinum; or (2) the oxalic acid method, which is used when iridium or palladium is present, and in which impure metallic platinum is first obtained as above, dissolved in aqua regia, oxalic acid added to the hot nitric acid-free solution, and the platinum precipitated with ammonium chloride. (II) To refine palladium, the metal is dissolved in aqua regia, the nitric acid removed with hydrochloric acid and ammonium chloride added. After filtration, more hydrochloric acid and ammonium chloride are added and the palladium is precipitated as ammonium chloropalladate with sodium chlorate. The separation of iridium, ruthenium, rhodium, and osmium from metal containing gold, platinum, palladium, and large quantities of silver is briefly described, and the treatment of wash waters from these various processes is outlined.—J. H. W.

Modern Tin Refining. Walter Savelsberg (*Metallbörse*, 1932, 22, 833–834, 865, 897–898).—Recent improvements in methods of tin refining include treatment of the liquated metal with aluminium (added as a tin–aluminium alloy) to remove the last of the copper, antimony, and arsenic. Excess of aluminium is removed by blowing air and steam through the metal at 250–260° C. About 0·1% aluminium is required for every 1% of impurity to be removed, but not more than 3% should be added. Difficulties are encountered in treating the dross owing to the ease with which it reacts with water with the evolution of arsine. Lead is not removed by this process, but the greater part may be separated by cooling the metal to 232° C., and, as soon as the tin has crystallized and the temperature shows a tendency to drop, applying suction to withdraw the still liquid tin–lead eutectic. The remainder of the lead is removed by treating the purified metal with stannous chloride at 250–260° C. and removing the crust. The hardhead obtained in the original liquation is heated with high-grade ferro-silicon which removes the iron and allows the remaining tin to be liquated out.—A. R. P.

ELECTROLYTIC METHODS

The New Refinery at Copper Cliff, Ontario. V. A. James (*Canad. Min. Met. Bull.*, 1932, (244), 335–352).—A detailed description of new plant for the electrolytic refining of copper and silver.—E. S. H.

The Electrolytic Copper Refining Plant of the Zinnwerke Wilhelmsburg G.m.b.H., at Harburg-Wilhelmsburg near Hamburg. G. Eger (*Siemens Rev.*, 1932, **8**, (3), 49–55).—[In English.] Following a *résumé* of the electrolytic copper refining process, a description is given of the plant at the Wilhelmsburg tin works, near Hamburg, erected in 1929–30. The daily output is 50 tons, and the unit is the largest of its kind installed at the present time by the German electrolytic copper-refining industry.—R. Gr.

Contribution to Our Knowledge of the Principles for the Technical Electrolysis of Zinc with Reference to the Current Relations and the Composition of the Electrolyte. P. Röntgen and H. Högel (*Abhandl. Inst. Metallhütt. u. Elektromet. Tech. Hochschule, Aachen,* 1932, [N.F.], **1**, 16 pp.).—In the production of electrolytic zinc from zinc sulphate solutions derived from the leaching of ores the voltage of the baths decreases with increasing acidity up to 20%; with up to 6–7% of free acid increase in the zinc content of the electrolyte reduces the resistance, but at higher acidities increasing zinc content increases the resistance. The current yield falls with rise in free acidity to an extent which is greater the lower the zinc content. In neutral solutions the deposits are needle-like and nodular, as well as dark and shiny in parts; with increasing acidity up to 20% the deposits become smoother and more crystalline. In 40% acid re-dissolution of the cathode deposit is rapid. Most of the troubles encountered in the electrolysis are attributed to the formation of lead sulphate and peroxide at the insoluble lead anodes. The lowest power consumption is obtained with 13–20% of free acid according to the current density used.
—A. R. P.

Investigations on the Influence of Current Density and Temperature on the Technical Electrolysis of Zinc. P. Röntgen (*Abhandl. Inst. Metallhütt. u. Elektromet. Tech. Hochschule, Aachen,* 1932, [N.F.], **1**, 8 pp.).—The factors which influence the hydrogen overvoltage, especially the current density and composition of the solution, are discussed with reference to their action in modern methods of producing electrolytic zinc directly from its ores. High temperatures and high current densities give better deposits with lower current costs, especially when the electrolyte contains small quantities of impurities. Colloids reduce the current yield to a larger extent at low temperatures than at high. Cobalt has a particularly pernicious effect on the current yields at low temperatures, but its action is much less marked in hot solutions. Taking all things into consideration, the most economical procedure appears to be the use of current densities of about 6000 amp./m.^{2} and a bath temperature of 60°–80° C.—A. R. P.

On the Effect of Colloids on Technical Zinc Electrolysis. P. Röntgen and F. Felchner (*Arch. Erzbergbau, Erzaufbereitung, Metallhüttenw.*, 1932, **2**, 26–48; and *Abhandl. Inst. Metallhütt. u. Elektromet. Tech. Hochschule, Aachen,* 1932, [N.F.], **1**, 23 pp.).—The effect of additions of gelatin and glue on the deposition of zinc from pure sulphate solutions under varying conditions of current density, acidity, and bath temperature has been investigated. In all cases addition of colloid reduced the current yield, especially at concentrations of 0·05–0·5 grm./l. Increasing current density counteracts the effect of colloids, but increasing acidity considerably enhances the effect. The bath voltage increases with increasing colloid, but by thermal decomposition of the colloid the voltage again falls and the current yield rises, especially at low p_H. Maximum current yield of zinc is obtained after the colloid has aged in the bath for 48 hrs. With rising temperature the yields are greatest at low acidity, but are decreased by addition of colloid. A theoretical explanation of the action of colloids is given.—A. R. P.

The Utilization of Secondary Reactions in Igneous Electrolysis. L. Andrieux (*Chim. et Ind.*, 1931, **25**, 1047–1057).—A historical survey of electrolysis in fused baths is first given and the influence of secondary reactions in the following processes is then reviewed—refining of aluminium, preparation of magnesium, preparation of boron, tungsten, and molybdenum.—W. A. C. N.

IX.—ANALYSIS

Tentative Methods of Chemical Analysis of Aluminium and Light Aluminium Alloys (B 40–28 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 309–324).—See this *J.*, 1928, **40**, 585.—S. G.

Tentative Methods of Chemical Analysis of Metallic Materials for Electrical Heating (B 71–29 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 255–273).—This tentative standard (cf. this *J.*, 1928, **40**, 587) is now published in a revised form.—S. G.

Tentative Methods of Chemical Analysis of Silver Solders (B 81–31 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 325–334).—See this *J.*, 1931, **47**, 487).—S. G.

On the Detection of Cæsium, Rubidium, and Thallium by Spot Tests. N. A. Tananaev (*Z. anal. Chem.*, 1932, **88**, 343–347).—*Detection of Cs:* One drop of KI solution is placed on a piece of filter-paper, then 1 drop of $SnCl_2$ and 1 drop of the solution to be tested, followed by a further drop of KI; the spot begins to darken owing to the formation of $CsSnI_5$. Tl should first be removed as TlI. *Detection of Rb:* Tl and Cs are first removed by precipitation with $KBiI_4$, the filtrate is evaporated to dryness, the residue ignited with $H_2C_2O_4$, the Rb extracted with H_2O, and the filtered solution again evaporated with HCl to dryness; this residue is moistened with a few drops of a mixed solution of $PdCl_2$ and $AuCl_3$, which precipitates Rb as bluish-black $Rb_2AuPdCl_7$. *Detection of Tl*: The solution is heated on a filter-paper impregnated with a HCl solution of $PdCl_2$ and $AuCl_3$; in the presence of Tl a cinnamon-brown colour appears which turns black with NaOH owing to reduction of the Au and Pd by TlOH.—A. R. P.

The Solubility of Antimony Trisulphide and Stannic Sulphide in Ammonia and Ammonium Carbonate. P. A. Epik (*Z. anal. Chem.*, 1932, **89**, 17–23).—Sb_2S_3 is soluble up to a maximum of 1·28 grm./100 c.c. of aqueous NH_3, but practically insoluble in $(NH_4)_2CO_3$ solution. SnS_2 is readily soluble in aqueous NH_3; its solubility in $(NH_4)_2CO_3$ solutions reaches a maximum of 0·17 grm./100 c.c. In view of these facts, the use of $(NH_4)_2CO_3$ solutions to separate As from Sn and Sb cannot be recommended.—A. R. P.

Separation of Cadmium from Zinc by H_2S. Leo Baumeister (*Chemist-Analyst*, 1932, **21**, (3), 7–8).—Separation is best effected in H_2SO_4 solution rather than in HCl. For the separation of little Cd from much Zn the solution should contain 4 c.c. of H_2SO_4 (*d* 1·84) per 100 c.c.; double precipitation is generally advisable. Determination of Cd by electrolysis is more convenient than weighing as $CdSO_4$ or $Cd_2P_2O_7$. For 1–10 mg. of Cd electrolysis is carried out in a feebly alkaline cyanide solution, but for more than 10 mg. of Cd a slightly acid sulphate solution is better. Cu-plated Pt cathodes are used; after weighing the deposit it can be removed without appreciably affecting the Cu by treatment with 2% HNO_3.—A. R. P.

Materials in the Analysis of Platinum Metals. IV.—On the Analytical Separation of Copper from Rhodium. O. E. Zviagintzev (*Zhurnal Prikladnoĭ Khimii* (*Journal of Applied Chemistry*), 1932, [B], **5**, (2), 217–218).—[In Russian, with German summary.] Alloys of Cu with Rh, especially if the Rh exceeds 50%, are very sparingly soluble in acids, even aqua regia. If the alloy is fused for some time, however, with 10 times its weight of Zn, it dissolves completely in aqua regia. When the alloy contains more than 50% Rh, this metal is precipitated with NH_4NO_2 in excess of NH_4Cl. The precipitate

(which contains some Cu) is redissolved, reprecipitated, heated to redness in a stream of H_2, and weighed as Rh. If the alloy contains less than 50% Rh, the Cu is first removed as CuCNS, and the Rh determined as above.
—M. Z.

Studies on the Oxime Method for the Gravimetric Determination of Various Metals by Means of the Thermo-Balance. Saburo Ishimaru (*Kinzoku no Kenkyu*, 1932, **9**, (9), 378–391).—[In Japanese.] The oxime method for the gravimetric determination of Cu, Mg, Zn, Cd, Al, Bi, Fe, Mn, Ni, Co, Ti, U, Th, Ca and Pb was studied by means of the thermo-balance. The results of the experiments are shown in a table.—S. G.

The Potentiometric Determination of Aluminium. W. Stefanovsky (*Zhurnal Prikladnoĭ Khimii* (*Journal of Applied Chemistry*), 1932, [B], **5**, (1), 92–98).—[In Russian, with German summary.] Accurate results cannot be obtained by the potentiometric titration of $Al(NO_3)_3$ with NaOH unless $NaNO_3$ is present; this reduces the error from 4·4–6·5% to 0·5–1·3%, but owing to the small change in potential the determination of the equivalent point is very difficult. Titration with HNO_3 of the excess NaOH added during the titration of the $Al(NO_3)_3$ gave a marked increase in accuracy. The potentiometric titration of $AlCl_3$ with NaOH gave no positive results: the errors were 8·3–8·6% and the degree of hydrolysis of the salt was greater.
—M. Z.

The Determination of Minute Amounts of Copper in the Presence of Iron and Certain Other Metals. L. Haddock and Norman Evers (*Analyst*, 1932, **57**, 495–499).—The solution is treated with citric acid, then with a slight excess of NH_4OH and a little Na diethyldithiocarbamate. The Cu compound is extracted by shaking with CCl_4 and the yellow constituent of the coloured solution is measured in a Lovibond tintometer.—A. R. P.

On the Disturbing Effect of Chlorine and Ammonium Salts in the Colorimetric Determination of Small Quantities of Mercury with Diphenylcarbazone. Vladimir Majer (*Z. anal. Chem.*, 1932, **87**, 352–356).—NH_4 salts and Cl interfere with the colorimetric determination of Hg. Cl is removed by evaporation over P_2O_5 and soda-lime in a vacuum desiccator, and NH_4 salts by precipitation of the Hg on Cu wire. The Hg is removed from the Cu by dissolution in Cl water and after removal of the excess Cl the Hg is determined colorimetrically with diphenylcarbazone.—A. R. P.

On the Preparation of Sodium Cobaltinitrite as a Reagent for Potassium. E. Rupp and A. Poggendorf (*Apoth.-Zeit.*, 1932, **47**, 282–283; *Chem. Zentr.*, 1932, **103**, I., 3205–3206).—A solution of 5 grm. of $Co(NO_3)_2$ crystals in 2·1 grm. of glacial $CH_3 \cdot COOH$ and 1 c.c. of H_2O is treated with a lukewarm solution of 10 grm. of $NaNO_2$ in 11 c.c. of H_2O, air is drawn through the mixture for 30 minutes to remove NO, and, after filtering, the solution is mixed with 20 grm. of anhydrous Na_2SO_4 and the mixture dried in a vacuum desiccator. The pulverized mass may be kept unchanged for 2 years in a brown glass bottle.
—A. R. P.

Determination of Silicon in Aluminium. L. H. Callendar (*Analyst*, 1932, **57**, 500–511).—Four methods are described and discussed. In all cases double evaporation is necessary to recover all the SiO_2 and the residue from HF treatment should be ignited to 1000° C. to ensure elimination of SO_3. There is no satisfactory method of determining Si and SiO_2 separately in Al.
—A. R. P.

Microelectrolytic Determination of Silver, Mercury and Cadmium in Ammoniacal Solutions. A. Okáč (*Z. anal. Chem.*, 1932, **89**, 106–112).—The method previously described for Cu, Ni, and Co (see this *J.*, 1932, **50**, 442, 443) may be applied to the determination of Ag, Hg, and Cd.—A. R. P.

The Potentiometric Estimation of Zinc. I. Tananaev (*Zhurnal Prikladnoĭ Khimii* (*Journal of Applied Chemistry*), 1932, [B], 5, (1), 86–91).—[In Russian, with German summary.] Existing volumetric methods for Zn are briefly summarized and the method involving precipitation of the Zn with an excess of $K_4Fe(CN)_6$ followed by potentiometric back-titration of this excess with $KMnO_4$ has been investigated. Direct potentiometric titration of Zn with $K_4Fe(CN)_6$ in the presence of $K_3Fe(CN)_6$ is unsuitable for routine analysis owing to the slow rate of attainment of the equilibrium potential and the low accuracy (0·5–1%). If, on the other, the excess of $K_4Fe(CN)_6$ is titrated with $KMnO_4$ in the presence of $KHSO_4$ after the Zn has been precipitated from a boiling solution, the change in potential changes sharply at the end point and the accuracy is 0·1–0·15%.—M. Z.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

(See also "Testing" and "Pyrometry.")

Modifications in the Haughton–Hanson Thermostat. J. L. Haughton (*J. Sci. Instruments*, 1932, **9**, 310–315).—A description of different modifications and developments of the original Haughton–Hanson thermostat (this *J.*, 1915, **14**, 145) with special reference to: the design of (1) the U-tube; (2) the cold bulb; and to (3) devices for slow heating and cooling; (4) controlling resistances, ammeter, and general lay-out. Several of these devices have been described previously, but the paper gives a most valuable review, and discusses critically the most suitable modifications for different purposes. —W. H.-R.

Recent Workshop Practice, with Special Reference to Optico-Mechanical Instruments for Exact Measurement. O. P. van Steewen (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1931, **7**, 177–180, 193–197).—The following instruments are described and illustrated: (1) Hirth Minimeter, with adaptations for taking exact internal measurements of spherical sections and of channels, or for automatically indicating internal measurements on a scale; (2) Zeiss Passameter, for the external measurement of diameter, sphericity, conicity, &c., and also for certain types of internal measurements; (3) Zeiss Passimeter, a companion instrument to the Passameter, for internal measurements; (4) vertical and horizontal forms of Zeiss Optimeter, and an adaptation of this instrument to internal measurement; (5) Werner Microlux Gauge; (6) Zeiss Ultra-Optimeter for especially accurate work; (7) optical gauges for screw-threads and for testing accuracy of pitch; (8) gear-testing apparatus; (9) a conveniently adjustable type of bench microscope for metallographic examination; (10) an optical profile-checking machine.—P. M. C. R.

Technique of Vibration Measurements. E. Lehr (*Z.V.d.I.*, 1932, **76**, 1065–1073).—A review of modern measuring instruments and bibliography.—v. G.

New Automatic Temperature Control. Anon. (*Fuel Economist*, 1932, **8**, (85), 59–60).—A mercury-in-steel thermometer and valve operated by compressed air designed for thermostatic control between 40° and 1200° F. (4° and 649° C.) are described.—J. S. G. T.

On the Permeability of Refractory Masses to Gas. F. Durau (*Z. tech. Physik*, 1932, **13**, 228–233).—Tests have been made at various temperatures on the amount of gas evolved by, and the permeability to gases of, tubes made of various refractories as used in the laboratory. All tubes were gas-tight up to 1200° C., but evolved considerable quantities of dissolved, occluded, or chemically produced (by reactions of the constituents) gases, the composition of which varied considerably.—J. W.

XI.—PHYSICAL AND MECHANICAL TESTING, INSPECTION, AND RADIOLOGY

The Testing of Large Castings. Anon. (*Shipbuilder*, 1932, **39**, 522).—A discussion on the testing of large castings deals with the values obtained from test-pieces attached to the casting and test-pieces cast separately, and also with special percussive or hammering tests for soundness, and suggests that such testing cannot reveal the condition of the casting as a whole, and that reliance must be placed on good foundry practice. Reference is also made to the use of the gamma rays for such testing.—J. W. D.

The Elongation Lines Method for the Determination of the Stress Distribution Governing the Safety Factor in Alternating Fatigue Tests. Otto Dietrich and Ernst Lehr (*Z.V.d.I.*, 1932, **76**, 973–982).—To determine the distribution of the elastic stresses in a metal the specimen is coated with a varnish (nature not stated) having suitable mechanical properties, and then loaded as used in practice. With loads well below the elastic limit, fissures perpendicular to the direction of maximum tensile stress appear in the varnish film. From the course of these fissures and from elongation measurements with a mirror apparatus the magnitude and distribution of the stresses can be determined.—v. G.

On the Method of Testing Metals in Statical Tension. W. Alexandrov and B. Pantchenko (*Vestnick standartizazii* (*Messenger of Standardization*), **1931**, 11–12 (35–36), 31–38).—[In Russian.] The following points must be considered in agreeing on a standard method of testing: (1) a definition of the test itself and of the characteristic features of the testing process; (2) rules for preparing the specimens; (3) shape and size of the specimens; (4) rules for testing technique; (5) evaluation of the results. The above points are examined and in their light are compared the standards adopted by various institutions and works.—N. A.

Tentative Methods of Compression Testing of Metallic Materials (E 9–27 T) —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1093–1097).—See this *J.*, 1927, **38**, 529.—S. G.

On the Theory of Herbert's Pendulum [Hardness Tester]. E. M. Gutair (*Vestnick Ingenerov i Tehnikov* (*Messenger of Engineers and Technologists*), **1932**, (5), 234–238).—[In Russian.] The time taken for a single oscillation of the Herbert pendulum is given by the expression, $T = \pi\left(\frac{Sc^2 + (r + e)^2}{g\left(\frac{r^2}{R - r}\right) + e}\right)^{\frac{1}{2}}$, where r is the radius of the ball, R the radius of the impression, e the distance between the centre of gravity of the pendulum and the centre of the ball, and Sc the radius of inertia. Errors in the conclusions of Pomp and Schweinitz (*Mitt. K.-W. Inst. Eisenforschung*, 1926, **8**, 79) are discussed.—N. A.

Testing Sheet Metals by Cupping. J. Cournot (*Usine*, 1931, **40**, (21), 39).—Abstract of a paper read before the Société Française pour l'Essais des Matériaux. Describes the test developed by Siebel and Pomp in which an initial hole is made in the test-piece before cupping. See this *J.*, 1930, **43**, 579; **44**, 600; 1931, **47**, 392.—H. W. G. H.

Tentative Accelerated Life Test for Metallic Materials for Electrical Heating (B 76–29 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 280–288).—See this *J.*, 1929, **42**, 560.—S. G.

Tentative Methods of Test for Determining the Temperature–Resistance Constants of Resistance Alloys (B 84–31 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 274–279).—See this *J.*, 1932, **50**, 91–92.—S. G.

Tentative Method of Test for Thermoelectric Power (B 77–30). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 289–291).—See this *J.*, 1930, **44**, 606.—S. G.

Tentative Definitions of Terms, with Units and Symbols, Relating to Magnetic Testing (A 127–31 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 219–222).—See this *J.*, 1931, **47**, 662.—S. G.

Tentative Specifications for Round-Hole Screens for Testing Purposes (E 17–31 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1075–1076).—See this *J.*, 1932, **50**, 93.—S. G.

Tentative Definition of the Term Screen (Sieve) (E 13–28 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1114).—See this *J.*, 1928, **40**, 620.
—S. G.

RADIOLOGY

Experimental Radiography Utilizing the Gamma Rays of Radium. C. G. Osment (*Brit. J. Radiology*, 1932, **5**, 269–274).—Without going into details of the underlying principles, the possibilities and advantages of using gamma rays instead of X-rays for the examination of metals are pointed out. The quantity of radium required for radiographic purposes depends on: (1) thickness of material to be radiographed; (2) number of objects to be radiographed; (3) maximum time that could be allowed for the exposure. Tables showing the connection between the thickness of steel penetrated and the amount of radium required, are given. Owing to their greater penetrating power, gamma rays will probably prove the only satisfactory method of testing castings having a thickness of more than 3 in. of steel or its equivalent. A number of radiographs obtained with gamma rays are shown and described.—S. V. W.

Radiographic Examination of Metals by Means of Gamma Rays and Radioactive Bodies. M. Holweck (*Bull. Soc. Ingénieurs Soudeurs*, 1932, **3**, 583–590).—The use of radium, mesothorium, or radon eliminates the complicated and bulky apparatus necessary for the production of X-rays. Examination of large objects *in situ* is therefore much easier. Exposures necessary are of the order of 15 hrs. and the quantity of radium necessary to examine thick material increases rapidly with the thickness. A table of quantities necessary for various thicknesses is given. It is possible, by means of gamma rays, to detect a fault representing 2% of the thickness of the material if the fault is near the photographic film, or 4%, if it is near the source of rays.—H. W. G. H.

Technical X-Ray Pictures [of Welds] and their Interpretation. W. Grimm and F. Wulff (*Autogene Metallbearbeitung*, 1932, **25**, 217–221 and 232–237).—The two methods of X-ray examination—visual and photographic—are explained; the former has limited application, but gives immediate information, whilst the latter has wider scope, but requires time for development of the film. The correct interpretation of X-ray photographs is not a simple matter, as there are many factors which may be misleading. These are explained. A radiograph of a weld is illustrated, showing the presence of entrapped gas and stress cracks due to shrinkage. Deductions regarding the position of the faults and their nature are explained. The effect of exposure time on the radiograph is illustrated by photographs of a boiler weld. The exposure is affected by voltage changes, differences in X-ray tubes, and the constitution of the material. The effects of space between film and specimen, undue pressure on the film, faulty developing, and faulty cassettes are also illustrated and explained. Examples are shown of radiographed acetylene and arc welds in steel, welds in copper, brass, aluminium, steel castings, bronze billets, and gas cylinders.—H. W. G. H.

XII.—PYROMETRY

The Use of Optical Pyrometers in Foundries. M. Held (*Fonderie moderne*, 1932, **26**, 390–392).—A description of the principles, construction, and methods of using total and partial radiation and disappearing filament pyrometers in the foundry for measuring temperatures above 1600° C. and a discussion of the conditions which dictate the type to be used, are given.—J. H. W.

On the Calibration of Thermocouples at High Temperatures. Keizô Iwasè (*Kinzoku no Kenkyu*, 1932, **9**, (8), 321–327).—[In Japanese.] The danger of supercooling tends to vitiate the cooling-curve method in the case of such standard silicates as lithium silicate or diopside, and the disadvantages of the alternative (quenching) method make the use of silicates infrequent. I. describes a method for the accurate determination by cooling curves for the above and other silicates. For the determination of the fixed points between 1000° and 1600° C., titanite (m.p. 1382° C.) and the nickel–carbon eutectic (m.p. 1324° C.) are recommended.—P. M. C. R.

An Improved Comparison Source for Measuring Furnace Temperatures. E. M. Watson and W. P. Zabel (*Gen. Elect. Rev.*, 1932, **35**, 120–121).—The brightness of a stout carbon filament in an incandescent lamp is compared directly against the brightness of the furnace. To reduce glare from the lamp the inside of the bulb is blackened with the exception of two eye-holes in line with the filament. Auxiliary equipment consists of a suitable transformer or resistance for reducing the voltage to that necessary for the lamp and a second regulating resistance for making the actual comparison. The filament current is taken, and this may be referred to a temperature scale.—S. V. W.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

Materials for the Scientific Designing of Casting Heads. W. I. Fundator (*Niimash Izvestia Nauchno-issledovatelskogo Instituta Mashinostroenia i Metalloobrabotki* (*Bulletin of the Scientific Research Institute of Machine Building and Metal Treatment*), 1932, (5–6), 289–318).—[In Russian.] Experimental data for the throughput capacity of straight and casting heads are given. A table shows the minimum rate of feed, *i.e.* the minimum cross-section of the heads at which the mould is filled completely without giving rise to rejects owing to cavities. Examples of calculations for casting heads in accordance with F.'s tables are given.—N. A.

Shrinkage and Gas Cavities. E. Scheuer (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 15–16).—A summary and discussion of a paper by S. in *Metallwirtschaft*, 1931, **10**, 947–951. The writer of the summary criticises the views of S. as to the effects of gas or shrinkage cavities in metal objects, suggesting that the weakening effect is much greater than might be anticipated.—R. G.

The New RWR Casting Process of the Vereinigte Aluminium-Werke A.-G. —— Kessner (*Metallwirtschaft*, 1932, **11**, 583–584; and (translation) *Light Metals Research*, 1932, **2**, (18), 2–5).—The aluminium is cast into a copper mould previously heated to the melting point of aluminium, so that the metal remains liquid until the mould is filled. The mould is then covered with a copper lid and inverted, and water is sprayed on this lid, so that the metal solidifies from the bottom upwards. To obtain a fine-grained structure the mould is vibrated at a suitable frequency and amplitude. The casting temperature is 720° C., casting time for a 50-kg. ingot 120–135 seconds, time to invert the ingot 16–18 seconds, time of shaking 10 minutes, total casting time 22–25 minutes. The castings are dense, free from gases and vapours, and have no shrinkage pipe.—v. G.

The Casting of Ingots. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 165–167).—A brief discussion including an illustrated account of the RWR casting process for aluminium, *Metallwirtschaft*, 1932, **11**, 583–584 (see preceding abstract).—R. G.

Action of Chloride Flux on Oxides Contained in Aluminium. Takayasu Harada (*Suiyokwai-Shi*, 1932, **6**, 807–816; *C. Abs.*, 1932, **26**, 5046).—[In Japanese.] Melted aluminium containing about 2·5% Al_2O_3 was treated with zinc chloride and titanium tetrachloride. The Al_2O_3 was decreased to about 0·45% in the best case. Chlorine and nitrogen gases decreased the Al_2O_3 to about 0·8%. H. concludes that the action of chloride flux in the removal of oxides in aluminium may be mechanical, as is that of chlorine and nitrogen.—S. G.

On the Normal and Inverse Segregation of Aluminium–Copper Alloys. Hans Bohner (*Metallwirtschaft*, 1932, **11**, 437–438).—On slow cooling of aluminium alloys with copper, the outside of the ingot is poorer in copper than the core. The difference increases at first with increase in the rate of cooling, then at a definite critical cooling rate changes its sign, and finally decreases further. This applies to alloys in the solid solution range (3% copper) as well as to those with more (up to 8·5%) copper.—v. G.

Studies on the Founding of Bronze. E. Moustacas *et al* (*Usine*, 1931, **40**, (5), 37).—Report of a discussion before the Association Technique de Fonderie, held in January 1931, and opened by M. If bronze castings are to be sold to specification it will be necessary to control the composition and mechanical properties of refined ingot metal which is very commonly used. Tensile and hardness tests, micrographic examination, and chemical analysis are considered necessary.—H. W. G. H.

Gas Porosity in Brass Castings. S. D. Tzypurdeev (*Metallurg* (*The Metallurgist*), 1932, **7**, (1), 84–93).—[In Russian.] The nature and cause of various defects which occur in brass castings are discussed with particular reference to the formation of gas-filled pores. This defect has given much trouble at the Koltchugin Works especially in casting Muntz metal and experiments on the laboratory and works scale have been made to discover the cause and means for its prevention. This paper records, however, only a summary of information already published on the subject together with an extensive bibliography.—M. Z.

The Melting of Thick Brass Castings : Bad Practice and its Consequences. Anon. (*Z. ges. Giesserei-Praxis* : *Das Metall*, 1931, **52**, 113–114).—It is difficult to make perfect large brass castings, and this is chiefly due to the use of unsuitable raw material, to overheating the molten brass, to melting for too long a time, to the use of unsuitable metal covers, and to lack of, or to insufficient, deoxidation. These faults and their effects are considered at some length and methods of obviating them are discussed. See also this *J.*, 1932, **50**, 196.—J. H. W.

Alloys for Pressure-Castings. N. F. Bolchovitinov (*Liteinoe Delo* (*Foundry Practice*), **1932**, (3), 17–20).—[In Russian.] Brief review of the present situation in this field.—N. A.

Moulds for Aluminium Die-Castings. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1931, **7**, 139–140).—Continuation of a contribution to *Werkzeug und Werkstatt*, 1930, **24**. The present section describes the preparation of an improved mould for the die-casting of a motor-bonnet. A complete list of requisite pieces, with reference numbers to the accompanying diagrams, together with the appropriate material for each piece, and full details of the actual process are given.—P. M. C. R.

Casting Water-Meters in Wet Sand. A. Heinz (*Z. ges. Giesserei-Praxis* : *Das Metall*, 1932, **53**, 395–398).—The sand-mixing, mould preparation, and the making of a difficult casting, such as a water-meter, in wet sand are described.—J. H. W.

The Standardization of Patterns in the Foundry. —— Mantelet *et al* (*Usine*, 1931, **40**, (14), 27).—Report of a discussion held by the Association Technique de Fonderie and opened by M. The need for co-operation between the engineer, the founder, and the pattern-maker which might be based on some simple, standardized rules, is emphasized.—H. W. G. H.

Notes on Foundry Sands. F. A. W. Livermore (*Met. Ind.* (*Lond.*), 1932, **41**, 293–294).—Foundry sands are classified under 4 heads: (*a*) moulding sand; (*b*) core sand; (*c*) facing sand; and (*d*) parting sand. Typical analyses of each of these sands are given and the qualities required by each class are described.—J. H. W.

Grain-Size and Bond Distribution in Synthetic Moulding Sand. A. H. Dierker (*Trans. Amer. Found. Assoc.*, 1932, **40**, 230–238; discussion, 239–240). —A method for the microscopic examination of moulding sands is described. The distribution of bonding clay, its variation according to grain-size and time of milling, and the relation of surface area to grain-size are discussed, and the progressive improvement of bond distribution with milling is illustrated by photomicrographs. It is claimed that the permeability, bond and fineness of a sand can now be specified for any given type of casting.—P. M. C. R.

Materials Handling in the Small Brass Foundry. D. G. Anderson and B. F. McAuley (*Trans. Amer. Found. Assoc.*, 1932, **40**, 310–321; discussion, 321–324; and (abstract) *Foundry Trade J.*, 1932, **46**, 289–290).—The introduction of mechanical handling and electrical melting into a small brass foundry turning out a wide variety of non-ferrous castings is described, with special reference to sand-conditioning, conveyance, and control, and to moulding and pouring equipment and procedure. It is stated that a uniform grade of sand can be used for many different types of casting, and that its employment makes it possible to use a single sand-conditioning unit. Unjacketed moulds can safely be moved into position on roller conveyors. Specially designed tumbling barrels are used for the rapid sand-blasting of small or medium castings, whilst a sand-blast cabinet is used for large work. High-quality metal can be produced from scrap by melting in an electric arc furnace. In the discussion, the questions of conveyor speeds and of sand sampling are raised.—P. M. C. R.

How Much Does it Cost to Train Foundry Apprentices? J. Franklin Carlz (*Trans. Amer. Found. Assoc.*, 1932, **40**, 217–229).—A consideration of the cost of a training course for foundry apprentices, established in 1927, shows that the cost per apprentice per year ($176.54) is more than balanced by increased and improved production.—P. M. C. R.

Present Tendencies in the Foundry. E. Ronceray (*Usine*, 1931, **40**, (Special No.), 51–54).—Reviews progress in foundry organization, technique, and equipment as indicated by the Paris Fair.—H. W. G. H.

XIV.—SECONDARY METALS: SCRAP, RESIDUES, &c.

On the Re-Working of Dirty Aluminium Residues. Anon. (*Metallbörse*, 1932, **22**, 578).—A brief review of recent articles on the subject by R. J. Anderson.—A. R. P.

The Melting of Aluminium Borings and Turnings. A. E. (*Machinery* (*Lond.*), 1932, **39**, 502).—Workshop notes. Hand-puddling must be used, or suitable fluxes stirred in, to promote coalescence of oxide-coated globules.—J. C. C.

The Melting of Aluminium Borings and Scrap. A. E. (*Machinery* (*Lond.*), 1932, **39**, 637).—A note. Figures are quoted for the recoveries obtained in American practice when remelting various classes of scrap.—J. C. C.

New Scrap Classifications on Red Grades [and] Aluminium Adopted at Convention. Anon. (*Daily Metal Reporter*, 1932, **32**, (52), 9).—An account of a meeting of the National Association of Waste Material Dealers at which the classifications of certain types of scrap brass, and new, pure aluminium clippings, new and old, pure aluminium wire and cable, old scrap sheet aluminium, and scrap aluminium castings, were revised.—P. M. C. R.

The Remelting and Refining of Old Copper for the Manufacture of Rolling Ingots, Billets and Plates. Richard Thews (*Metallbörse*, 1932, **22**, 161–162, 193–194).—A brief description is given of the refining of scrap copper in reverberatory furnaces by a blast of hot air, the various stages in the deoxidation of the product and the methods of casting to obtain sound ingots for subsequent working. An account is also given of the effects of small quantities of impurities and of various devices which have been adopted to mitigate or overcome these defects.—A. R. P.

Recovery of Gold and Silver [from Jewellery Scrap]. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 318).—To recover gold from gold–copper alloys which cannot be parted in nitric acid, the alloy scrap is dissolved in aqua regia, any silver chloride being filtered off, and the filtrate treated with an excess of caustic potash to precipitate the copper, leaving a solution of potassium aurate from which the gold is recovered by addition of hydrogen peroxide. A method for recovering silver from copper–silver alloy scrap is briefly outlined.—A. R. P.

Precious-Metal Scrap. Anon. (*Metallurgia*, 1932, **6**, 114).—The description of a process for the recovery of gold, platinum, palladium, and iridium from jeweller's scrap. Heterogeneous scrap is melted and cast into bars, which are dissolved in molten lead and the base-metal impurities removed by oxidation before cupellation. The precious metals are then cast into anodes and electrolysed, when the silver is deposited on the cathode and the other metals are collected at the anode as slimes, which are treated chemically and separated in the order iridium, gold, platinum, and palladium. Rich scrap is cast directly into anodes and electrolysed.—J. W. D.

On the Treatment of Residues Containing Precious Metals. W. Stein (*Mitt. Forschungsinst. Edelmetalle*, 1932, **6**, 19–25, 35–40).—Brief outlines are given of methods for the recovery of the precious metals from alloy scrap, doublé scrap, filings, old plating baths and wash-water, lemel, and hand-wash water.—A. P.

The Recovery of Precious Metals from Factory Waste. John S. Isdale (*Brass World*, 1932, **28**, 138–139).—Describes the recovery of precious metals by means of exhaust fans and collectors over buffing machines, burning wooden floors of workshops, the use of settling tanks, and by precipitation from electroplating solutions.—J. H. W.

On the Production of Remelted and Guarantee Zinc Low in Iron. Wilhelm E. Herrmann (*Chem. Zeit.*, 1932, **56**, 133–134).—The advantages and disadvantages of remelting zinc scrap in reverberatory furnaces and iron kettles are discussed at some length. Kettles are preferable for ferruginous zinc as the iron–zinc alloy rises to the relatively cool surface, whereas in the reverberatory furnace the surface of the metal is the hottest part of the charge, so that the iron tends to disperse throughout the metal and can be satisfactorily removed only by treatment with sulphur. The converse is true with regard to the removal of lead, the hot bottom of the kettles assists in distributing the lead throughout the zinc, whereas in the reverberatory furnace the lead settles readily to the hearth floor; by using a forehearth in addition, a further separation of lead may be effected. The reverberatory furnace yields a uniform high-grade product when large tonnages are to be treated, but the kettle is best for occasional charges. To prevent attack of the molten zinc on the iron of the kettle, a semi-steel, containing 2% manganese, should be used without removing the casting skin.—A. R. P.

Purchases of 654,890,231 Pounds of Scrap Analyzed. J. W. Furness (*Daily Metal Reporter*, 1932, **32**, (5), 4, 9, and 11).—From an analysis prepared by F., Chief of the Minerals Division of the U.S. Department of Commerce, of purchases of scrap metal in 1930.—P. M. C. R.

XV.—FURNACES AND FUELS

FURNACES

Basic Principles of Selection of Furnaces. R. J. Sarjant (*Metallurgia*, 1932, **6**, 147).—The selection of the most suitable type of furnace for a given operation depends on such factors as the adaptability value of the fuel, the reliability and flexibility of output, and the mechanical stability. These various factors are discussed, and particular reference is made to the case of control when using gas, oil, or electricity in preference to coal.—J. W. D.

Calculations for an Annealing Furnace. M. W. Groshev (*Metallurg* (*The Metallurgist*), 1932, **7**, (1), 39–63).—[In Russian.] Detailed calculations for the design, operation, heat-balance, etc., of an annealing furnace selected for installation at the Ural Machinery Works, Sverdlovsk.—M. Z.

Gas-Furnace Attains Temperature Exceeding Melting Point of Platinum. Anon. (*Eng. and Min. J.*, 1932, **133**, 449–450).—Operating on the principle of surface combustion, in contact tubes possessing a highly reactive surface a Degussa Lilliput furnace is claimed to be able to attain a temperature of 1,850° C. Favourable thermal conditions are obtained by symmetrical distribution of the flame, low resistance to the flow of gas and air, and effective insulation. Corundum and magnesia are used for the construction of the furnace. Industrial furnaces for melting platinum and other metals of high melting points are lined with magnesia or zirconia.—R. Gr.

Industrial Furnaces for Gas. Lawrence E. Biemiller (*Amer. Gas J.*, 1932, **137**, (3), 26–28).—Cf. this *J.*, 1932, **50**, 130, 270. Gas-fired ovens for japanning and metal decorating (lithographing) are briefly described.—J. T.

Wild-Barfield Low-Temperature Electric Furnace. Anon. (*Machinery* (*Lond.*), 1932, **39**, 459).—Cf. this *J.*, 1932, **50**, 643. An illustrated description of an electric furnace with forced-air circulation for temperatures up to about 700° C.—J. C. C.

Non-Oxidizing Electric Furnace. Anon. (*Machinery* (*Lond.*), 1932, **39**, 596–597).—An electric resistance furnace is described in which a non-oxidizing atmosphere is maintained by introducing gas through a special type of distributor. In this way a gas curtain is formed wherever there is any possibility of an air inflow.—J. C. C.

1-Ton High-Frequency Electric Furnace. Anon. (*Machinery* (*Lond.*), 1932, **39**, 537).—A brief description of a Metrovick 1-ton high-frequency electric furnace, operating at 500 cycles, 2000 v.—J. C. C.

Melting and Annealing Furnaces for Aluminium and its Alloys. —— von Zeerleder (*Congrès internat. mines, Liège*, **1930**, June 22–28; also *Métallurgie*, **1930**, 611–620; and (abstract) *Technique moderne*, 1930, **22**, 731; *C. Abs.*, 1932, **26**, 4281).—A review of progress effected during the last 10 years in melting and annealing furnaces for aluminium and its alloys.—S. G.

Electric Annealing Furnaces. A. G. Robiette (*Papers Swansea Tech. Coll. Met. Soc.*, **1932**, 1–23).—Following a brief historical review of electric furnaces, R. surveys the economic aspect of electric heating. Principles governing the construction of furnaces are dealt with from the points of view of resistor elements, refractory lining and thermal insulation. Examples are given of the application of electric furnaces for industrial purposes.—R. Gr.

Furnace Atmospheres. S. Tour (*Canad. Mach.*, 1932, **43**, (8), 31).—From an address at a Toronto meeting of the American Society for Steel Treating. Furnace atmospheres are classified as transient or quiescent; the former are subdivided according to the fuel employed, variations in the quality of which, with incompletely controlled ventilation, frequently lead to inefficient running. Atmospheres of the oxidizing, reducing, and "neutral" type, with their special applications, are discussed, and applied also to the "quiescent" type of furnace, which includes the electrically heated furnace and the muffle. —P. M. C. R.

FUELS

Large Scale Brass Annealing in Gas-Fired Muffles. W. Wirt Young, Jr. (*Gas Age-Record*, 1931, **68**, 907–908, 923).—Details are given of the construction and operation of a continuous brass coil-annealing furnace, 30 ft. × 8 ft. × 7 ft., fired with town's gas, using surface combustion high-pressure burners. Production capacity is 5,000–6,000 lb. of net brass per hr., heated to 1100°–1250° F. (593°–677° C.). Gas consumption (cal. val. 530 B.Th.u. per ft.^{3}) is 0·66 ft.^{3} of gas per lb. of net brass annealed. Gas is being applied in the following operations: non-oxidizing annealing of brass and nickel–brass, bright-annealing of brass wire and strip, heating of brass and nickel–brass billets for extrusion, and heating of brass for drop-forging.—J. S. G. T.

Results Obtained by Industrial Gas Research. J. F. Quinn (*Gas Age-Record*, 1931, **68**, 49–52).—Developments in the application of gaseous heating to the following processes are very briefly referred to: brass melting and bright-annealing, stereotype metal melting, zinc-base die-casting, and the development of various types of burners and furnaces.—J. S. G. T.

Industrial Gas Research and Its Relation to Gas Sales. N. T. Sellman (*Gas Age-Record*, 1931, **68**, 685–687).—It has been established that sand cores are best baked by convected heat. Immersion heating has been extended to melting soft metals other than stereotype metal.—J. S. G. T.

Gas in Pacific Coast Industries. Fred C. Dietrich (*Gas Age-Record*, 1931, **68**, 251–253, 282).—Applications of natural gas as fuel for soft metal melting, japanning, drying, and cleaning metals are briefly referred to.—J. S. G. T.

Gas Flames in Conversion to New Gases. R. B. Harper (*Gas Age-Record*, 1931, **68**, 735–740, 779–785, 811–818).—Fundamentals of gaseous combustion in industrial burners and factors concerned when a change occurs in the nature of the gas consumed are briefly described and illustrated.—J. S. G. T.

Selection, Utilization and Distribution of Gas Mixtures. J. A. Perry (*Gas Age-Record*, 1931, **68**, 679–682).—Factors entering into the choice of a gas mixture composed of coal gas, carburetted water gas, and water-gas for any definite heating process are discussed.—J. S. G. T.

Tentative Revisions of A.S.T.M. Standards. Standard Definitions of Terms Relating to Coal and Coke (D 121–30). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1165).—The "Tentative Definition of the Term Coke" (see following abstract) is intended to be added, when adopted, to the present standard definitions.—S. G.

Tentative Definition of the Term Coke (D 121–30 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 713).—See this *J.*, 1930, **44**, 720.—S. G.

The Use of Coal in the Melting and Heating of Metals. R. J. Sarjant (*Metallurgia*, 1932, **6**, 149–152).—The characteristic of coal from the aspect of its use as a furnace fuel is discussed as a result of the research work which has been carried out to elucidate its physical and chemical properties. Detailed consideration is given to the composition and heating value of coal, to its behaviour on heating, and to clinkering properties. The utilization of coal for melting, reheating, and heat-treatment furnaces is fully dealt with, and the question of smoke emission referred to.—J. W. D.

Some Future Fuel Problems in Metallurgical Practice. H. C. Armstrong (*Proc. 3rd Internat. Conference Bituminous Coal*, 1932, **1**, 652–656; *C. Abs.*, 1932, **26**, 4694).—The problems are: (1) future use of high-sulphur coal; (2) cleaning of fuel gas; (3) automatic thermostatic control, and (4) smoke elimination.—S. G.

Experiments for the Production of a Coke Useful for Smelters and Foundries by the Mixing of Coals of Different Qualities. Erich Koch (*Ges. Abhandl. Kenntnis Kohle*, 1930, **9**, 367–375; *C. Abs.*, 1932, **26**, 4446).—The proportion of the various coals used and a special method for determining this proportion are given.—S. G.

Mechanism of Combustion of Pulverized Coal. A. Grebel (*Proc. 3rd Internat. Conference Bituminous Coal*, 1932, **2**, 420–447).—S. G.

The Effective Combustion of Coal, with Special Reference to Pulverized Fuel. Anon. (*Fuel Economist*, 1932, **7**, 511–518).—The composition of coal, processes involved in combustion, the burning of coal in stokers, and the effective combustion of pulverized coal, which is largely dependent on the type of burner employed, are briefly discussed. Modern types of burners, including the turbulent and tangential types, are described.—J. S. G. T.

A Brief Résumé of Information on the Storage of Coal. (Sir) Frederic L. Nathan (*Fuel Econ. Rev.*, 1932, **11**, 5–8).—Literature relating to phenomena associated with the spontaneous heating of coal in store is briefly reviewed. Factors affecting oxidation and heating of stored coal include (1) type of coal; (2) size of coal; (3) accessibility of air; (4) presence of pyrites, or (5) moisture, and (6) temperature. Coal should be stored on dry, level, well-drained ground, cleared of vegetation. Coal consisting of lumps with little or no dust should have ventilating channels made in it; channels in the case of dusty coal are a potential source of danger.—J. S. G. T.

Use of CaO in the Determination of S in Coals by the Eschka Method. N. J. Ivison (*Fuel*, 1932, **11**, 23–24).—Lime may be substituted for magnesium oxide in the analytical procedure, but is not so satisfactory when the sulphur content of the coal is high.—E. S. H.

Diffusion Combustion. W. M. Hepburn (*Metal Progress*, 1932, **22**, (3), 24–28).—Combustion of this type is produced by the diffusion of oxygen from a stream of air into a parallel stream of gas: such combustion is confined to a surface, the "flame front," the form, size, and luminosity of which are capable of exact control. The method of combustion is claimed to give constant emissivity and uniform carbon precipitation, maximum free carbon content, constant flame temperature over the determined length of flame projection, and exclusion of atmospheric gases by maintaining, if desired, a protective layer of sooty gas. This combination is said to result in quicker heating, lower furnace temperature, accurate control, and good surface condition of product. Types of burner and furnace are described.—P. M. C. R.

Determination of Sulphur in Coal by the Perchlorate Method. G. Frederick Smith and A. Garrell Deem (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1932, **4**, 227–229).—The coal (1 grm.) is treated with 1 grm. KNO_3, 5 c.c. HNO_3 (*d* 1·4), 0·16 grm. NH_4VO_3, 2–4 grm. $CH_2ClCOOH$, and 15 c.c. of 70% $HClO_4$, and the mixture is shaken for 10 minutes at 120° C., then heated to 180–185° C. until all organic matter is oxidized and a precipitate of V_2O_5 formed. After cooling somewhat, 5–10 c.c. HCl (*d* 1·19) are added and the mixture is again heated until V_2O_5 separates. The product is boiled with 100 c.c. H_2O and 0·2 grm. $NH_2OH{\cdot}HCl$, the insoluble material separated, and the S precipitated with $BaCl_2$. The results are usually about 0·3% lower than those obtained by the Eschka process, probably owing to more complete removal of the SiO_2. The method is not applicable to the analysis of coke.—A. R. P.

Comparative Tests on the Determination of the Total Sulphur in Coal by the Methods of Hackl and Eschka. C. Otin and C. Cotrutz (*Brennstoff-Chem.*, 1932, **13**, 126–127).—Both methods give equally good results, but Hackl's method requires a longer period of heating.—A. R. P.

On the Determination of Sulphur in Coal and Coke. Rudolf Lanzmann (*Brennstoff-Chem.*, 1932, **13**, 167).—The Eschka method gives good results even when much sulphur is present, whereas the calorimeter combustion method often gives erratic results when the sulphur content is high.—A. R. P.

XVI.—REFRACTORIES AND FURNACE MATERIALS

The Properties and Uses of the More Important Refractory Materials. Geoffrey Staniland and G. W. Lee (*Eng. Rev.*, 1932, **45**, 701–703).—Factors affecting the melting point of refractories are discussed, and the use of Seger cones is described. Permanent and reversible thermal expansion, thermal conductivity, porosity, chemical, and mechanical properties are considered, and suitable materials for various purposes are selected on the bases previously indicated.—P. M. C. R.

The Characteristics of Firebricks under Working Conditions. Anon. (*Eng. Rev.*, 1932, **45**, 704–706).—The severe requirements of modern furnace practice necessitate careful selection of firebrick. This involves the following factors: working temperature, texture, chemical composition, and density. Causes of failure are examined, and the use of plastic refractories for repairs is advocated.—P. M. C. R.

Developments in Unburned Magnesite Brick. A. E. Fitzgerald (*Blast-Fur. and Steel Plant*, 1932, **20**, 658–666).—Cf. this *J.*, 1932, **50**, 397. Traces the development of the use of magnesite. The manufacture of bricks and the testing of unburned magnesite, burned magnesite, and chrome brick are also dealt with.—R. Gr.

Raw Materials for Silica Brick Manufacture. Norman H. Stolte (*Ceramic Age*, 1932, **19**, 255–256).—A review.—E. S. H.

Tentative Method of Control Test for Resistance of Fireclay Brick to Thermal Spalling Action (C 38–31 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 410–411).—See this *J.*, 1932, **50**, 201.—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Definitions of Terms Relating to Refractories (C 71–31). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, **1146**).—Several definitions of terms published under the title "Tentative Definitions of Terms Relating to Heat-Transmission of Refractories" (see following abstract) are intended to be added, when adopted, to the present standard definitions.—S. G.

Tentative Definitions of Terms Relating to Heat Transmission of Refractories (C 71–31 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 415–416).—See this *J.*, 1932, **50**, 201.—S. G.

XVII.—HEAT-TREATMENT

Short-Time Annealing of Aluminium Strip and Sheet in the Continuous Electric Annealing Furnace. H. Masukowitz (*Z. Metallkunde*, 1932, **24**, 236–239; discussion 239; and (translation) *Light Metals Research*, 1932, **2**, (16), 2–10).—The superiority of continuous annealing furnaces in the manufacture of high-quality metal strip for deep-drawing purposes is emphasized. The change in the Erichsen value of 1 mm. aluminium sheet during heating in a furnace maintained between 630° and 800° C. indicates that with furnace temperatures of at least 700° C. the shortest possible period of annealing has a favourable influence on the Erichsen value and that short-time annealing at 420°–550° C. results in practically the same high Erichsen value. Large scale experiments with aluminium strip have shown that annealing in a continuous furnace results in higher and more uniform Erichsen values than annealing in a muffle furnace.—M. H.

Heat-Treating and Forging Some Light Alloys. W. C. Devereux (*Metallurgia*, 1932, **7**, 17–18).—A discussion of a paper by D. to the Sheffield Society of Engineers and Metallurgists indicates the need for care and control in working Duralumin, "Y" alloy, and the "R.R." alloys. Control of furnaces;

blistering; the use of forged bars and extruded or rolled bars for stampings; grain-growth; age-hardening; and proper heat-treatment temperatures are considered. Special reference is also made to a new type of test carried out on the Amsler repeated impact testing machine, which gives marked differences in the results between various materials. A new etching solution of hydrofluoric acid and sulphuric acid is suggested for showing the presence of cracks or defects in forgings (cf. following abstract).—J. W. D.

Heat-Treating and Forging Some Light Alloys. D. R. Tullis. W. C. Devereux (*Metallurgia*, 1932, 7, 59).—Correspondence between T. and D. regarding D.'s paper (preceding abstract). The phenomena of grain-refining growth in aluminium alloys, when soaked at forging temperature; and the mechanism of age-hardening are further discussed.—J. W. D.

The Condition of Cooling of Duralumin Forgings. W. M. Aristov (*Niimash Izvestia Nauchno-issledovatelskogo Instituta Mashinostroenia i Metalloobrabotki* (*Bulletin of the Scientific Research Institute of Machine Building and Metal Treatment*), **1932**, (5–6), 267–277).—[In Russian.] Duralumin has a tendency to self-quenching during the process of cooling, even if the final forging temperature is 350° C. The depth of the air-quenched layer of Duralumin is very small and can be removed by turning. Mechanical tests have shown that the parts which cool most rapidly undergo work-hardening while being forged. Forgings which have sharp variations in cross-section must be cooled in warm sand after being worked.—N. A.

Investigation of the Heat-Treatment of "Y" Alloy. M. Scharov and N. Merkuriev (*Tehnika Vosdushnogo Flota* (*Technics of the Aerial Navy*), 1932, **6**, (3), 260–284).—[In Russian.] Optimum mechanical properties are obtained by the following heat-treatment: annealing at 520 ± 5° C. for 4 hrs., quenching in boiling water and ageing at 200° C. for 12 hrs., or at 225° C. for 3 hrs. The mechanical properties of "Y" alloy are approximately equal to those of "No. 12" alloy at room temperature but markedly superior at higher temperatures after 300° C. —N. A.

Bright-Annealing Copper Wire in an Atmosphere of Steam. J. B. Nealey (*Gas Age-Record*, 1932, **70**, 111–112, 119).—Plant comprising a gas-fired steam superheater for bright-annealing copper wire in a current of steam is described.
—J. S. G. T.

XVIII.—WORKING

The Mechanism of Plastic Deformation (Extrusion of Duralumin). S. I. Gubkin (*Niimash Izvestia Nauchno-issledovatelskogo Instituta Mashinostroenia i Metalloobrabotki* (*Bulletin of the Scientific Research Institute of Machine Building and Metal Treatment*), **1931**, (8), 363–390).—[In Russian.] Extrusion tests on Duralumin, have been carried out with a Gagarin press at temperatures of 20°, 100°, 150°, 200°, 250°, 300°, 400°, and 500° C. using dies of different sizes. In the graph of the logarithm of the maximum "steady extrusion pressure" against temperature, 4 straight-line sections occur at: (i) below 100° C.; (ii) 100°–200° C.; (iii) 200°–400° C.; and (iv) 400°–500° C. The discontinuities must represent some changes which must occur between 100° and 200° C. and at about 400° C. A detailed mathematical analysis of the extrusion process in a plastic mass is given. Hardness at high temperatures was determined by 3 different methods: (i) Brinell, the tests being carried out on Gagarin's press; (ii) Brinell, under a static load; (iii) dynamically by the falling ball method. The curves of variation of hardness with temperature are analogous to the extrusion pressure curves. The influence of velocity on the magnitude of the deformation stress is small at low temperatures, begins to be marked at 200° C. and becomes greater at higher temperatures.—N. A.

The Theory of Difference of Principal Stresses in its Application to the Processes of Drawing and Pulling in Dick's [Extrusion] Press, &c. S. I. Gubkin (*Niimash Izvestia Nauchno-issledovatelskogo Instituta Mashinostroenia i Metalloobrabotki* (*Bulletin of the Scientific Research Institute of Machine Building and Metal Treatment*), **1931**, (9) 471–483).—[In Russian.] Mohr's theory of differences of principal stresses is entirely applicable to the analysis of the technical processes employed in the working of metals under pressure. The stress δ created by the drawing process may be determined by the formula:

$$\delta = \left(\frac{V_d}{V_e}\right)^{\frac{1}{c_1}}\left\{(p_0 + b)\frac{m_2}{m_1}\left[1 - \left(\frac{D_2}{D_1}\right)^{m_1}\right] - \frac{bm_2}{m_1 + n}\left(\frac{D_0}{D_1}\right)^{\alpha}\left[\left(\frac{D_1}{D_2}\right)^{n} - \left(\frac{D_2}{D_1}\right)^{m_1}\right]\right\}$$

where V_d is the rate of drawing, V_e the rate of elongation, p_0 the limit of flow of the non-work-hardened material, $1/c_1$ a coeff. depending on the properties of the metal, and b a constant depending on the tendency of the metal to increase in strength; $m_2 = 2\left(1 + \frac{\mu}{\tan\alpha}\right)$, $m_1 = \frac{2\mu}{\tan\alpha}$, where μ is the coeff. of external friction, α the angle of the die aperture, D_1 the diameter before, D_2 the diameter after, and D_0 the initial diameter during, drawing, α the coeff. of correction for the irregularity of stress through the cross-section of the wire due to inaccuracy in the angle of the die, and n a constant depending on the properties of the metal. This theory is also applicable to extrusion with Dick's press, the formula then being:

$$\delta_f = \left(p_0 + b\right)(1 + Z)\left[\left(\frac{D_1}{D_2}\right)^{2/z} - 1\right] - \frac{2b(1 + Z)}{2 + 2Zn}\left(\frac{D_0}{D_1}\right)^{n}\left[\left(\frac{D_1}{D_2}\right)^{2/z}\left(\frac{D_1}{D_2}\right) - 1\right]$$

where $Z = \frac{\tan\alpha}{\mu}$, and δ_f the extrusion pressure. All the other symbols being as before. To check the formulæ, experiments were performed, the results of which were as follows (extrusion pressures in kg./mm.^{2}, the calculated value being in brackets): aluminium, 88·5, (93·7); Duralumin, 162·2, (169·2); brass I, 125·4, (132·3); brass II, 137·8, (145·1).—N. A.

Improvements in the Cold-Working of Metals. J. R. Miller (*Heat-Treat. and Forging*, 1931, **17**, 559–561; and (summary) *Metallurgist* (Suppt. to *Engineer*), 1931, **7**, 138–139).—It is claimed that a combination of rolling and drawing produces less directional distortion in the material than do ordinary cold-rolling or cold-drawing methods. X-ray patterns of cold-rolled strips before and after annealing are compared with analogous patterns produced by material made by the combined process. The four-high mill used in production is described; in it strip may be reduced without interruption to the thinnest commercial gauges. The process can be applied to brass, bronze, hard chrome-nickel alloys, and carbon-steels. A great economy is effected by the saving of annealing costs.—P. M. C. R.

Use of a Lead Coating in the Cold-Working of Metals. G. de Dudzeele (*Congrès internat. Mines, Liège*, **1930**, June 22–28; and *Métallurgie*, **1930**, 499–506; *Chim. et Ind.*, 1932, **27**, 1076–1077; *C. Abs.*, 1932, **26**, 4283).—The surfaces of metals can be covered with a thin layer (0·012–0·015 mm.) of lead, which facilitates cold-working of the metal more than the copper coating generally used for the same purpose, and can be removed electrolytically or chemically without affecting the underlying metal in any way. The advantages of such lead coatings are discussed.—S. G.

Researches on Tube Drawing. W. Jung-König, W. Linicus, and G. Sachs (*Metallwirtschaft*, 1932, **11**, 395–401; and (summary and discussion) *Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 136–138).—The power consumption and change in properties of brass and Lautal tubes have been determined when the metal is drawn over a stationary mandrel and when drawn with a core. The power consumption has been calculated in relation to the reduction in area and the shape of the die; it can be considerably reduced by careful polishing of the die. The hardening of the metal is less than is the case in wire drawing, which indicates that there is a greater homogeneity in the deformation in tube drawing. The internal stresses in the drawn material are greater the steeper is the die angle; it, therefore, appears to be possible to reduce the danger of splitting by using a slender die angle for the last draught, as the deformation in this stage determines the internal stress.—v. G.

A New Type of Roll for the Cold-Rolling of Metals. F. Krau (*Z. Metallkunde*, 1932, 24, 226–228; discussion, 228–229).—The requirements of rolls for the cold-rolling of high-quality aluminium, copper, nickel, iron, and brass are given. The manufacture, properties, and microstructure of a special type of chill-cast roll are described.—M. H.

The Problem of Cold-Compressing in the Manufacture of Screws. W. Aumann (*Z. Metallkunde*, 1932, 24, 200–206).—A mathematical and technological treatment of the cold-compressing process for screws, for which the original paper must be consulted. Compression diagrams (compression depending on tension of pressure—"Druckspannung") are given of 72 : 28 brass, iron, nickel, zinc, and Duralumin.—M. H.

Forging and Stamping of Duralumin. A. Vella-Ferrand (*Usine*, 1931, 40, (12), 37–41).—A description of the practice adopted at the Forges de Foulain and the Forges de Bologne. The material is received in the form of annealed bar which is examined visually and tested for tensile properties, hardness, and density. It is cut, by circular or band saws, into pieces which are heated in electric resistence furnaces, thermostatically controlled at a temperature between 400°–430° C. Stamping is often preceded by a hand-forging operation to obtain the approximate shape of the finished article. The dies are made from nickel–chrome–molybdenum steel and must be very highly finished. They are designed to produce the most satisfactory distribution of the "fibres" of the metal, which is investigated by macro-etching. After each stage of fabrication, the forgings are etched in hot caustic potash and examined for flaws. Heat-treatment is carried out either in electric furnaces or gas-heated salt baths.—H. W. G. H.

Forging and Stamping of Duralumin. (Experimental Work.) W. M. Aristov and N. I. Korneev (*Niimash Izvestia Nauchno-issledovatelskogo Instituta Mashinostroenia i Metalloobrabotki* (*Bulletin of the Scientific Research Institute of Machine Building and Metal Treatment*), 1931, (11–12), 606–622).—[In Russian.] The information given is now well known.—S. G.

The Deformation of Duralumin by Forging at High Temperatures. E. F. Bachmetew and S. I. Gubkin (*Niimash Izvestia Nauchno-issledovatelskogo Instituta Mashinostroenia i Metalloobrabotki* (*Bulletin of the Scientific Research Institute of Machine Building and Metal Treatment*), 1932, (2), 85–97).—[In Russian.] A method of testing Duralumin undergoing deformation by forging at high temperatures is worked out, by which it is possible to obtain preliminary curves for the so-called "true" stresses due to the compression exerted by the blow. The tests were carried out at 450° C. The increase in hardness after deformation at the above temperature is slight, and may be neglected in the preliminary calculations. The rate of recrystallization under the conditions of the experiments is less than that of deformation, with the result that a structure similar to that after deformation in the cold, is obtained. X-ray analysis, however, shows that after forging at 450° C. the distortion of the crystal lattice is less; this is confirmed by a study of the hardness.—N. A.

Investigation of the "Critical Interval" in Work-Hardening of "German Silver" and "Aluminium–Bronze." W. S. Bugakov (*Zhurnal Tehnicheskoy Fiziki* (*Journal of Technical Physics*), 1932, [B], 2, (2), 173–189).—[In Russian.] Changes in mechanical properties, solubility, electrical resistance density, and residual strain of "German silver" and "aluminium–bronze" for different degrees of work-hardening indicate that a "critical interval" exists between a 20–30% degree of work-hardening, within which a sharp change in properties occurs. At this stage, there is a radical alteration in the relative positions of the crystal axes. In "aluminium–bronze," lines due to twinning appear at 20% work-hardening.—N. A.

Manufacture of Zinc Vessels for Dry Batteries. Wolfgang Litten (*Maschinenbau*, 1932, 11, 344–346).—Zinc cups for dry batteries are frequently made by bending up sheet and soldering or welding the overlapping joint. Better cups are, however, obtained by deep-drawing or hot extrusion. In deep-drawing the original sheet must be of quite even thickness and the surface of the drawing tool must be quite smooth.—v. G.

Operation of a Directly-Driven 1500-Ton Press at a Pressure of 300 Atmospheres.—I–II. Chr. Bernhoeft (*Z. Metallkunde*, 1932, 24, 210–213, 261–263).—(I.) Large-scale extrusion experiments with copper, aluminium, brasses, special brasses, &c., with variation of the rate of extrusion, pressure, length of the ingot, and cross-section of the extruded rod are described. (II.) An illustrated description is given of experiments made to elucidate the mechanism of flow during extrusion.—M. H.

The Life of Presses. W. Sack (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1931, 7, 185–186).—The choice of materials is of great importance in view of the combined or alternating effects of tension, compression, bending, and torsion to which pressing machinery is exposed. Although a heavy press entails slower working and greater power consumption, the increased running cost is balanced by greater reliability, fewer breakdowns, and consequent steadier production. Cases of breakdown are discussed and causes of failure analyzed. Among these were overloading, small local defects, poor finish, and fatigue. Questions of repair and maintenance are considered.—P. M. C. R.

The Working of Aluminium. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1931, 7, 45).—Appropriate speeds of cut and feed and optimum depth of cut for the machining of aluminium are discussed.—P. M. C. R.

The Machining of Light-Metal Connecting Rods. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1931, 7, 89).—The (multiple) grinding of the rod-heads, drilling of oil-holes, preparation of the bolt-sockets, and exact machining of the bearings are carried out in much reduced time by the special machinery described.—P. M. C. R.

Haynes Stellite Cutting Tools. W. A. Becker, E. E. Gordon, and W. A. Wissler (*Trans. Amer. Soc. Mech. Eng.*, 1931, 53, MSP.11*a*, 93–100; and (abstract) *Machinery* (*N.Y.*), 1931, 37, 369–370).—Describes briefly the physical properties of Stellite and gives the more important details of several types of machining operations in which it is being successfully used. Its most important property is red hardness. Measurements of hardness were made by an improved method up to 1100° C. The resulting data show that the cobalt–chromium–tungsten alloy is harder than high-speed steel at temperatures above 500° C. This is believed to account for its superior cutting quality. In general, Stellite bits can be used economically on all operations on cast iron, semi-steel, malleable iron, bronze, or similar metals, and on mild steel if the section is heavy and the tools are rigidly supported. It has not been successful on automatic or semi-automatic machines for cutting steel.—S. G.

Production of Hard Fusible Alloys for Tools. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1931, 7, 685).—The structure of tungsten carbide is traced from solidification-point to red heat, and the effect on hardness of facilitating or suppressing the various transformations by varying the rate of cooling is discussed. Modification by the partial or complete substitution of molybdenum or chromium for tungsten, and of boron or titanium for silicon, is possible, and suitable adaptations of furnace conditions are suggested.—P. R .

Diamond and Widia. F. K. Böck (*Maschinenkonstrukteur*, 1931, 64, 220–223).—The sources of diamonds are considered. The preparation and properties of Widia are discussed, and the advantages and limitations of each as a cutting material are compared. B. considers that for many purposes diamond is superior to Widia and allied materials, and states that in view of its long life and superior performance the cost for small work is not prohibitive. Wider application should accompany a fall in the price of the material.—P. M. C. R.

High-Duty Cutting Materials. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1931, 7, 85–87).—The preparation, mounting, brazing, and setting of tungsten carbide tools are discussed. The development of Widia and other tungsten carbide products (Carboloy, Diamondite, Strauss-metal) is traced, and the performance of Widia tools is discussed, and compared with that of Stellite, which is recommended for materials of intermediate hardness. —P. M. C. R.

High-Duty Cutting Tools [Brazing]. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1931, 7, 59).—Directions are given for the attachment of Widia tools to steel holders. Grooving should be avoided, and the tool should be fixed by brazing only; for this copper is preferred to brass. The tool should be embedded after brazing in powdered charcoal, and, until this ceases to adhere to the joint, should not be placed in sand.—P. M. C. R.

Hard Metals in Operation. B. Fetzer (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1931, 7, 216–219).—High-speed tool materials are classified and discussed, with comparative figures for Brinell hardness and tensile strength. Performance figures are given for Widia tools on cast-iron of various types, cast and forged mild steel, special steels, bronzes, brasses, copper, aluminium, and certain non-metallic insulators. Cutting speed, cutting angle, necessary modifications in machinery, and lubrication are discussed, and a table of cutting speeds and lubricants for sawing is given. This includes saws of all types of steel, and varying degrees of fineness, and the optimum conditions of their use with a wide range of ferrous and non-ferrous metals and alloys. —P. M. C. R.

The Economical Use of Old Machinery with the Help of Special Adaptations. Alfred Winter (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1931, 7, 197–200).—Modernizing adaptations of old types of grinding machinery are fully described, with illustrations.—P. M. C. R.

XIX.—CLEANING AND FINISHING

Cleaning Aluminium. Anon. (*Amer. Machinist* (*Eur. Edn.*), 1932, 76, 973).—The types of cleaning solution suitable for degreasing aluminium are: (1) volatile solvents such as petrol, kerosene, carbon tetrachloride, and triethylchlorine; (2) water solutions of soap and alkalis of a mild nature; (3) "water-soluble controlled alkali" solutions. The make-up and methods of using these solutions are described. A matt finish is produced by attacking the surface with a strong alkali. A bright finish is produced by dipping the parts in a solution containing nitric acid 5 gall., hydrofluoric acid 1 gall., sulphuric acid 1 quart or nitric acid 8 parts, hydrofluoric acid 1 part.—J. H. W.

Pickling Sheet Metal and its Control. —— Lang (*Glashütte*, 1932, 62, 490–491, 510–512; *C. Abs.*, 1932, 26, 5525).—L. discusses in detail the pickling of raw ware, and emphasizes the necessity for control of: (1) the acid; (2) strength of the pickling bath; (3) the pickling time; (4) the wash water and the neutralizing solution especially—S. G.

Acid-Resisting Metals Used for Pickler's Racks. D. E. Stamm and J. C. Weaver (*Metal Progress*, 1932, 21, (3), 61–64).—The old type of wooden rack can be economically replaced by considerably lighter baskets in acid-resisting alloy; improved designs for quick unloading are described. For heavy work

Monel metal or cast bronze compete with the ferrous alloys Duraloy (chromium–iron) and Durimet (chromium–nickel–silicon). The latter is recommended for use with sulphuric acid. Rubber-coated metal gives good results in hydrochloric acid pickling.—P. M. C. R.

Metals and Music. Gilbert E. Smith (*Met. Ind.* (*Lond.*), 1932, **40**, 465–466). —The metals used for making parts of various musical instruments and the reasons for using them are given, and in particular the use of bronzes in the manufacture of bells is discussed.—J. H. W.

On the Use of Sea-Water for Colouring Metals. Ernst Beutel and Artur Kutzelnigg (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 378–379).—Copper and its alloys can be coloured various shades of brown by immersion for various periods in hot sea-water containing hydrogen peroxide, sodium perborate, potassium ferricyanide, or potassium permanganate.—A. R. P.

Molybdenum in Metal Colouring. Georg Buchner (*Oberflächentechnik*, 1932, **9**, 14).—For colouring cadmium or zinc the metal is electrolytically oxidized in a 0·5–1% solution of ammonium molybdate containing ammonium sulphate. Other metals may be coloured by boiling in dilute molybdate solutions containing an addition agent, *e.g.* oxalic acid, fluorides, silicates, borates, or tungstates. —A. R. P.

The Finishing of Brass Stampings for Automotive Hardware. Allen W. Carter (*Monthly Rev. Amer. Electroplaters' Soc.*, 1932, **19**, (7), 17–19).—Details of buffing, cleaning, and nickel and chromium plating operations are given briefly.—A. R. P.

Matting of Metals. Rudolf Plücker (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 317–318).—To obtain a yellow matt finish on copper, brass, bronze, and nickel–brass, the metal is dipped into a warm mixture of 200 parts of nitric acid, 1 part of sodium chloride and 1 part of soot, then into a hot mixture of 3 kg. of nitric acid, 2 kg. of sulphuric acid, 15 grm. of sodium chloride, and a solution of 10–15 grm. of zinc sulphate in 50 c.c. of water. To obtain a bright matt finish, the articles are then passed rapidly through a mixture of 50 parts of sulphuric acid, 100 parts of nitric acid, 1 part of sodium chloride, and 2 parts of soot, and to produce a matt-grained finish they are immersed for several hrs. in a mixture of 1 volume of saturated potassium bichromate solution and two volumes of concentrated sulphuric acid.—A. R. P.

XX.—JOINING

Apparatus for Turning the Ends of Tinned Copper Tubing [for Brazing]. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1931, **7**, 242).—The tinned tubing was to be prepared for brazing on to other parts. The necessary adjustments are described and illustrated.—P. M. C. R.

Welding Processes Applicable to Aluminium. W. M. Dunlap (*Amer. Soc. Test. Mat. Symposium on Welding*, **1931**, 24–27; and (abstract) *Iron Age*, 1931, **127**, 1203–1204).—The oxy-acetylene flame is usually employed for heavy gauge sheet and plate. The atomic hydrogen process has no advantages, but metallic arc welding has reached a position of considerable importance. The carbon arc is used to a less extent. Resistance welding is used extensively, but aluminium cannot be successfully flash welded. Percussion welding also finds considerable use for light repetition work.—H. W. G. H.

The Welding of Elektron in Aircraft Construction. Hans A. Horn and Karl Tewes (*Z. Flug. u. Motor.*, 1931, **22**, 609–662).—Welded Elektron parts included engine casing, tanks for fuel and oil, and tubular seats, and their use effects great economy in weight. Oxy-acetylene welding with Elektron wire is recommended; careful cleaning is necessary. The flux contains a high proportion of lithium salts and is rich in chlorides: it is applied fairly thickly on account of the protection it affords against fire.

Support, at distances varying with the thickness of the material, is needed to avoid distortion on account of the softening of the alloy. Butt-welding is necessitated to ensure the continual removal of the flux, and in any case is preferable to lap-welding. Methods of application are illustrated. Protection from atmospheric and other corrosive agencies is afforded partly by careful manufacture of the alloy, the resistance of which has been improved by certain additions; a chromate–saltpetre bath gives a protective coating. Annealing to 300° C. removes working stresses and gives additional strength. —P. M. C. R.

Copper Alloy Welding Rods. I. T. Hook (*Iron and Steel Eng.*, 1931, **8**, 337–341).—The welding characteristics and strength of welds made in iron and steel with rods of deoxidized copper, common brass, Muntz metal, Tobin bronze, manganese bronze, phosphor-bronze, wrought nickel–silver, extruded nickel–silver, Ambrac, Monel metal, Everdur, golden and white brazing solder, and silver solder are briefly described. All rods require a flux with a borax or boric acid base preferably with the addition of a little sodium chloride or fluoride. All the above rods except those containing zinc can be used for arc as well as torch welding.—A. R. P.

Hard-Facing [with Stellite] in Industrial Fields. W. A. Wissler and A. V. Harris (*J. Amer. Weld. Soc.*, 1931, **10**, (2), 17–20; and (abstract) *Machinery (N.Y.)*, 1931, **37**, 627).—Examples are given of the use of insets of Stellite for facing softer materials, including aeroplane tail skids and the steel rings of cement mills.—J. C. C.

Welding Inspection. R. Kraus (*Amer. Soc. Test. Mat. Symposium on Welding*, **1931**, 141–151).—By watching the welding in progress and from the external appearance of the product, the inspector should be able to detect bad welding. The points he should notice are discussed and some simple non-destructive tests are described.—H. W. G. H.

Metallurgical Considerations on Welding. Franz Rapatz (*Stahl u. Eisen*, 1931, **51**, 245–253).—The effect on the quality of a weld of the following factors is discussed and illustrated: fusibility and composition of welding rod, nature of alloying elements, steadiness of arc, strength of current, alternating or direct current, composition of the flame in gas-welds, nature of electrode coating, if any, such subsequent processes as "burning-off," and the heat-treatment of welds with or without additional mechanical treatment. Effects of the latter are tabulated. The effects of welding of various types on the neighbouring material are described and illustrated.—P. M. C. R.

Stress Distribution in Welded Joints with Special Reference to Boilers. Kochendörffer (*Autogene Metallbearbeitung*, 1932, **25**, 5–12).—In such applications as boiler engineering, the most important problems presented by welded joints are those of the heat distribution due to welding and the danger of "notch effect." Experiments with the Hele-Shaw apparatus producing stream-lines constrained to follow the shape of typical weld-sections give qualitative results only, but serve to show that certain types of filler, especially concave, produce regions of high stress under tensile loading. It is emphasized that quantitative deductions from these experiments are not safe. Confirmation of the quantitative deductions is attempted by stress analysis and etching with Fry's reagent on model test-pieces.—H. W. G. H.

The Distribution of Stress in Fillet-Welds. G. N. Borrow (*Welder*, 1932, **3**, (27), 33–36).—Reviews the present position of research on this subject.—H.

Fundamental Research Problems in Welding. Anon. (*J. Amer. Welding Soc.*, 1932, **11**, (2), 5–7).—A classified list of problems of fundamental interest, compiled by the Fundamental Research Committee of the American Bureau of Welding.—H. W. G. H.

General Survey of Welding Processes. F. T. Llewellyn (*Amer. Soc. Test. Mat. Symposium on Welding*, **1931**, 7–22; and (summary) *Amer. Machinist*

(*Eur. Edn.*), 1931, 74, 695).—Welding processes are classified and their technique briefly described. The field of use of each process and the physical properties of the welded product are discussed.—H. W. G. H.

Electric Welding. Marcel Mathieu (*Bull. Soc. Franç. Elect.*, 1931, [v], 1, 810–845; discussion, 1932, [v], 2, 256–261).—A survey of electric welding practice, covering, nature and sources of current, methods of welding (arc, hydrogen arc, resistance, and spot welding), types of machinery, applications of arc and resistance welding, and testing of welds. Special attention is given to the questions of electrical supply and to welding machines, especially those with automatic control.—P. M. C. R.

Atomic Hydrogen Welding. G. W. Akimov (*Tehnika Vosdushnogo Flota* (*Technics of the Aerial Navy*), 1931, 5, (1), 28–33).—[In Russian.] A brief description of the process and its applications, based on information obtained during a technical visit abroad.—N. A.

Arcogen: The Combined Gas-Electric Welding Process. H. Münter (*Autogene Metallbearbeitung*, 1930, 23, 349–356, 365–373; and (summary) *Welding News*, 1931, 2, 3).—In praise of the process.—H. W. G. H.

Electric Welding by Means of High-Frequency Alternating Current. F. Kisliuk (*Elektrichestvo* (*Electricity*), **1932**, (4), 226–231).—[In Russian.] The feasibility of electric welding with a frequency of 200–500 cycles/second is discussed. The method is specially valuable for welding iron of narrow-cross-section and copper with carbon electrodes, the strength of the welded seam being apparently considerable. With a frequency of 500 cycles/second welding can be carried out with naked electrodes.—N. A.

Some Resistance Welding Problems. C. L. Pfeiffer (*J. Amer. Weld. Soc.*, 1931, 10, (4), 5–11; and (abstract) *Welding Eng.*, 1931, 16, (5), 35–38; (6), 42–45).—There are at least 11 factors to be considered and co-ordinated in making a resistance welded joint, and these are dealt with in detail in relation to the welding of multiple sheets and to plated parts. The problem of welding dissimilar metals is considered and the requirements for balanced conditions are discussed. Examples are given of spot welding precious metals, butt-welding Permalloy wire under carbon tetrachloride and butt-welding copper rod and wire.—J. H. W.

The Electric Arc and its Application to Welding. C. Leonard (*Bull. Soc. Franç. Elect.*, 1931, [v], 1, 938–955; 1932, [v], 2, 133–150; discussion, 264–265).—(I). The electric arc is considered as a means of transforming electrical energy into heat, light, or energy of other types. The conduction of electricity through metals, electrolytes, and gases is reviewed, and brief consideration is given to thermionic discharge, fall of anodic potential, and the minimum intensity necessary to maintain the arc. (II). Arc welding with a metallic electrode is described, with a discussion of the influence on the arc of electrode position, of voltages and current density, of atmosphere and of electrode coating. The nature and stability of the arc both with a.c. and d.c. are discussed. Polyphase arcs are briefly considered, and a description and analysis of the atomic hydrogen welding process are given.—P. M. C. R.

The Sources of Current Supply to the Arc in Rod Welding, Especially with Direct Current. J. Berger (*Bull. Soc. Franç. Elect.*, 1931, [v], 1, 856).—After a discussion of the part played by the arc in welding of this type, B. states shortly the necessary characteristics of a satisfactory current supply. Types of generator are then described and illustrated.—P. M. C. R.

On the Promotion of the Skill of Welders in Electric Arc Welding. Y. Nishimura (*Journal of Zosen Kiokai* (*Society of Naval Architects of Japan*), 1932, 49, 95–106).—[In Japanese.] Deals with the training of welders, the necessary equipment and tests for the qualification of those under training.
—S. G.

A Full Automatic Welding Head. Anon. (*Tram. and Rail. World*, 1931, **69**, 205).—It is claimed that the Weldomatic machine can be used on repair or repetition work requiring a straight-line weld. It consists of automatically controlled head, operator's panel, and motor-generator set. Changes in arc voltage are amplified in transmission to the motor, which therefore responds to any alterations with increased sensitiveness. The automatic feed of electrode wire is controlled by this device. Electrode nozzles are of the split type, wear being reduced by local Stelliting.—P. M. C. R.

Modern Welding Machines and their Applications. Paul Neumayer (*Bull. Soc. Franç. Elect.*, 1931, [v], **1**, 846–855; discussion, 1932, [v], **2**, 261–264).—The main types of resistance and arc welding are briefly enumerated, and the corresponding machinery is described and illustrated. Some recent applications of welding are given, with some emphasis on the tendency to replace castings by welded structures.—P. M. C. R.

The Storage of Acetylene. H. Grohmann (*10e. Congrès internat. acétylène*, **1930**, 192–203; *Chim. et Ind.*, 1932, **27**, 1059–1060; *C. Abs.*, 1932, **26**, 4444).—A discussion of the hazards of acetylene stored in solution in methyl ketone. The presence of a porous absorbent was generally considered to prevent or retard propagation of decomposition throughout the mass of dissolved acetylene, but G.'s investigation disproved this supposition.—S. G.

XXI.—INDUSTRIAL USES AND APPLICATIONS

Aluminium as a Can Material. Gulbrand Lunde (*Tids. Hermetikind.*, 1932, **18**, (6), 169–179; and (abstract) *Aluminium Broadcast*, 1932, **3**, (37), 25; *C. Abs.*, 1932, **26**, 4656).—The advantages of aluminium as a can material are that there is no blackening, no metallic odour or taste, no solution of injurious metals, easy opening, and lighter cans.—S. G.

Preliminary Report on the Work of the Packing Industry Laboratory [Aluminium as a Packing Material]. Gulbrand Lunde (*Tids. Hermetikind.*, 1931, **17**, (12), 331–335; *C. Abs.*, 1932, **26**, 4656).—Deals, among other matters, with aluminium as a packing material.—S. G.

The Use of Aluminium in [Apparatus for] Hydrogenation and the Patent Protection of the Apparatus. Geo. Weissenberger (*Petroleum Z.*, 1932, **28**, (34), 8–9).—S. G.

Tank Cars for the Chemical and Allied Industries. —— Karsten (*Maschinenkonstrukteur*, 1931, **64**, 206–208).—Applications and design of tank cars are considered. The use of aluminium foil for heat-insulation appears to be increasing. A tank for transporting acetic acid is illustrated; it is constructed from aluminium sheet, and carries an aluminium heating coil.—P. M. C. R.

Heavy Electric Traction Progress in America. Charles Kerr, Jr. (*Tram. and Rail. World*, 1931, **69**, 187–190).—In certain multiple-unit motor-rail cars the use of aluminium in car-body and equipment has effected considerable economy in weight with consequent increase in carrying power. Commutator covers, terminal boxes, and axle caps are now made of aluminium, which has also been advantageously used in the control section.—P. M. C. R.

Insulation by Means of Metals. H. Niemann (*Wärme u. Kälte Tech.*, 1931, **33**, (7/8), 1–5; *C. Abs.*, 1932, **26**, 4392).—A discussion of the merits of an insulation formed of aluminium sheet 7 microns thick and crumpled to leave pores. The material weighs only 3 kg./m.^{3}.—S. G.

Tentative Specifications for Aluminium-Base Alloy Die-Castings (B 85–31 T) —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 292–294).—See this *J.*, 1932, **50**, 103–104.—S. G.

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***Royal Mint, London.** *Sixty-Second Annual Report of the Deputy Master and Comptroller of the Royal Mint,* 1931. Roy. 8vo. Pp. iv + 172, with 3 plates. 1932. London : H.M. Stationery Office. (3*s.* 6*d.* net.)

Schiebold, Ernst. *Die Laumethode.* ("Methoden der Kristallstrukturbestimmung mit Röntgenstrahlen. Leitfaden für Studierende der Physik, Chemie, Mineralogie, Metallkunde, sowie d. Ingenieur- u. allg. Naturwiss.," Band I.) Pp. xii + 173. 1932. Leipzig : Akademische Verlagsgesellschaft. (M. 12 ; kart, M. 13.)

Society of Public Analysts and Other Analytical Chemists, The. *Some Reminiscences of its First Fifty Years.* By Bernard Dyer ; and *A Review of its Activities.* By C. Ainsworth Mitchell. Cr. 4to. Pp. viii + 278 + 4 plates. 1932. Cambridge : W. Heffer and Sons, Ltd. ; London ; Simpkin Marshall, Ltd. (12*s.* 6*d.* net.)

***Soulier, Alfred.** *Traité de Galvanoplastie. Source de Courant—Preparation des Pièces—Cuivrage—Nickelage—Argenture—Dorure—Reproduction des Objets—Moulages—Recettes Pratique.* 8e. édition, revue et augmentée d'une annexe sur le *Chromage.* Cr. 8vo. Pp. viii + 203, with 32 illustrations. [1932.] Paris : Garnier frères, 6 rue des Saints-Pères. (9 francs.)

***Taylor, E. R.** Compiled by. *Definitions and Formulæ for Students. (Metallurgy.)* 4 in. × 5½ in. Pp. iv + 44, illustrated. 1932. London : Sir Isaac Pitman and Sons, Ltd. (6*d.* net.)

***Umhau, John B.** *Summarized Data of Tin Production.* (United States Department of Commerce, Bureau of Mines. Economic Paper 13.) Med. 8vo. Pp. 34, with 13 illustrations in the text. 1932. Washington, D.C. : Government Printing Office.

Valentini, Ascanio. *Elementi di elettrochimica generale ed applicata.* Pp. xiii + 252. 1931. Milano: Accademia Elettrochimica. (L. 12.)

***Veszelka, J.** *Untersuchungen über die Gleichgewichtsverhältnisse weiterlegierter Bronzen.* (A m. kir. Bányamérnöki és Erdömérnöki Föiskola bányászati és Kohászati osztályának Közleményeiböl, 1932. évf. IV. kötet; Aus den "Mitteilungen der berg- und hüttenmännischen Abteilung an der kg. ung. Hochschule für Berg- und Forstwesen zu Sopron, Ungarn.," Band IV, 1932.) 4to. Pp. 42, with 66 illustrations. 1932. Sopron: Pächter der Röttig Romwalter Drückerei A.G.

***Who's Who, 1933.** An Annual Biographical Dictionary with which is incorporated "Men and Women of the Time." Eighty-fifth year of issue. Post 8vo. Pp. xlviii + 3648. 1933. London: A. and C. Black, Ltd. (60*s.*)

XXIV.—BOOK REVIEWS

[All books reviewed are contained in the Library of the Institute.]

Précis de Métallographie microscopique et de Macrographie. Par Léon Guillet et Albert Portevin. Troisième édition. Roy. 8vo. Pp. 407, with 647 illustrations. 1932. Paris: Dunod. (128 francs.)

This book, which has now reached its third edition, forms a valuable addition to the list of text-books on metallurgy and the reputation of its two authors renders it authoritative. It is a charming book to read; the subject is presented in an interesting way and in language easily understood by a foreigner. It is profusely illustrated, the illustrations being admirably chosen, well prepared, and adequately reproduced.

The book commences with the discussion of the microscopic examination of metals and gives a detailed account of the preparation of material for such examination. No reference is made to the elegant and effective method, recently developed in America, which employs a microtome for the preparation of the surface. The equilibrium diagram and methods for its determination are discussed. No reference, however, its made to the use of X-rays. The mechanical properties of metals and alloys are then described. It is here surprising to find the statement that the fatigue test is of minor importance. A large section is devoted to iron and steel, with special reference to alloy steels. A further section is devoted to non-ferrous metals. A valuable and well-illustrated section is devoted to the macroscopic examination of metals, a subject which has recently suffered a period of partial eclipse from which it is now emerging.

An alphabetical index would form a valuable addition to the book.—J. D. Grogan.

Gmelin's Handbuch der Anorganischen Chemie. Achte, völlig neu bearbeitete Auflage. Herausgegeben von der Deutschen Chemischen Gesellschaft. Bearbeitet von R. J. Meyer. System-Nummer 58: **Kobalt.** Teil A, Lieferung 2. Pp. 221–502, illustrated (R.M. 48; subscription price, R.M. 42); System-Nummer 59: **Eisen.** Teil B, Lieferung 5. Pp. 873–1166, illustrated. (R.M. 53.50; subscription price, R.M. 47.50.) Sup. Roy. 8vo. 1932. Berlin: Verlag Chemie, G.m.b.H.

The section, system number 58, deals with the derivatives of cobalt, exclusive of the ammines, in the manner adopted in the earlier sections. The compounds are dealt with in order, beginning with the compounds of cobalt and hydrogen which is followed by compounds with oxygen, the hydroxides, nitrides, azides, amide, hyponitrite, nitrites, nitrates, fluorides, chlorides, chlorates, perchlorates, bromides, bromates, iodides, iodates, periodates, sulphides, sulphites, sulphates, thiosulphates, dithionates, amidosulphonate, selenides, selenites, selenates, tellurides, tellurites, tellurates, borides, borates, carbides, carbonyls, carbonates, thiocarbonates, acetates, oxalates, tartrates, citrates, acetyl-acetonates, cyanides, cyanates, thiocyanates, silicides, silicates, phosphides, phosphates, arsenides, arsenates, stibides and complex compounds with compounds of other metals including bismuth, lithium, and the alkali metals, the alkaline-earth metals, zinc, cadmium, mercury, aluminium, titanium, zirconium, thorium, tin, lead, vanadium, columbium, chromium, tantalum, molybdenum, tungsten, uranium, manganese, and nickel. The properties, both chemical and physical of these compounds are described very fully and where organic complex compounds exist these are included. It is indeed difficult, if not impossible, to find a compound, into the composition of which cobalt enters, which has been omitted. The present instalment completes a very full, useful, and accurate account of the chemistry of the element cobalt and its derivatives.

The B section of system number 59 is completed by the present instalment, which deals with the complex compounds of iron in which another metal is involved. The treatment is systematic, and commences with the lithium iron compounds, which are followed by iron compounds with compounds of the alkali metals, the alkaline-earth metals, zinc, cadmium, mercury, aluminium, gallium, indium, thallium, titanium, zirconium, thorium, tin, lead, vanadium, columbium, chromium, molybdenum, tungsten, uranium, manganese, nickel, and cobalt. Organic compounds of these complex derivatives, where such exist, are described, as well as compounds with ammonium salts, ammonia, and hydroxylamine.

The two sections under review maintain the high standard of excellence set up by the earlier sections. The work will prove a continuous source of satisfaction to chemists, and although the price of the whole work is prohibitive to many chemists individually, this work must find a place in all chemical libraries, since it presents the most complete account of our knowledge of inorganic chemistry.—JAMES F. SPENCER.

Die Abhängigkeit der Werkstoffdämpfung von der Grösse und Geschwindigkeit der Formänderung. Von Ernst Bankwitz. (Mitteilungen des Wöhler-Instituts, Braunschweig, Heft 11.) Demy 8vo. Pp. iv + 53, with 35 illustrations in the text. 1932. Berlin: NEM-Verlag G.m.b.H. (R.M. 3.60.)

This is an account of a research conducted at the Wöhler Institute, the three main objects of which may be summarized as follows: (1) to determine the extent of the damping effects with small changes of form; in the case of the light metals and other good thermal conductors the difficulties in making these determinations are great; (2) to determine the influence of the rate of change and form on the magnitude of the damping phenomena; and (3) to investigate to what extent the static properties of materials are affected by alternating stresses.

It has been found that on the curves showing the damping characteristics of materials with low yield-points such as the light metals, copper, &c., the null point and the first portion of the curves cannot be satisfactorily determined; but by means of new diagrams showing the numbers of alternations in the tests and their relationship to damping effects the null point has been fairly accurately determined. Thermal measurements have confirmed these results. The latter part of the report deals with the raising of the yield-point by the application of alternating stresses.—W. A. C. NEWMAN.

Die Ferromagnetischen Legierungen und ihre Gerwerbliche Verwendung. Von W. S. Messkin, umgearbeitet und erweitert von A. Kussmann. Med. 8vo. Pp. viii + 418, with 292 illustrations in the text. 1932. Berlin: Julius Springer. (R.M. 44.50.)

The literature of the ferromagnetic alloys is extensive and scattered. The authors, in this volume, have collected together and summarized a good deal of this literature, more especially that relating to ferromagnetic alloys which have found, or may possibly find, industrial application, and have discussed their physical-chemical characteristics and internal structures. It can be said at once, that they have done their task well. The manuscript of the work, originally due to Messkin, and having a bias which would make the work invaluable to the steel-worker and electro-technician, was extended by Kussmann to include a discussion of the physical chemistry of these alloys. The resulting joint work will therefore appeal to a much wider circle of readers. The practical man, the student of physics or chemistry, the crystallographer, will all find something of interest here.

Chapters devoted to a brief account of magnetic quantities and their measurement are succeeded by a description of methods and apparatus available for testing materials used in the construction of permanent magnets. This is followed by chapters dealing with: the effects of chemical composition and condition on magnetic properties, magnetic analysis, characteristics of technological importance, including the effects of cold- and hot-working, steels used for the construction of permanent magnets, including alloy steels containing tungsten, chromium, molybdenum, cobalt, and copper, alloy steels for the construction of dynamos and transformers, and alloys having high magnetic saturation values. The whole is very well done. There is just one small point that may be somewhat confusing at first. In 1930 an international decision was reached that the unit of magnetic field strength, H should be called the "Oersted," and not, as formerly, the "Gauss." This latter name is now reserved for the unit of magnetic induction, usually denoted by B and equal to μH. In the text of this book, the "Oersted" is used for the unit of H, but as some of the diagrams had been completed before 1930, and as others are reproduced from the original papers in which they occur, this same unit of field strength, is, in most of the diagrams, called the "Gauss."

The book is very well printed on good paper; the diagrams and tables are extremely clear (some of the equilibrium diagrams are models of distinctness which I would commend especially to metallographers); it is provided with adequate name and subject indexes and is well bound. I regret that I am unable to recommend it to a wide circle of buyers, as distinct from readers. The book will undoubtedly find its way on to the shelves of our scientific and larger industrial libraries and will often be taken down therefrom. But it will not be found in the more limited libraries of students or researchers; and that is where it should be. Its price, about £3 at to-day's rate of exchange, precludes that possibility. At best, student days are *short* days in more ways than one. A reduction of price to, say, 25*s.*, will secure for the book the wide circulation it deserves.—J. S. G. THOMAS.

Metal Aircraft Construction. By M. Langley. Demy 8vo. Pp. vii + 240, with 241 illustrations. 1932. London: Gale and Polden, Ltd., 2 Amen Corner, E.C.4. (15*s.* net.)

The appearance of this small but well-filled book is a welcome event. It is intended for the junior draughtsman, but it will prove of service to all who seek information on the use of metals and alloys in aircraft construction. To readers interested in the materials used in modern aircraft production, Chapter I on the development of metal aircraft, Chapter II on materials, and Chapter VII on workshop processes and detail design should prove of special value. A brief survey of the principal materials used in the construction of wings, fuselages, boat hulls, and floats, undercarriages, &c., is given. To a specialist on a particular material of construction the data given may appear, in certain instances, brief and rather superficial. The author has, however, given a good outline of the main points of the subject in a volume which, although small, provides useful practical data not readily available elsewhere in collected form.—H. SUTTON.

The Sorption of Gases and Vapours by Solids. By James William McBain. Demy 8vo. Pp. xii + 577, with 151 illustrations. 1932. London: George Routledge and Sons, Ltd. (25*s.* net.)

The large mass of existing data dealing with this important subject has been collated for the first time in the present book, and there is no doubt that the result of this formidable task will be widely valued. Part 1 is introductory, dealing with historical and general features and with methods of measurement. In Part 2 the available experimental data on various materials are classified and discussed. Hypotheses and theories are briefly classified and finally discussed separately in Part 3. This latter section, in common with the remainder of the book, is admirably concise and clear. The classical thick compressed film theory is regarded by the author as insufficiently supported in view of the necessity for the assumption of long range attractive forces not yet shown to exist. The Langmuir theory, which postulates the inelasticity of the collision between a molecule of gas and a solid, is regarded as more successfully fitting the facts. According to this view, the complicated phenomena known as adsorption are primarily always physical, other processes, chemical or physical, following.

While the book is mainly for the pure physicist it is not altogether without interest for the metallurgist. Numerous references are made in the text, and, in addition to the usual subject index, a substance index and an author index are provided. Excellent printing of the text and figures contributes to a valuable scientific reference volume.—R. GENDERS.

Refractories. By F. H. Norton. Roy. 8vo. Pp. x + 594, with numerous illustrations. 1931. New York: McGraw-Hill Publishing Co. Inc. London: McGraw-Hill Book Co. Ltd. (36*s.* net.)

The subject of refractories is receiving increasing attention in these days and the publication of a book on the subject is not without extreme interest, especially as good works on it are only few in number. In this instance preference is given to American practice, especially in the descriptions of manufacturing processes. Practically nothing is said on the important subject of the proper use of refractories in furnace design and construction, this being too large a field, according to the author, to be summarized in a volume of this nature. Attempts have been made throughout to indicate directions in which profitable research might be conducted. In the first chapter a review of the literature up to date is given and a record is made of bibliographies in which the fullest information may be found. There follow three chapters which deal with the various classes of primary refractories, their preliminary treatment, and their plastic and moulding characteristics. The drying and burning of the clays and the ultimate products demand special kilns, accurate temperature control, and a knowledge of theoretical principles underlying these processes. These are fully discussed and illustrated in the next series of chapters, and an attempt has been made to include the results from most of the recent important investigations. Very naturally the mechanical, physical and chemical properties of commercial refractories are given wide consideration in sections devoted to load bearing capacity, spalling, reactions between refractories and glasses, expansion and shrinkage, heat transmission, microscopic examination, X-ray studies, and chemical analysis. A short chapter

at the end is given over to a consideration of refractory cements and plastics. As a whole the book is thoroughly readable, modern in its outlook, and well balanced in its conception.
—W. A. C. Newman.

Technische Elektrochemie. Band III.—Schmelzfluss-Elektrolyse Alkalimetalle, Erdalkalimetalle, Magnesium, Aluminium, Beryllium u.s.w. Von Jean Billiter. Zweite, umgearbeitete und vermehrte Auflage. Med. 8vo. Pp. vii + 196, with 72 illustrations. 1932. Halle (Saale): Wilhelm Knapp. (Br. M. 12.50; geb. M. 14.)

The extraction of the light metals from their ores has resulted mainly from the electrolysis of their molten salts, dissolved, in most instances, in other fused media. The importance to which these light alloys and the ever-increasing number of their useful alloys, have attained, has intensified the interest in methods for the extraction of the pure metals. The electrolysis of molten salts is therefore becoming a vitally important part of electrochemistry.

The introduction serves to enlighten the reader on various theoretical phases of the subject—ionization, dissociation, Faraday's law, electromotive force, decomposition potentials, &c. There follow seven chapters, each of which deals with the electrolytic separation of a particular metal. The following are included—sodium compounds, including the production of sodium, chlorine, and caustic soda; lithium and potassium; alkaline-earth metals; beryllium; magnesium, including the electrolysis of the chloride, and of the oxide in fluoride mixtures; aluminium, including the purification of bauxite, and the electrolysis of the molten oxide–fluoride mixtures; and cerium mixed metal. Although one or two errors have been detected, they do not detract from the general value of the book as a source of relatively detailed information on the various processes. Of particular interest are a number of the photographs which are new and up-to-date so far as ordinary text-book reproduction is concerned.—W. A. C. N.

Handbook for Electric Welders. Demy 8vo. Pp. 75, with 21 illustrations. [1932.] London: Murex Welding Processes, Ltd., Ferry Lane Works, Forrest Rd., Walthamstow, E.17. (1*s.* net.)

The first two chapters of this booklet attempt the difficult task of explaining electrical theory in simple language and, although successful to a certain extent, they have not been written with the easy confidence which is characteristic of the other chapters. They are followed by a brief outline of elementary ferrous metallurgy, an explanation of the behaviour of flux-coated electrodes in the arc, and concise instructions for beginners. The most valuable part of the booklet is perhaps the next three sections, on making a fillet-weld, making a butt-weld, and welding cast-iron. Each is written by a practical welder and gives detailed instructions in sound technique. Three shorter sections follow, on stainless steel, tramway, and non-ferrous welding. Of these, the first and last are disappointingly brief, and give little indication of the difficulties which may be expected. We should like to have much more information on the arc-welding of non-ferrous materials. A chapter on the mechanical and physical properties of weld metal (ferrous welds only being considered) is followed by a section on estimating quantities, which will be found invaluable by every foreman welder.

The booklet can be recommended to everyone interested in metallic arc welding; the fund of information it contains would be expanded, in the average text-book, to cover many dozens of pages and to cost many dozens of pence.—H. W. G. Hignett.

The Purox Manual. Instructions for Welding and Cutting by the Oxy-Acetylene Process. Second Edition. Med. 8vo. Pp. 150, with 89 illustrations in the text. 1931. New York: The Linde Air Products Co. ($1.00.)

The first five chapters of this book describe welding and cutting apparatus and accessories as manufactured by the publishers of this handbook. They are not, therefore, of great interest to a welder who wishes to use a blowpipe of different make. The sixth chapter gives concise practical instructions for oxygen cutting and the seventh introduces the sections on welding by explaining how the welder may recognize the materials he is likely to be called on to weld. Monel metal is among those mentioned, but nickel is unaccountably omitted. The next seven chapters deal with the welding of wrought and cast steel and iron, whilst the non-ferrous metals are surveyed in the last two chapters—" Welding Sheet Aluminium " and " Welding Cast Aluminium."

This book is written from a very narrow viewpoint; it fails to show any broad view of his art to a welding apprentice and it therefore fails to impress as a useful manual for his instruction. For example, although extremely detailed practical instructions are given throughout, no indication is given that there is more than one opinion as to the best method of blowpipe manipulation. Again, no account of any process can be complete without pointing out its limitations and defects in relation to other processes.—H. W. G. Hignett.

Foundations and Methods of Chemical Analysis by the Emission Spectrum. Being the Authorized Translation of "Die Chemische Emissionsspektralanalyse." By Walther Gerlach and Eugen Schweitzer. Med. 8vo. Pp. 123, with 53 illustrations. 1931. London: Adam Hilger, Ltd., 24 Rochester Place, Camden Rd., N.W.1. (12*s*. 6*d*. net.)

In this book the authors summarize and amplify their work on the application of emission spectra to the qualitative and quantitative analysis of metals and alloys with special reference to the method of homologous pairs of lines. The book commences with a discussion of the nature, application, and basic principles of chemical spectrum analysis, then passes to a description of the electrical and optical apparatus employed in the work, and finally to a consideration of methods of qualitative and quantitative spectrographic analysis, in which is included an account of experiments on the refinement of the method by photometric intensity measurements. A brief bibliography of the most important papers covering the subject concludes the book; most of these papers have already been abstracted in this *Journal*, and reference to them will more fully indicate the nature of the subject-matter of this book.

After many years' experience in this type of spectrographic analysis, the authors have come to the conclusion that the method offers considerable advantages over chemical analysis for the detection and determination of small quantities of impurities in metals and alloys. Whether this be true in all cases or not, the fact remains that their work has aroused very considerable interest in the metallurgical world, and metallurgists are under a debt of gratitude to them for this admirably lucid exposition of the results of their researches, which should enable others to repeat, expand, and amplify the work. The translation has been done very well indeed, the publishers have produced the book in good, clear type, and the illustrations are excellent. The book can be thoroughly recommended to all who desire to gain a thorough knowledge of this fascinating branch of analysis.—A. R. POWELL.

Die Massanalyse. Zweiter Teil: **Die Praxis der Massanalyse.** Von I. M. Kolthoff, unter Mitwirkung von H. Menzel. Zweite Auflage. Post 8vo. Pp. xi + 612, with 23 illustrations. 1931. Berlin: Julius Springer. (Geh., R.M. 28; geb., R.M. 29.40.)

That a second edition of this book is required within three years of the publication of the first edition testifies to its value as a text-book of analytical chemistry. The style and scope of the work have already been fully discussed in the review of the first edition which appeared in this *Journal* (1928, 39, 720). In preparing this edition the author has considerably extended the field covered, to include all the latest advances made in analytical chemistry up to and including the early part of 1931, and in order to do this without making the book unwieldy, details of analytical procedure and the critical discussions of the methods are printed in smaller type; nevertheless, this edition contains exactly 100 pages more than the last. Among the additions may be mentioned the use of ceric sulphate instead of permanganate for oxidimetric titrations and the determination of various common and rare metals by bromometric titration of their compounds with 8-hydroxyquinoline. The book is again well supplied with references as footnotes, and thus provides an exhaustive survey of modern analytical technique; there is no doubt that this new edition is the foremost textbook on chemical analysis, and English-speaking chemists will look forward to the second English translation.—A. R. POWELL.

Rechenverfahren und Rechenhilfsmittel mit Anwendungen auf die Analytische Chemie. Von Otto Liesche. ("Die Chemische Analyse." Herausgegeben von Wilhelm Böttger. XXX Band.) Roy. 8vo. Pp. viii + 201, with 24 illustrations. 1932. Stuttgart: Ferdinand Enke. (Geh., R.M. 20; geb., R.M. 22.)

This is a useful little book not only for advanced chemical students, but for all analytical chemists; it consists of a series of practical hints on mathematical calculations and their application to working out analytical results from the figures obtained both in direct and in indirect analysis. The first section contains a description of rapid methods of adding, subtracting, multiplying, and dividing, and shows how many apparently complicated mathematical operations can be made mentally after memorizing a few simple rules. Section II discusses the use of logarithms and the construction and use of slide rules and calculating machines. In Section III examples are given of methods of working out results from the figures obtained in all kinds of analytical operations, and, finally, the last section describes the construction and use of nomograms.

The book is very well written, and makes interesting reading; probably there are very few analysts who will not find something of value to themselves in the book.—A. R. POWELL.

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

1933 FEBRUARY Part 2

I.—PROPERTIES OF METALS

(Continued from pp. 1–9.)

Production and Technical Importance of Beryllium. Anon. (*Maschinenkonstrukteur*, 1932, 65, (15/16), 100).—The sources and preparation of beryllium are reviewed. The following useful properties of the metal are emphasized: (1) strengthening, hardening, and anti-corrosive effects on copper, aluminium, and nickel; (2) high melting-point (1285° C.) with accompanying retention of strength at comparatively high temperatures; (3) very low sp. gr. (1·84); (4) a transparency to X-rays 17 times as great as that of aluminium, with possible radiographic applications. The oxide is stated to possess good insulating properties.—P. M. C. R.

On the Thermal Variations of the Density and Molecular Weight of Molten Bismuth. A. Jouniaux (*Bull. Soc. chim. France*, 1932, [iv], 51, 677–681).—The specific volume v_t of molten bismuth at $t°$ as deduced from measurements of the density between 400° and 1100° C. is given by the expression $v_t = 0{\cdot}1011 + 1{\cdot}28(t - 420)10^{-5}$. The molecular weight of bismuth decreases with rise in temperature until 420° C., when the molecules become monatomic; above 1400° C., the molecular weight rises again to a maximum, then decreases until at 2100° C. it again becomes equal to the atomic weight.—A. R. P.

[Discussion of L. L. Wyman's Paper on] Copper Embrittlement. C. S. Smith. W. A. Scheuch. L. L. Wyman (*Min. and Met.*, 1932, 13, 481–483).—Cf. this *J.*, 1932, 50, 722. C. S. S. gives photomicrographs of copper containing 0·103% silicon after annealing for 2 hrs. at 600°–1050° C. packed in cuprous oxide scale. The depth of penetration of the oxide zone has been measured and the results plotted against the temperature of annealing; the curve is a parabola concave to the depth axis. On subsequently annealing copper having an outer oxidized zone in a reducing atmosphere, the embrittling effect extends inwards only to the depth of the oxidized zone so that however high the annealing temperature or however long the line of annealing, the brittle zone will never extend beyond the limits of the original oxidized zone. W. A. S. suggests a hydrogen annealing test as a means of evaluating commercial supplies of copper. L. L. W. suggests that the time of demarcation between the oxidized and unoxidized zones is always parallel to the surface of the metal, but C. S. S., while generally agreeing with this statement, has proved that the line is liable to become very irregular after prolonged exposure of the metal to oxidizing conditions.—A. R. P.

An Empirical Rule on the Behaviour of Some Plastic Bodies [Copper Crystals] Under Pressure. Karl Przibram (*Sitzungsber. Akad. Wiss. Wien*, 1932, [II*a*], 141, 63–69).—The behaviour of copper crystals under pressures of 10–24 tons/in.^{2} is expressed approximately by the equation $S = bp(x_0/d)/[1 - bp(x_0/d)]$, where s is the reduction in thickness under p tons/in.^{2} pressure, b is a constant, x_0 is the original thickness, and d is the edge of a cross-section. The actual values for lead agree less closely, and those for copper at lower pressures than 5 tons/in.^{2} very poorly, with the calculated values.—A. R. P.

The Elastic Limit of Non-Ferrous Metals [Copper; Brass]. P. Schoenmaker (*Rec. trav. chim.*, 1932, 51, 598–604).—[In German.] Tensile tests performed on specimens of copper and brass failed to reveal an elastic limit at 18° C. A slight discontinuity was observed in the stress–strain diagram at 0° C., and at lower temperatures this develops into a well-defined elastic limit. The relation between deformation and the type of lattice is discussed.—E. H.

The Resistance of Copper and Its Alloys to Repeated Stress. II.—Effect of Impurities in, and Additions to, Copper. Lack of Satisfactory Accelerated Test Methods. H. W. Gillett (*Metals and Alloys*, 1932, 3, 236–238).—Cf. this *J.*, 1932, **50**, 679. A correlated abstract in which the effects of phosphorus, arsenic, and antimony in annealed copper and of oxygen in cold-drawn copper are summarized in a series of tables. All additions to copper which increase the endurance diminish the electrical conductivity; within the " tough pitch " range oxygen appears to have little influence on the endurance. No data on oxygen-free copper are available.—A. R. P.

Diffusion of Positive Ions of Salts through Copper at a High Temperature. Analysis of the Ions Emitted with the Aid of a Mass-Spectrograph. Jean Cichocki (*J. Phys. Radium*, 1932, [vii], 3, 478–485).—Chlorides of lithium, sodium, potassium, magnesium, copper, strontium, barium, nickel, and aluminium diffuse through copper foil at 900°–1320° C. and give rise to the emission of positive ions from the surface. These ions have been analysed by the mass spectrograph and are shown to consist of both simple cations of the salt and complex ions containing copper.—E. S. H.

Photoelectric Effect at Magnesium Surfaces. H. Gerding and R. Gerding-Kroon (*Rec. trav. chim.*, 1932, **51**, 612–618).—[In German.] The photoelectric effect has been measured at a surface of magnesium. The effect is reduced by exposure of the metal surface to oxygen.—E. S. H.

On the Oxidation of Mercury by Air. A. Stock, F. Gerstner, and H. Köhler (*Naturwiss.*, 1932, **20**, 954–955).—The dissolution of mercury in water and aqueous solutions proceeds with the intermediate formation of mercuric oxide, and is particularly rapid when air is bubbled through the mixture. Some solubility measurements are given. The vapour of mercuric oxide dissociates at room temperature. The importance of mercuric oxide for some physical, chemical, and biological processes is discussed.—J. W.

The Electrical Conductivity of Mercury at High Temperatures and Pressures. Werner Braunbek (*Physikal. Z.*, 1932, **33**, 830–831).—Read before the VIII Deutsche Physikertag, September, 1932. The electrical conductivity of mercury under 300 atm. pressure is found to decrease linearly with increase of temperature from 0° C. to 650° C.—J. S. G. T.

The Thermionic and Photo-Electric Work Functions of Molybdenum. Lee A. DuBridge and W. W. Roehr (*Phys. Rev.*, 1932, [ii], **42**, 52–57).—The photo-electric and thermionic emissions of molybdenum were studied during prolonged degassing at high temperatures. In the final degassed state, photo-electric curves, analysed by Fowler's method, gave the true work function as $4{\cdot}15 \pm 0{\cdot}02$ v. at both room temperature and 940° K. Thermionic data gave the work function as 4·15 v. in complete agreement with the photo-electric method; the value of the constant A in the Richardson equation was 55 amp./cm^2.deg.^{2}, in good agreement with the theoretical value of 60. Incompletely degassed specimens may reach apparently stable states, and these account for the slightly different values previously found by Dushman, Rowe, Ewald, and Kidner (*Phys. Rev.*, 1925, [ii], **28**, 338; this *J.*, 1925, **34**, 378), and Martin (*Phys. Rev.*, 1929, [ii], **33**, 881; this *J.*, 1929, **42**, 405).—W. H.-R.

The Electrical Conductivity of Oxygen Occluded by Palladium. Donald P. Smith (*Z. Physik*, 1932, **78**, 815–823).—Experimental results of measurements of the electrical resistance of a palladium wire either containing occluded oxygen or after evolution of this oxygen from the wire, confirm S.'s previous conclusion that the resistance of palladium containing anodically occluded oxygen is changed by such occlusion in a manner associated with the gas itself (see following abstract).—J. S. G. T.

The Assumption of the Transport of Electricity by Oxygen in Metals. Alfred Coehn (*Z. Physik*, 1932, **78**, 824–825).—C. considers that no evidence for the actual transport of electricity by occluded oxygen in metals has been brought forward by Smith (see preceding abstract).—J. S. G. T.

The Rôle of the Platinum Metals in Dental Alloys. E. M. Wise, Walter S. Crowell, and J. T. Eash (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 363–407; discussion, 407–412).—See this *J.*, 1932, **50**, 476.—S. G.

Vacuum Apparatus for Measuring Thermal Expansion at Elevated Temperatures, with Measurements on Platinum, Gold, Magnesium, and Zinc. J. B. Austin (*Physics*, 1932, **3**, 240–267).—An apparatus for measuring linear thermal expansion *in vacuo* between room temperature and 950° C. by an optical interference method is described. Although designed primarily for metals which oxidize readily, it appears to be applicable to all metals in temperature ranges through which their vapour pressure is low. l_t denoting the length at t° C. of a rod of length l_0 at 0° C., the following relationships were determined experimentally: for platinum, $l_t = l_0(1 + 8{\cdot}868 \times 10^{-6}t + 1{\cdot}324 \times 10^{-9}t^2)$; for gold, $l_t = l_0(1 + 14{\cdot}06 \times 10^{-6}t + 1{\cdot}672 \times 10^{-9}t^2 + 1{\cdot}197 \times 10^{-12}t^3)$; for magnesium (annealed at above 250° C.), $l_t = l_0[1 + (24{\cdot}80 + 0{\cdot}00961t^2) \times 10^{-6}]$. A study of the expansion of zinc single-crystals yields no evidence for the existence of more than one polymorphous form between 20° and 350° C. The vaporization of magnesium and zinc *in vacuo* was much greater than was anticipated from their behaviour in air at 1 atmosphere pressure, and it is suggested that the true vapour pressure of metals at temperatures of a few hundred degrees may be greater than is commonly supposed.—J. S. G. T.

Radioactivity of Samarium. G. Hevesy and M. Pahl (*Nature*, 1932, **130**, 846–847).—Samarium is found to possess a radioactivity, which is not due to the presence of any known radioactive element.—E. S. H.

The Atomic Weights of Selenium and Tellurium. O. Hönigschmid (*Naturwiss.*, 1932, **20**, 659).—New determinations of the atomic weights of these elements are in very close agreement with those obtained by the mass spectra method; the values obtained were: selenium, 78·962 ± 0·002; tellurium 127·587 ± 0·019.—J. W.

The Colour of Silver as a Function of Its Surface Nature. A. Kutzelnigg (*Kolloid-Z.*, 1932, **61**, 48–50).—The repetition of reflections, caused by the increasing looseness of packing of the crystallites, produces changes in the colour of silver, which passes from the mirror-like state, through matt-white, yellowish-grey, brownish-black, to black. In all these forms a yellowish colour can be recognized photometrically.—E. S. H.

Changes in the Specific Heat of Tin in the Superconducting State. W. H. Keesom (*Pontificia Acad. Sci. Novi Lyncaei, Sci. Nuncius Radiophonicus*, **1932**, (14), 6–7; *C. Abs.*, 1932, **26**, 5824).—Between 3·70° K. and 3·72° K. the sp. heat of tin diminishes from 0·0078 to 0·0054.—S. G.

Measurements Employing Liquid Helium. XVIII.—The Behaviour of Super-Conducting Tin under the Incidence of Slow-Moving Electrons. W. Meissner and K. Steiner (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1932, **16**, 135–146).—Reprinted from *Z. Physik*, 1932, **76**, 201–212; see this *J.*, 1932, **50**, 467.—M. H.

The Equilibrium $Sn + 2CO_2 \rightleftharpoons SnO_2 + 2CO$. G. Meyer and F. E. C. Scheffer (*Rec. trav. chim.*, 1932, **51**, 569–573).—The composition of gas in equilibrium with tin and stannic oxide at 500° C. is carbon dioxide 73·6, carbon monoxide 26·4%; at 800° C. it is carbon dioxide 79·8, carbon monoxide 20·2%. Temperature has no great influence. The heat of reaction is determined as 3800 grm.-cal. per mol.—E. S. H.

The Emission of Positive Ions from Hot Tungsten. P. B. Moon (*Proc. Cambridge Phil. Soc.*, 1932, **28**, 490–496).—The positive-ion currents emitted by tungsten at temperatures between 3000° K. and 3200° K. have been measured. The "work-function" associated with the ionic evaporation appears to lie between 10 and 11 electron volts.—E. S. H.

Conduction of Heat and Electricity in Zinc and Cadmium Crystals. E. Goens and E. Grüneisen (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1932, **16**, 220–236).—Reprint from *Ann. Physik*, 1932, [v], 14, 164–180; see this *J.*, 1932, 50, 596.—M. H.

Stresses Produced in a Circular Plate by Eccentric Loading and by a Transverse Couple. Raymond Jefferson Roark (*Bull. Univ. Wisconsin, Eng. Exper. Sta.* Series, No. 74, 1932, 1–41).—Expressions for the stresses and deflections produced by centrally loading circular plates with either free or fixed edges are given, with reservations as to the amount of deflection compared with thickness of plate. The deflection for eccentrically loaded plates with free edges, and the curvature and stresses involved, are expressed by equations; further expressions give deflection and curvature values for eccentric loading of plates with fixed edges, and it is assumed that these equations are also valid for determining stresses. No mathematical analysis is arrived at for the action of a transverse couple centrally applied, although an empirical formula for the maximum flexural stress is given, with an approximation to the value for shear stress. The effect of a central hole in a plate thus stressed is considered, and the case of an actual failure in service is found to give results in fair accordance with the proposed formulæ.—P. M. C. R.

Metallic Films and Surfaces. K. Richter (*Kolloid-Z.*, 1932, 61, 208–218).—The processes available for obtaining metallic films are classified as: (1) mechanical methods (rolling, beating, spraying), (2) chemical methods (electrodeposition, reduction, thermal decomposition), and (3) condensation methods (condensation of vapour and cathode sputtering). A review is given of the properties (mechanical, optical, magnetic, electrical, and photo-electric), chemical reactivity, and structure of these films. Technical applications of metallization, particularly the silvering of non-metallic substances, are discussed.—E. S. H.

Non-Conducting Modifications of Metals. J. Kramer and H. Zahn (*Naturwiss.*, 1932, 20, 792).—A short preliminary report on the special electrical properties of thin metal films of iron, nickel, platinum, zinc, copper, tin, antimony, and the changes they undergo on heating.— J. W.

On the Absolute Magnitude of Metal Surfaces. O. Erbacher (*Naturwiss.*, 1932, 20, 944–945).—From the quantity and magnitude of the more noble atoms deposited in a monatomic film on a metal surface the absolute magnitude of the surface can be determined. The active part of the absolute surface of the more noble metals (referred to the measured surface) can be determined by charging the surface with hydrogen atoms. Polished nickel, silver, and gold have an absolute surface which is 1·7 times as great as the measured surface; after rubbing with emery this value increases to 2·5, and in both cases it is independent of the grain size. The active surface of polished platinum is 0·07–0·44, that of platinum rubbed with emery 2·1, and that of platinized platinum 17 times as great as the measured surface.—J. W.

Eleventh Report of the German Commission for Atomic Weights. M. Bodenstein, O. Hahn, O. Hönigschmid, and R. J. Meyer (*Ber. deut. chem. Ges.*, 1931, [B], 64, 1–21).—The following atomic weights have been re-determined, in each case by chemical methods; calcium, thallium, arsenic, tantalum, sulphur, chromium, chlorine, rhenium. The existence of isotopes has been demonstrated in the following cases: krypton, xenon, mercury, chromium, molybdenum, and the atomic weights of these elements have been revised accordingly. Spectroscopic methods have shown the existence of isotopes of oxygen, nitrogen, chlorine, and lead, and radiological investigations have been made on the possible existence of isotopic forms of polonium and radium. In both cases the results were negative.—P. M. C. R.

On the Lorentz–Lorenz Correction in Metallic Conductors. R. de L. Kronig and H. J. Groenewold (*Proc. K. Akad. Wet. Amsterdam*, 1932, 35, 974–978).—[In English.] A mathematical treatment.—E. S. H.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 9-16).

Studies on Light Alloys. Luigi Losana (*Industria chimica*, 1930, 5, 145–150; *C. Abs.*, 1930, 24, 5701).—The coeff. of thermal expansions, heat conductivity, and sp. heat at various temperatures of a number of aluminium–silicon, and aluminium–magnesium alloys have been measured. The equilibrium curves are shown. The following conclusions are reached: the coeff. of expansion of aluminium–silicon alloys up to 500° C. decreases with increasing silicon; magnesium–aluminium alloys show a similar decrease with increasing aluminium. The heat conductivity of aluminium–silicon alloys decreases with increasing silicon (a very large drop is noted with 0–1% silicon); magnesium–aluminium alloys show decreases when small quantities of aluminium are added to magnesium, and *vice versa*, with a sudden jump at about 55% magnesium, corresponding with Al_2Mg_3 (electrical conductivity shows a similar phenomenon). Sp. heats decrease rapidly with increased silicon, whilst with magnesium–aluminium there is a rapid drop with increased aluminium up to 20% aluminium, followed by a slow increase up to 60% magnesium, and then a gradual drop. This maximum is most noticeable at lower temperatures.—S. G.

A New Aluminium Alloy. [—— Harden] (*Met. Ind.* (*Lond.*), 1932, 41, 488).—A short note, describing the mechanical properties and applications of an aluminium alloy containing 2–4% of chromium and small percentages of nickel and manganese. Its melting point is about 700° C., and it is said to be particularly suitable for castings, to be but little heavier than aluminium, and to have the hardness and strength of many steels.—J. H. W.

Equilibrium Relations in Aluminium–Cobalt Alloys of High Purity. William L. Fink and H. R. Freche (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, 99, (Inst. Metals Div.), 141–148; discussion, 148).—For abstract of the paper see this *J.*, 1932, 50, 221. In the discussion, the method of determining the composition of a melt in equilibrium with a constituent which is freezing out is discussed briefly by *W. M. Peirce* and *W. L. Fink*.—A. R. P.

Cadmium in Aluminium–Copper Alloys for the Manufacture of Electrical Conductors. Anon. (*Alluminio*, 1932, 1, 315).—An abstract of an account of some work done by Bosshard on the suitability of cadmium–copper–aluminium alloy wires for electrical conductors and published in the *Bulletin d'Information du Bureau International de l'Aluminium*, No. 23. This alloy behaves better than Aldrey in the Mylius test, but worse in corrosion tests in sodium chloride–hydrogen peroxide solution; its mechanical properties are much inferior to those of Aldrey and its electrical conductivity is only slightly superior.—G. G.

Study of Certain Light Alloys of Aluminium and of "Aluminium-Bronze" [for Coinage]. Camille Matignon (*Chim. et Ind.*, 1932, 28, 23–36).—Cf. this *J.*, 1932, 50, 534. The third series of alloys investigated included the following: (1) containing nickel 1·2–3%; (2) Dauvin alloys "D 13," "D 135," "D 75"; (3) Thiébaut alloys 2, 3, 5, and 10; (4) containing manganese 5–10%; (5) containing manganese 1–3·5%; (6) alloy "A 5" prepared by M. Badin according to Boutes' formula, and (7) Silverine made by Gelley. These various materials have been subjected to certain mechanical tests, the results of which are given, and compared with similar results obtained in the case of other groups. A further group of trials has been made with some of the alloys previously examined which have given superior results, and also with a Montley alloy, Savoye alloy, and some Badin and Durville types of aluminium–bronzes. The general conclusions from a huge mass of tables are set out at length.
—W. A. C. N.

Investigations of Duralplat Sheets. Karl Schraivogel and Erich K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1932, V13–18).—Reprinted from *Z. Metallkunde*, 1932, 24, 57–62. Cf. this *J.*, 1932, 50, 424, 728.—B. Bl.

On the Effect of Magnetic Treatment on the Age-Hardening of Quenched Steels and Alloys [Duralumin]. Yosiharu Matuyama (*Kinzoku no Kenkyu*, 1932, **9**, (9), 367–377).—[In Japanese.] See this *J.*, 1932, **50**, 660.—S. G.

The Mechanics of Plastic Deformation: The Flow of Duralumin Through Orifices. S. I. Goubkin (*J. Rheology*, 1932, **3**, 501–548).—Experimental determinations of the tensile strength, Young's modulus, hardness, and the flow characteristics at various temperatures and pressures, of Duralumin annealed at 350° C., are detailed and discussed. A theory of plastic flow is developed. —J. S. G. T.

Experiments with "C 17 ST" and Duralumin "681 ZB" Sheets. I.—Mechanical Tests. II.—Corrosion Tests. K. Schraivogel and E. K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1931, 20*).—The alloy "C 17 ST" (Aluminum Company of America) after quenching from 495° C. and ageing at 160° C. has better mechanical properties but poorer resistance to corrosion than the alloy "681 ZB."—B. Bl.

Comparative Experiments with German and French Duralumin Sheets. K. Schraivogel (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1931, 19*).—Sheets of the German Duralumin "681 B" are stated to be superior to sheets of French Duralumin in tensile and plastic working properties.—B. Bl.

Experiments with KS–Seewasser Sheets. E. K. O. Schmidt and K. Schraivogel (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1931, 20*–21*).—Some values are given for the mechanical properties and resistance to corrosion of sheets of KS–Seewasser.—B. Bl.

[Birmasil Special] A High-Strength Light Casting Alloy. Anon. (*Nickel Bulletin*, 1932, **5**, 202–203; and (abstract) *Met. Ind.* (*Lond.*), 1932, **41**, 518).—Discusses the properties of "Birmasil Special" alloy—an aluminium alloy containing up to 3·5% nickel with 8–13% silicon.—J. H. W.

Equilibrium Relations in Aluminium–Zinc Alloys of High Purity. William L. Fink and Kent R. Van Horn (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 132–140; discussion, 140).—See this *J.*, 1932, **50**, 223. —S. G.

Helumin Light Metal. L. Lang (*Rev. Fonderie moderne*, 1932, **26**, 374).—Brief note on the properties of a light aluminium alloy Helumin.—J. H. W.

Some Mechanical Properties of the Light Metals and Criteria for their Application. G. Guzzoni (*Ingegnere. Rivista Tecnica del Sindacato Nazionale Facista Ingegneri*, 1931, **5**, (3). See *J.*, 1932, **50**, 348.—S. G.

Precipitation Hardening: Contributions to the Micrography of the Aluminium Alloys. H. Röhrig (*Light Metals Research*, 1932, **2**, (18), 6–8).—Translated from *Z. Metallkunde*, 1932, **24**, 181–184, 207–210. See this *J.*, 1932, **50**, 726.—J. C. C.

The Diffusion of Metals in the Solid State. The Diffusion of Copper and Aluminium. G. Grube and R. Haefner (*Z. Elektrochem.*, 1932, **38**, 835–842).—The diffusion of copper and aluminium in one another at 600° C. when copper is plated on to aluminium has been investigated. Chemical analysis and microscopic examination show distinct zones of diffusion as: (1) pure copper; (2) the compound $CuAl_2$; (3) the eutectic (32% copper); (4) the η-solid solution; (5) pure aluminium. Adherence of the diffusion layer on the eutectic is poor owing to the brittleness of the latter. On the other hand, surface hardening of the aluminium occurs when the conditions are such that the saturation concentration of the η-solid solution is not or only a little exceeded. The Brinell hardness of the copper surface of the specimens was raised from 25 to 72 by heating them with aluminium powder and dehydrated cupric chloride. The hardness was also raised when a copper–aluminium alloy containing about 80% of copper was heated with aluminium powder and ammonium chloride. The diffusion of copper into aluminium resulting in the formation of the η-solid solution is as rapid as that of aluminium into copper resulting in the formation of the α-solid solution.—J. H. W.

Some Results Obtained by the Cementation Method on the Metal Couples: Copper–Beryllium, Copper–Silicon, Silver–Beryllium, Silver–Silicon, Gold–Beryllium, and Gold–Silicon. L. Loskiewicz (*Congrès internat. mines, Liège*, **1930**, June 22–28; and *Métallurgie*, **1930**, 535–545).—See this *J.*, 1931, **47**, 516.—S. G.

"Aluminium–Bronze." J. Strauss (*Canad. Mach.*, 1932, **43**, (4), 26–27).—A report of an address to the Ontario Chapter of the American Society for Steel Treating. An account is given of the aluminium–copper series of alloys, with their main applications, and their properties in the cast, heat-treated, rolled, and drawn states are described. The effects of small additions of other metals are enumerated, and the special drawbacks of the "aluminium-bronzes" in regard to shrinkage, segregation, and grain-growth are discussed. —P. M. C. R.

Magnetic Properties of the System [of Alloys] Mn–Cu–Al. S. Valentiner and G. Becker (*Physikal. Z.*, 1932, **33**, 872).—Read before the VIII Deutsche Physikertag, September, 1932. The magnetic susceptibility of the manganese–copper alloys containing 10–35% of manganese shows a large temperature coeff. at low temperatures. A systematic determination of the physical, including magnetic, properties of the manganese–aluminium–copper alloys has been carried out, and the results are correlated. Structural peculiarities found by Personn in the case of the alloy Mn–Al–Cu_2 are confirmed by the magnetic characteristics of this alloy.—J. S. G. T.

Investigation of the Workability of Copper–Manganese Alloys of High Electrical Resistance. M. P. Slavinsky, A. P. Belaiew, and R. R. Syromiatnikov (*Metallurg* (*Metallurgist*), 1932, **7**, (2), 3–16).—[In Russian.] The theory of electrical conduction through metals is briefly examined. In alloys used as electrical resistances the conductivity, temperature coeff. of resistance, and thermal e.m.f. should be as low as possible. These conditions are most satisfactorily fulfilled by solid solutions in which the greatest obstacles to the passage of the current are presented by the irregular distribution of the atoms. Although it should be theoretically possible to cast alloys with the desired electrical properties, the requirement that the casting may readily be worked into strip, wire, &c., introduces complications. In the copper-manganese alloys, the maximum resistance attained is 135·70 microhm with 36·8% copper, but the limit of workability lies at 32–34% manganese, above which a change in structure occurs. Small quantities of calcium are without effect on the properties of the alloys, but facilitate their preparation. The addition of aluminium is desirable, since it reduces the temperature coeff. and removes the thermal e.m.f. The workability of the alloys is improved by annealing below 600° C. X-ray analysis and micrographic examination alone are insufficient to indicate the changes in electrical resistance and workability of the alloys of the Manganin type.—M. Z.

Influence of Impurities on the Properties of Bronzes. —— Ameline (*Usine*, 1931, **40**, (19), 31).—Abstract of paper read before the Association Technique de Fonderie. See this *J.*, 1932, **50**, 602.—H. W. G. H.

Special Bronze for Telephone and Telegraph Conductors. [F. Freude] (*Wire and Wire Products*, 1932, **7**, 284–285, 303, 387, 390–391, 396).—Translated by Samuel J. Rosch from *Metallbörse*, 1931, **21**, 1491, 1539, 1673. See this *J.*, 1932, **50**, 376.—J. H. W.

Bronzes, Brasses, and Atmospheric Corrosion. —— Duberect (*Rev. Fonderie moderne*, 1932, **26**, 407–408).—Discusses the compositions and qualities required of "good" bronzes and brasses possessing high resistance to atmospheric corrosion.—J. H. W.

The Resistance of Copper and Its Alloys to Repeated Stress. III.—The Brasses and Nickel Brasses. H. W. Gillett (*Metals and Alloys*, 1932, **3**, 257–262).—A correlated abstract. The latest available data are tabulated for the static and dynamic mechanical properties of 60 : 40, 65 : 35, 70 : 30, 75 : 25, 80 : 20, 85 : 15, and 90 : 10 brasses, Muntz metal, and brasses containing 10–20% nickel with 53–74% copper. All these alloys are stronger than copper, and all are liable to fail by corrosion-fatigue, but this tendency decreases with increasing copper content. The alloys can be over-cold-worked, and notches and similar surface irregularities tend to produce early fatigue failure.—A. P.

Free-Cutting Brasses. P. M. (*Machinery* (*Lond.*), 1932, 40, 169–171).—Free-cutting brasses are all in the α–β group, and contain a small proportion of lead, which, if properly distributed, causes turnings to break off short. The addition of up to 2·5% of nickel increases ductility and tends to make the distribution of lead more uniform. Brass containing up to 1% of silicon has recently been introduced and, while not quite so ductile as the nickel alloy, is harder and possesses valuable abrasion-resisting properties. Details of the composition and mechanical characteristics of these alloys are tabulated.—J. C.

Tungum Alloy. Edwin Gunn (*Architect*, 1932, 132, 131).—Discusses the properties of Tungum, which is described as containing 85% copper. Cf. this *J.*, 1932, 50, 539.—P. M. C. R.

[Lead–Tin–Cadmium] Ternary Alloy in Rochdale. H. A. Braddock (*Plumbing Trade J.*, 1932, 12, 173–174).—The best material for pipes for Rochdale (Lancashire) water has been found to consist of lead 98·25, tin 1·5, and cadmium 0·25%. The ultimate strength (1·69 tons/in.^{2}) is considerably higher than that of lead. The fatigue limit is 0·57 tons/in.^{2}. The greater tensile strength has made it possible to manufacture pipes of two-thirds the weight of ordinary lead pipes. Experiments show that the amount of lead dissolved from these pipes by the moorland water is much less than that dissolved from lead pipes.—E. S. H.

Electrical Conductivity and Constitutional Diagram of Binary Alloys. VII.—The Lithium–Cadmium System. G. Grube, H. Vasskuhler, and H. Vogt (*Z. Elektrochem.*, 1932, 38, 869–880).—The lithium–cadmium alloys have been investigated by means of heating and cooling curves, temperature-resistance curves, and the expansion of the solid alloys. Thermal analysis revealed 5 different solid-solution ranges. The conductivity isotherms of the alloys containing up to 61·4% of lithium show 2 marked peaks, at 25 and 50% lithium. These were confirmed by thermal analysis, and proved the existence of the hitherto unknown compound $LiCd_3$. LiCd crystallizes directly from the melt; $LiCd_3$ forms during cooling by precipitation from the β-solid solution at 370° C. A third, hitherto undetected, compound, Li_3Cd, was revealed by thermal analysis, and is formed by the cooling of the γ-solid solution at 270° C. The results were correlated to form the constitutional diagram of the series.—J. H. W.

Booth's Wrought Elektron. Anon. (*Aluminium Broadcast*, 1932, 3, (34), 8–15).—A full account is given of the composition, properties, uses, and commercial forms of the alloys " AZM " and " AM. 503." Tables are included of the mechanical and physical properties of the alloy " AZM " both in the extruded and forged conditions and at high temperatures, and of the alloy " AM. 503 " as extruded or rolled.—J. C. C.

Magnesium–Tin Alloys. Anon. (*Tin*, 1932, August, 4–5).—A brief account is given of the properties of an alloy containing tin 6, cadmium 1, zinc 1, manganese 1, and magnesium 91%. This alloy has good casting and corrosion-resistance properties.—J. H. W.

Dow Metal. Anon. (*Chem. and Met. Eng.*, 1932, 39, 520, and *Met. Ind.* (*Lond.*), 1932, 41, 466).—Short note.—J. H. W.

Mercury as a Dispersion Medium (The Colloidal Nature of Iron Amalgam). N. M. Tchuiko (*Ukrainskii Khemitchnii Zhurnal* (*J. Chim. Ukraine*), 1931, 6, (5/6), 229–240).—[In Ukrainian, with Russian summary.] True amalgams, if added to iron amalgam which is a colloidal system, either cause the iron to separate (zinc amalgam) or stabilize the amalgam (tin amalgam). To ascertain the effect on the rate of separation of the iron, of changes in viscosity due to the addition of true amalgams, the viscosity of the system before and after sedimentation, with and without addition of zinc and tin amalgams, has been determined. The viscosity is greater before sedimentation, whereas in the case of a true amalgam the viscosity differs little from that of pure mercury. The increased rate of sedimentation caused by the addition of zinc amalgam is attributed, not to a change in viscosity, but to an increase in the size of the iron particles. The stability of iron amalgams is ascribed to the difference in potential between the iron and the mercury, and from preliminary cataphoresis experiments the iron appears to be positively charged.—M. Z.

Nickel Alloys and Their Application. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1932, **8**, 49).—A summary of the beneficial effects produced by additions of nickel to "aluminium-bronze," bearing bronze, and various types of steel.—P. M. C. R.

Konal—or Konel. A High-Temperature Alloy. Anon. (*Met. Ind.* (*Lond.*), 1932, **41**, 440).—A short note on Konal, a nickel-base alloy, a typical composition of which is cobalt 18, iron 6, titanium 2·5, and nickel 73·5%. —J. H. W.

Kanthal—a New Electrical Resistance Alloy. Anon. (*Machinery* (*Lond.*), 1932, **41**, 192–193).—Cf. *J.*, this volume, p. 14. Kanthal is an alloy having higher resistivity, lower sp. gr., and greater resistance to sulphur attack than the nickel–chromium alloys. It is made in three grades, A1, A, and D, suitable for temperatures up to 1325°, 1250°, and 1150° C., respectively.—J. C. C.

[Monel Metal.] Anon. (*Power Plant Eng.*, 1932, **36**, 626).—A summary of the results of recent mechanical tests on Monel metal, with special reference to large forgings. Details are given of longitudinal and transverse tests made on a propeller shaft 14 ft. in length and 6 in. in diam.—P. M. C. R.

Effect of Cold-Working on the Izod Notched-Bar Impact Value of Monel Metal. N. B. Pilling (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (II), 576–583).—See this *J.*, 1932, **50**, 430.—S. G.

The Internal Friction of Potassium–Sodium Alloys in the Liquid State. R. Kremann, Max Pestemer, and Hellmut Schreiner (*Rec. trav. chim.*, 1932, **51**, 557–563).—[In German.] The relative viscosities of liquid alloys of potassium and sodium over the whole range of compositions have been determined at 125° C. As the amount of potassium is increased the relative viscosity falls, passes through a minimum at about 25% potassium, then rises to a very sharp maximum at 77% potassium, and thereafter falls rapidly. The sharp maximum corresponds with the composition K_2Na. There is no inflection to indicate the formation of Na_2K, which is known in the solid state.—E. S. H.

Two Methods of Forming Sodium and Potassium Nitrides. H. Wattenberg (*Ber. deut. chem. Ges.*, 1930, [B], **63**, 1667–1672).—The nitrides of sodium and potassium may be prepared by: (1) direct union of the metal with electrically-activated nitrogen, when nitride (X_3N) and azide (XN_3) are successively formed; (2) the action of heat on the azide, which loses nitrogen, with some tendency to explosion, at 350° C.: heating must therefore be carefully regulated. The nitride is also obtained by heating the azide with the metal; the reaction then proceeds at about 200° C. The properties and reactions of sodium nitride, and the preparation of potassium and rubidium nitrides from the corresponding azides, are discussed.—P. M. C. R.

Hoyt Metals. Anon. (*Indian Eng.*, 1932, **92**, (2), 36–37).—A survey of the properties and functions of white bearing metals, together with a description of the proprietary alloy "No. 11" (tin 91·40, antimony 3·49, copper 4·31, lead 0·18, nickel 0·55%, iron and aluminium, trace), for which are claimed exceptional toughness and resistance to breakage, with high anti-frictional properties.—P. M. C. R.

Zinc-Base Die-Casting Alloys. Anon. (*Met. Ind.* (*Lond.*), 1932, **41**, 642).—A trade booklet has been issued describing certain zinc-base die-casting alloys. The physical and mechanical properties are given of 4 of these alloys, containing, respectively (%): aluminium 4·10 each; copper 2·70, nil, 1·00, 1·25; magnesium 0·03, 0·04, 0·03, nil; the remainder being 99·99 + zinc.—J. H. W.

The Age-Hardening of Metals. Paul D. Merica (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, 99, (Inst. Metals Div.), 13–54).—Eleventh [American] Institute of Metals Division lecture.—An extensive review of the mechanism of age-hardening, with a critical discussion of modern theories on the subject, a bibliography of 65 references, and a table showing practically all the known systems in which age-hardening can occur.—A. R. P.

Effect of Magnetic Treatment on Age-Hardening of Quenched Steels and Alloys. Yosiharu Matuyama. E. G. Herbert (*Metallurgia*, 1932, 7, 23–24).—Experimental work on the magnetic hardening of metals (this *J.*, 1931, **47**, 339, 379, 432) by Herbert has not been confirmed by Matuyama (this *J.*, 1932, **50**, 660). An abstract is here given of the latter's work, followed by correspondence by Herbert on the results obtained. It is claimed by Herbert that in order to reproduce experimental results of an unusual character experimental conditions should be closely reproduced, and that an essentially different method has been adopted by Matuyama. The two methods of experimenting are discussed, and it is stated that one method takes account of both elastic and plastic deformations, whilst the other measures plastic deformations only. The essential precautions necessary in carrying out such investigations are given in detail, and reference is made to further work on the ageing changes following the mechanical, thermal, and magnetic disturbance of metals, starting from the purest obtainable gold, nickel, and iron, up to hardened tool steel, which it is claimed confirm the results of the previous investigations. —J. W. D.

Electromagnetic Surface Hardening of Alloys. G. Mahoux (*Science et Industrie*, 1932, 16, 401–408, 459–469).—Previous work, mainly on steel (see *Compt. rend.*, 1930, **191**, 1328, and this *J.*, 1931, **47**, 228) demonstrates the effect on this type of hardening of nature of material, its thermal history previous to treatment, and furnace temperature. The present investigation is directed to detecting changes in (*a*) electrical resistance, (*b*) microstructure on exposing certain ferrous and non-ferrous materials to an electromagnetic field. The materials tested for (*a*) were nickel–chrome–molybdenum–steel, austenitic steel, cast-iron, Alugir, and magnesium. The methods of measuring and recording the resistances are described and illustrated. In each case the resistance first decreases, and then shows a sudden rise, followed by a final decrease: when a Faraday cage was used the process was much more gradual, and in the case of Alugir did not reach completion. The results of investigations of magnetic properties are as yet inconclusive. Materials examined for (*b*) included cast iron, several types of steel, electrolytic and other types of copper, 2 alloys of the Duralumin class, Alugir, and "RR. 50." In each case a distinct refinement of structure took place, accompanied by a redistribution of originally massive constituents; resistance to attack by etching reagents showed an appreciable increase, and hardness tests—not yet applied throughout the series—show, in addition to a small but distinct increase at the periphery, a considerably larger rise in the interior of the samples. Desirable extensions of the investigation are outlined.—P. M. C. R.

Magnetic Moment and the Chemical Bond in Alloys. J. Dorfman (*Nature*, 1932, **130**, 506).—Assuming that atoms of copper, zinc, aluminium, and tin entering the nickel lattice become singly ionized, it is calculated that the negative values of the magnetic moments of these foreign atoms correspond with the number of valency electrons left attached to the corresponding ion. A new approach to the problem of the chemical bond between metals is suggested.—E. S. H.

Permeability and Hysteresis Associated with Magnetization in the Energic Preferential Direction. Franz Preisach (*Physikal. Z.*, 1932, **33**, 913–923).—Paper read before the VIII Deutsche Physikertag, September, 1932. Attention is directed to the effect of tensile stresses on the magnetic properties of metals and alloys, and to the phenomena of spontaneous demagnetization and a reversible inversion of magnetization exhibited by thoroughly annealed Permalloy.—J. S. G. T.

Measurements Employing Liquid Helium. XIV.—Systematic Researches on the Superconductivity of Some Alloy System. W. Meissner, H. Franz, and H. Westerhoff (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1932, 16, 57–106).—Reprinted from *Ann. Physik*, 1932, [v], 13, 505–554; see this *J.*, 1932, 50, 607–608.—M. H.

Measurements Employing Liquid Helium. XVI.—Investigations Relating to Superconduction in the Case of Carbides, Nitrides, Borides, and Silicides. W. Meissner, H. Franz, and H. Westerhoff (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1932, 16, 117–126).—Reprinted from *Z. Physik*, 1932, 75, 521–530; see this *J.*, 1932, 50, 352.—M. H.

Transformations of Solid Metal Phases. U. Dehlinger (*Z. Physik*, 1932, 79, 550–557).—Cf. this *J.*, 1930, 44, 558; 1931, 47, 330; 1932, 50, 306. A system of differential equations, which on integration yield expressions representing characteristic electrical resistance properties found in the alloy Al_2Zn_3, is developed.—J. S. G. T.

The Equilibria $Pb + SnCl_2 \rightleftharpoons PbCl_2 + Sn$ and $Cd + PbCl \rightleftharpoons CdCl_2 + Pb$ in the Liquid State. (A Contribution to the Question of the Applicability of the Ideal Mass-Action Law.) F. Körber and W. Ölsen (*Mitt. K.-W.-Inst. Eisenforschung*, 1932, 14, (9), 119–136).—The isotherms of these two heterogeneous equilibria deviate only slightly from the ideal mass action law on the side of the more noble metal, but much larger differences occur with high contents of the less noble metal. The reactions in the slag are highly dependent on the temperature and are governed by the heats of formation of the constituents of the solid slag. The solidification diagrams of the alloys of the metals and their slag mixtures afford good confirmation of the limits of the approximate validity of the mass-action law and for the direction of the deviations.—J. W.

Representation of Polynary Systems. Ernesto Denina (*Rec. trav. chim.*, 1932, 51, 624–626).—A discussion.—E. S. H.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 16–19.)

Preparation of Graded Abrasives for Metallographic Polishing. J. L. Rodda (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, 99, (Inst. Metals Div.), 149–155; discussion, 156–158).—For abstract of the paper, see this *J.*, 1931, 47, 656. In the discussion, in which *H. E. White, L. L. Wyman, E. M. Wise, W. M. Peirce*, and *J. L. Rodda* took part, it is stated that the nature of the liquid and the distribution of the particle size have a considerable effect on the rate of settling and the degree of packing of the particles of an abrasive. Crystalline alumina is claimed to give a more uniform powder after crushing than natural emery.—A. R. P.

Preparation of Microtome Sections of Metals. J. Kisser (*Z. wiss. Mikroskop.*, 1930, 47, 172–180; *C. Abs.*, 1930, 24, 5691).—A general discussion of the cutting of hard *vs.* plastic materials, based on analogies with paraffin sectioning. By using a drawing cut, 2 μ sections of lead may be made. The use of sections, or the study of cut surfaces, is not discussed.—S. G.

Report of Committee E-4 [of A.S.T.M.] on Metallography. C. H. Davis and O. E. Harder (*Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 507–509).—See this *J.*, 1932, 50, 485.—S. G.

[X-Ray Studies of Phase Boundaries in] The Copper Zinc Alloys. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, 8, 168–170).—The work of Owen and Pickup (this *J.*, 1932, 50, 672) on the study of phase boundaries by X-ray methods is summarized. The value of the X-ray method and the lack of justification for some of the high claims made by certain investigators are discussed. Whilst X-ray study is valuable, it is limited and does not render obsolete all other methods. Particular difficulties arise in the determination of the liquidus of a system, in the technique of high-temperature X-ray analysis and analysis *in vacuo*, and in preparing specimens of powder in a refractory tube. —R. G.

Discontinuous Extension of Zinc Crystals. R. Becker and E. Orowan (*Z. Physik*, 1932, 79, 566–572).—When a zinc crystal is stressed in a Polanyi apparatus until flow begins and the main load is then removed, flow continues under small stress, falling asymptotically to zero. With high optical magnification, the time–extension curve is of step-like character, the steepness of the step increasing considerably with rise of temperature. With approximation to the ordinary conditions of tensile tests, the steps become flatter, and so frequent that the impression of continuous extension is produced.—J. S. G. T.

Investigations Relating to Improvement (Vergütung) of the Zinc–Aluminium Alloy of Composition Al_2Zn_3. Herbert Meyer (*Z. Physik*, 1932, 78, 854).—Schwarz and Summa (*Metallwirtschaft*, 1932, 11, 369–371; this *J.*, 1932, 50, 615), by X-ray analysis, have found a cubic face-centred lattice characterizing the quenched alloy Al_2Zn_3; in time the hexagonal lattice associated with zinc mixed crystals is present to an increasing extent. The authors correlate this result with the electrical properties of the alloy in terms of a "suppressed polymorphism" of the zinc (see *Z. Physik*, 1932, 76, 268; this *J.*, 1932, 50, 472).—J. S. G. T.

On Precision Measurements of Lattice Constants. F. Wever and O. Lohrmann (*Mitt. K.-W. Inst. Eisenforschung*, 1932, 14, 137–150; and (summary and discussion) *Metallurgist* (Suppt. to *Engineer*), 1932, 8, 190–192).—Methods for the evaluation of Debye–Scherrer röntgenograms with the greatest possible accuracy are critically reviewed, the different correction formulæ and methods for extrapolating the measured values to a reflection angle of 90° are discussed and the procedure for obtaining lattice constants with the aid of a standard substance is described in detail.—J. W.

The Structure of Real Crystals. E. Orowan (*Z. Physik*, 1932, 79, 573–582).—O. considers the theoretical bases of the hypothesis of secondary structure occurring in crystals, advanced by Zwicky (see *Proc. Nat. Acad. Sci.*, 1931, 17, 524) to be untenable.—J. S. G. T.

On Crystal Threads and Fibrous Aggregation Forms. H. W. Kohlschütter (*Kolloid-Z.*, 1932, 61, 270–280).—The formation of dendritic and similar crystal growths in metals is discussed.—E. S. H.

X-Ray Diffraction Patterns Show Strain in Metals. N. P. Goss (*Metal Progress*, 1932, 22, (5), 48–51).—The crystal structure of certain substances, as shown by X-ray examination, is discussed, and the application of X-ray analysis to the industrial study of metals and alloys is described. Examples are given of the comparative study of X-ray diffraction patterns and of their interpretation.—P. M. C. R.

The Stereochemistry of Crystalline Compounds. Paul Niggli (*Ber. deut. chem. Ges.*, 1930, [B], 63, 1823–1838).—Crystalline, and especially inorganic compounds, are considered from the point of view of stereochemistry as applied to molecular structure. Certain theoretically deduced crystallographic relationships are found to agree with data obtained experimentally; special consideration is given to (1) the crystallographic systems of the elements, in their relation to the periodic table; (2) the crystallography of certain inorganic compounds of the AB type (sulphides, oxides, selenides, carbonates, chromates, sulphates, &c.).—P. M. C. R.

IV.—CORROSION

(Continued from pp. 19–22.)

Blackening of Aluminium. Anon. (*Aluminium Broadcast*, 1932, 3, (34), 3; and *Met. Ind.* (*Lond.*), 1932, 41, 130).—A note explaining that the apparent "blackening" of aluminium which is boiled in water is due to interference colours produced by a transparent film of aluminium hydroxide. The coloration is not truly black, but usually varies between light brown and deep bronze.—J. C. C.

On the Causes of Corrosion Phenomena Occurring in Aluminium Kettles for Linseed Oil. G. Eckert (*Farbe u. Lack*, 1932, 37, 113; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (26), 92).—Cf. this *J.*, 1932, 50, 82. In experiments to elucidate the cause of a new instance of corrosion of aluminium vessels in which linseed oil was heated, it was found that no corrosion occurred so long as the temperature did not exceed 300° C. A vessel in which the oil had reached a temperature of 370° C. was corroded, but only above the oil level, showing that vapour alone caused the damage. In further experiments, copper and aluminium plates dipped into linseed oil heated to the limiting temperature showed loss in weight after 17 hrs., and a greater loss occurred when the plates were exposed to the condensed vapours from superheated oil. It is important for the life of the heater that the temperature of boiling be carefully controlled.—S. G.

Technical Notes on the Alloy Chromal. Anon. (*Alluminio*, 1932, 1, 249–250).—Corrosion tests on Chromal, "ML 460," (aluminium with chromium 0·79 and nickel 2·3%) carried out by Bosshard and published in *Bulletin du Bureau International d'Aluminium*, No. 23, indicate that in salt-water with or without hydrogen peroxide this alloy behaves no better than chromium-free aluminium alloys.—G. G.

Tests with Blistery Duralumin Sheets. K. Schraivogel (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1932, 13).—The formation of detached blisters on the surface of Duralumin sheets during the high-temperature ageing process has no effect on the mechanical properties even after the metal has been subjected to the salt-spray test.—B. Bl.

Influence of Heat-Treatment on the Corrosion-Resistance of Duralumin. P. Brenner (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1932, 13).—No intercrystalline corrosion occurs in normally heat-treated Duralumin (quenched from 500° C. and aged at 20° C.) in the salt-spray test, but this type of corrosion is pronounced when the alloy is quenched from 450° C., especially if it is aged at an elevated temperature, *e.g.*, 16 hrs. at 140° C. —B. Bl.

Resistance of Various Unprotected Light Metals to the Weather. E. K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1931, 21*).—Of the alloys tested, Duralumin gave the best and a magnesium alloy the worst, results.—B. Bl.

Anticorodal Cattle-Truck Doors. —— Zurbrügg and W. Steinegger (*Aluminium Broadcast*, 1932, 3, (37), 18).—The results of loss-of-weight corrosion tests on aluminium, Anticorodal, and 3 other aluminium alloys immersed in a mixture of sulphuric and carbolic acids used for washing cattle trucks, are tabulated. They show that no attack of any significance is to be expected in service.—J. C. C.

Experiments with Magnalium Sheets (Corrosion Tests). G. Goldbach (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1931, 21*).—Magnalium sheets 1 mm. thick withstand the action of 3% sodium chloride solutions without change.—B. Bl.

Corrosion Tests of Light Metal Plates Containing Various Bolts and Nuts. E. K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1932, 13).—Salt-spray corrosion tests of plates of K.S.-Seewasser alloy and Silumin containing nuts and bolts of Lautal, brass, nickel–bronze, zinc-coated iron, and nickel steel are described.—B. Bl.

Resistance to Corrosion of Alclad Sheets. [H. C. Knerr] (*Usine*, 1931, 40, (15), 31).—From *Iron Age*, 1930, 126, 1759, 1821. See this *J.*, 1931, 47, 172.
—H. W. G. H.

Examination of Alclad Sheets from a Ford Aeroplane. E. K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1931, 24*).—The cause of certain corrosion phenomena observed on the sheets was found to be faulty plating.—B. Bl.

Corrosion Tests with Duralplat Riveted Joints. P. Brenner (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1931, 24*).—Cf. this *J.*, 1932, 50, 738. Whereas with round-headed rivets the metal layers under the rivet head are rapidly dissolved so that the rivet becomes loose, with countersunk rivets there is no loosening discernible after 29 days in sodium chloride solution containing hydrogen peroxide.—B. Bl.

Condenser Performance has Tripled. Anon. (*Power Plant Eng.*, 1932, 36, 28–29).—Condenser tube corrosion and erosion have been greatly reduced by the fitting of rolled tubes and the elimination of ferrules; special bushings are now available to facilitate the fitting of such tubes on old tube sheets. In spite of increased circulation velocity, water friction and air entrainment have been much decreased in this way. Modern methods of cleaning condenser tubing include chemical means, sand-blasting, cleaning with a rubber plug, or a scraper, and chlorination—the latter where sewage contamination is suspected.
—P. M. C. R.

Chlorine-Resisting Lead–Silver Electrodes. I.–II. M. A. Rabinovitsch and A. S. Rubantchik. P. B. Zhivotinsky (*Ukrainskii Khemichnii Zhurnal* (*J. Chim. Ukraine*), 1931, 6, (5/6), 245–261).—[In Russian.] The utility of lead, silver, and some lead–silver alloys for electrodes in the electrolysis of alkali chlorides, has been investigated. The metal anode appears to be first depolarized by the action of the electrolyte, the degree of depolarization depending on the extent of corrosion. Later, a protective layer is formed which inhibits further attack, and the electrolysis then proceeds normally. The dissociation potentials of potassium chloride with an anode of silver 61, and lead 39% endorse this view, lead chloride, silver chloride, lead peroxide, and silver oxide being formed in succession, after which the anode becomes stable. As the protective layer is liable to damage, its stability under various conditions has been investigated to determine the commercial utility of such electrodes. The rate of corrosion of the lead–silver electrodes becomes stable after treatment for 160–190 hrs. in sodium chloride solution (*d* 1·36) at 10°–15° C. and 200–300 amp./m.^{2}; it is not affected by the structure of the alloys nor by the nature of the surface. Corrosion is intensified by increasing the concentration of the salt, but reduced considerably by saturation of the solution with lead chloride, owing to the formation of a protective layer of lead peroxide. A similar effect is obtained by enclosing the anodes in an asbestos sheath lined with PbO_2.—M. Z.

Destruction Phenomena in Elektron Sheets under Incorrect Pickling Treatment. E. K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1931, 24*).—Undue prolongation of the time of pickling and prolonged local attack of Elektron cause a deterioration in the tensile properties.—B. Bl.

The Corrosion of Tin. " Etchings " and " Black Spots." Sven Brennert (*Teknisk Tidskrift*, Uppl. C., *Bergsvetenskap.* 62, 1932, 57–59, 69–72; *C. Abs.*, 1933, 27, 54).—The black spots occasionally appearing on the tinned surface of dairy apparatus, milk containers, &c., form as a result of potential differences between the tin surface and the corroding solution (milk or sodium chloride solution at ordinary temperature). It is shown experimentally that the spots occur only when the tension on the tin surface reaches a certain value above that of the solution. A newly tinned surface submerged in milk possessed a "dissolution tension" below that of milk; thus no black spots occurred. The conditions which cause an increase in the solution tension are: (1) contact with a sufficiently large surface of an "ignoble" (relative to tin) metal, *e.g.*, copper; (2) the formation of the resistant film on the tin surface as a result of a prolonged contact with milk or sodium chloride solution. An exposure of pure metallic tin through damage of this film thus results in corrosion. The black spots consist mainly of SnO. In milk a considerably higher solution tension is required to produce black spots than in sodium chloride solution. A milk container which was in constant contact with sweet milk showed black spots after 4–5 months, whereas with 5% sodium chloride solution the spots appeared after 2 hrs. Although sweet and sour milk possess approximately the same solution tension, they act quite differently in respect of their ability to form the resistant film on the tin surface. The tension on this film in sweet milk is always considerably higher than in sour milk. For this reason it is practically impossible to produce black spots with sour milk. In mineral acids and in warm sodium hydroxide the film is unstable, resulting in an even attack on the whole surface in the form of "etchings." In cold, dilute sodium hydroxide and in sodium carbonate solution a strongly resistant film is rapidly produced. The tension on the tin surface in the latter case can be so high that gaseous oxygen is generated without formation of black spots. Practical tests also showed that tinned surfaces could be kept for months in sodium carbonate solution without showing spots or etchings. Investigations of the effect of the purity of tin on the speed of the corrosion showed no essential difference whether pure tin, technical tin, or tin alloys containing lead, nickel, antimony, bismuth, silver, or copper, respectively, were used. A number of photomicrographs show the gradual growth and appearance of the black spots.—S. G.

The Relation Between Zinc Corrosion and Temperature. —— Freitag (*Oberflächentechnik*, 1932, 9, 79–80).—A brief account of the work of Cox, published in *Indust. and Eng. Chem.*, 1931, 23, 902; cf. this *J.*, 1932, **50**, 26. —A. R. P.

Corrosion of Galvanized Iron Hot-Water Cisterns. Edwin Gunn (*Architect*, 1932, **132**, 225).—The rusting and pitting of galvanized hot-water tanks has generally been attributed to abrasions sustained in fitting and screwing; it is here ascribed to the virtual insulation of piping from cistern by the packing of the joint (*e.g.*, by hemp). A method of obviating this condition by ensuring proper electrical contact between cistern and pipes is described.—P. M. C. R.

An X-Ray Investigation of the Iron–Copper System. A Study of the Corrosion of Galvanized Sheet Iron. James H. Carter (*Iowa State Coll. J. Sci.*, 1932, **6**, 413–416; *C. Abs.*, 1932, **26**, 5892).—Armco iron and pure copper were melted together in a crucible of magnesia under nitrogen to form melts over the whole range of compositions. The melts were cooled in air and a part of each melt was annealed at 1700° C. for 12 hrs. The X-ray analysis was made by the Hull–Debye–Scherrer method. When the amount of copper is less than 12·02% only iron lines appear; when it is greater than 83·39% only copper lines appear. Annealing at 1700° C. for 12 hrs. produced no change in the X-ray diagrams, but photomicrographs indicated that a change in structure had started. Galvanized sheet iron was subjected to the action of mixtures of carbon dioxide, oxygen and nitrogen in distilled water for more than 4 months at 26° C. For constant carbon dioxide content and increasing oxygen content, corrosion passes through a minimum. The minimum corrosion occurred at 20% oxygen and 0·03% carbon dioxide. Corrosion proceeds most rapidly where a film of ferric hydroxide forms and protects a spot from oxygen. This spot becomes anodic and ferrous hydroxide forms indefinitely.—S. G.

Zirconium. VII.—Corrosion-Resistance of Zirconium Alloys. Henry L. Coles and James R. Withrow (*Trans. Amer. Inst. Chem. Eng.*, 1931, **27**, 253–

262).—Alloys containing zirconium, nickel, silicon, and iron are resistant to solutions of sulphuric or hydrochloric acids and may prove to be useful in chemical industry, An alloy having the composition nickel 71·41, iron 12·03, silicon 9·15, zirconium 2·70, carbon 0·355, aluminium 0·32% is especially recommended for this purpose. The introduction of zirconium in steel improves the resistance towards sodium hydroxide solutions.—E. S. H.

Report of Committee B-3 [of A.S.T.M.] on Corrosion of Non-Ferrous Metals and Alloys. T. S. Fuller and Sam Tour (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 201–225).—See this *J.*, 1932, **50**, 548.—S. G.

Report of Sub-Committee VI [of Committee B-3 of A.S.T.M.] on Atmospheric Corrosion. Atmospheric Corrosion Test Programme. W. H. Finkeldey (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 226–242).—See this *J.*, 1932, **50**, 548.—S. G.

Report of Sub-Committee VII [of Committee B-3 of A.S.T.M.] on Liquid Corrosion. R. J. McKay and H. E. Searle (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 243–247).—See this *J.*, 1932, **50**, 548.—S. G.

Report of Sub-Committee VIII [of Committee B-3 of A.S.T.M.] on Galvanic and Electrolytic Corrosion. C. L. Hippensteel (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 248–251).—See this *J.*, 1932, **50**, 548.—S. G.

Corrosion in Recesses of Chemically Processed Components. E. E. H. (*Machinery* (*Lond.*), 1932, **41**, 45–46).—Special precautions must be taken when dipping or plating articles containing recesses in which solutions can become entrapped, otherwise corrosion troubles will occur. Careful washing is not always sufficient to remove objectionable chemicals, and changes in material or design may be necessary. The application of wax or grease may in some cases retard corrosion.—J. C. C.

On the Wear of Turbines by Erosion and Corrosion. Marc Dutoit and Maurice Monnier (*Bull. Assoc. Suisse Élect.*, 1932, **23**, 537–547).—Three principal sources of wear are considered: (1) mechanical erosion by suspended matter or floating solids. Water from mountainous districts carries a high proportion of alluvial matter, which can be partly removed in a settling tank, or more completely by its later developments of the Büchi or Dufour type. An example of the latter is illustrated. A device is described for the dispersal of floating bodies, which otherwise may do considerable damage by becoming caught among the blading, causing loss of power, undistributed pressures, and severe erosion; (2) chemical action, often facilitated by erosion or cavitation. Calcium sulphate, stated to be one of the most active corrosive agents, cannot be cheaply eliminated, and D. and M. recommend the use of corrosion-resistant alloys; (3) cavitation. The effects on pressure conditions of water pressure, rate of flow, and the actual setting of the blades, are considered from a mechanical point of view and their relation to the usual cavitation factor σ is discussed. Suitable modifications in construction are considered. Emphasis is again laid on choice of material, and it is recommended that the repair of blading be carried out by electric or autogenous welding rather than by the Schoop spraying process, which does not give sufficiently firm adhesion to resist the severe service conditions.—P. M. C. R.

Experiences with Cavitation. J. N. H. Christman (*Power Plant Eng.*, 1932, **36**, 779–780).—An account is given of marked cavitation in impeller blading from a centrifugal pump. Alterations in the angle of entry eliminated the trouble. Better construction and balance, and the use of materials with good resistance to distortion, are demanded by modern propeller and impeller practice, and the influence of load is briefly discussed.—P. M. C. R.

Effect of Copper Sulphate on Pipe Materials. C. C. McKee (*Power Plant Eng.*, 1932, **36**, 658–659).—About one part per million of copper sulphate is added to the water in many cooling tower systems to prevent the growth of algæ. Samples of piping made of galvanized steel, ordinary black steel, brass and copper were suspended (on wire) in the direct flow of such a system for a period of 60 days. After 2 days the galvanized sample showed vigorous attack of the zinc, but no further action was evident. After the full period, the percentage losses of weight were: galvanized pipe 0·66, black steel 4·9, brass (no change), copper (increased 0·47); hence brass or copper should be used in such cooling systems.—P. M. C. R.

Pulp and Paper Advance in Fight Against Corrosion Loss. J. D. Miller (*Chem. and Met. Eng.*, 1932, 39, 484–486).—Production of sulphur dioxide is the first step in the sulphite process for making pulp from wood. The burner-gas cooler is usually of the vertical lead-pipe type. The gas fan, cooled-gas lines and acid lines are of 10% antimonial-lead. Cold-acid valves are commonly of lead-lined bronze with water-sealed gas valves of lead. Digester parts such as liners of the digester head, valves, bottom bowls, strainers, thermometer wells, pumps, and pipe fittings have usually been of bronze of various analyses. Piping has been made of extra heavy brass or copper. Chromium-plating is one of the outstanding developments, and is being used in suction-box covers, calender rolls, evaporator tubes, and pulp screens; screen plates are usually of bronze. A fine, endless wire screen used in the Fourdrinier machine for forming a sheet from a water suspension of properly refined pulp, is usually made of brass wire. Copper is used for heat-exchangers and for piping for conveying the water used in the processes.—F. J.

Petroleum Pays Increasing Toll to Corrosion. Stanley Gill (*Chem. and Met. Eng.*, 1932, 39, 481–483).—Losses arising from corrosion of equipment in the oil industry have steadily increased, and this is attributed to production of oils of high sulphur content and to higher temperatures and pressures in refining operations. An abbreviated list of the more destructive corrosive conditions is as follows: (*a*) oxygen-free oil-well brines; (*b*) aerated oil-well brines; (*c*) hydrogen sulphide, air and water; (*d*) soils; (*e*) low-temperature distillation; (*f*) high-temperature distillation. Strainers or screens, used to exclude sand from the wells, are made in brass or bronze, in the absence of hydrogen sulphide, commercially pure nickel being the best for exceptionally severe conditions. Working barrels of oil-pumps are of brass and other alloys or of steel with $\frac{1}{16}$-in. liners of brass, bronze, chrome-nickel steel or nickel. Aluminium foil cemented to the undersides of roofs of storage tanks has given satisfactory protection, all-aluminium roofs being prohibitively expensive. In low-temperature distillation equipment, Admiralty metal, special bronzes, nickel-chromium, "stainless" steels, and pure nickel are used for heat exchangers and condensers and for return bends and plugs in pipe stills. Severe corrosion occurs in high-temperature pressure still equipment. The interior surfaces of the heavy reaction chambers or soaking drums have been satisfactorily protected by chromium-plating.—F. J.

Causes and Methods of Combating Tank Corrosion. W. F. Cloud (*Oil Weekly*, 1932, 66, (3), 30–32).—Corrosion of oil storage tanks may be: (1) mainly external, due to the action of damp air; (2) internal, occurring in the absence of air, and due to reactions of oil gases, especially hydrogen sulphide, and salt water. The mechanism of the latter processes is summarized. Suggested methods of eliminating corrosion are painting, asphalting, concreting, suspension of zinc plates below oil–water level, coating with aluminium foil or paint, and the use of aluminium tanks in preference to iron. Aluminium paint gives good but not permanent protection. Investigations have shown that aluminium tanks are much less liable to corrosion than iron or steel, provided that: (1) steel–aluminium connections, even though insulated, are avoided in contact with salt water; (2) the use of steam coils is reduced to a minimum. Aluminium resists hydrogen sulphide corrosion effectively, but is attacked by concentrated salt water. General anti-corrosion precautions are given.
—P. M. C. R.

Modern Nitric Acid Production Demands Special Alloys. Thomas McKnight (*Chem. and Met. Eng.*, 1932, 39, 490–492).—Alloys used in the manufacture of nitric acid by the pressure system of ammonia oxidation require to be resistant to scaling in highly oxidizing gases at elevated temperatures and to prevent contamination and decomposition of the materials in process. Nickel, high-silicon iron, 18% chromium, 18 : 8 chromium–nickel steel are used. Nickel is generally used for parts in contact with ammonia vapours, or preheated mixtures of air and ammonia, its tendency to decompose ammonia being lower than that of most metals. It is sufficiently strong in the form of castings, forgings, or seamless tubes, but failures have occurred with large welded tubes. Such tubes are reinforced with steel clamps, but in some cases tubes have been made by boring and turning solid forged bars. Catalyst-holders are made of wrought nickel or preferably of cast nickel containing 3% silicon. Heat-treating the former at 950° C. in steam, forms an oxide film which retards the tendency to scale: the latter has better resistance to scaling than even the heat-treated wrought nickel. The properties and treatment of the chromium and nickel–chromium steels are also discussed.—F. J.

Corrosion of Metals and Metal Alloys by Phosphoric Acid and Phosphorus. M. W. Ryssakov and I. N. Bushmakin (*Zhurnal Prikladnoi Khimii* (*Journal of Applied Chemistry*), 1932, 5, (6/7), 715–721).—[In Russian, with German summary.] To determine the most suitable materials for chemical plant used for handling them, the action of phosphoric acid at 105°–350° C. under 1–200 atm. pressure, and of molten yellow phosphorus at 80° C., has been investigated on the following metals: steel, copper, lead, and the special alloys V4AE2, V4AE3B, Thermisilid E, Thermisilid (Krupp), Monel metal, Calite E (Calorizing Co.), Duriron (Duriron Co.), Hastelloy C, and Hastelloy D (Haynes Stellite Co.), silver–copper and silver–nickel alloys of the Russian Institute of Metals. Most of the special acid-resisting alloys are comparatively inert to 65% phosphoric acid at 105° C., but at 300° C. all the alloys except the two silver ones are severely corroded. Copper is comparatively stable, as the rate of dissolution in phosphoric acid is but slightly affected by rise in temperature; corrosion is pronounced, however, in phosphorous acid at temperatures above the decomposition point. Silver remains absolutely unaffected by either acid, but is slightly attacked by metaphosphoric acid. Oxygen increases the rate of dissolution of copper and above 200° C. also of silver in phosphoric acid. Molten phosphorus has no effect on any of the above metals and alloys, except copper and the silver–copper alloys, which become covered with a layer of copper phosphide which permeates later into the interior of the metal. At low temperatures, the layer is protective against further attack, but at higher temperatures, the attack becomes rapid.—M. Z.

Phosphoric Acid Imposes Severe Corrosive Burden. William C. Webber *Chem. and Met. Eng.*, 1932, 39, 542–545).—Phosphoric acid, produced by digestion of phosphate rock with sulphuric acid, contains, in the weak acid process, up to 22%, and in the strong acid process, up to 32% phosphorus pentoxide. Lead is suitable, subject to its usual limitations of strength and softness, for use in these processes, but, out of contact with the solution, it is attacked by the gases evolved and must be protected. Very discouraging results have been obtained with alloys. Hard lead with an abrasive facing of embedded grains of alundum ("Plumbalun") is used for raking blades in the Dorr type of agitator and in thickener tanks. Cast lead may be used for filter shells and for valves, although stainless steel valve seats are now used with antimonial-lead valve covers. Hard lead is also used for the bodies of diaphragm pumps, submerged parts of the Howard acid feeder and tube sheets of drum evaporators. The body of the latter is of cast lead and the tubes of lead-covered copper. Lead Y valves are used for weak non-crystallizing acids and lead-lined wood tanks for weak sulphuric acid storage.—F. J.

Corrosion Looms Large in Sulphuric Acid Plants. J. J. Healy, Jr. (*Chem. and Met. Eng.*, 1932, 39, 492–493).—Lead is used for handling cold sulphuric acid of 60°–66° Bé and is most generally used for any strength below 60° Bé. In the chamber process, Glover towers and Gay-Lussac towers are made of lead, lined with acid-proof brick, whilst coils, coolers, and the conventional chambers are also of lead. Hard lead, though not so resistant to corrosion as soft lead, is used for pumps and equipment where structural features require it. In the contact process, hot acid of 60°–66° Bé. is handled in cast iron or lead, between which there is very little choice. Valves are best made of lead, though far from perfect. Cold acid up to 66° Bé, should be stored in lead-lined steel or wooden tanks. In the petroleum industry the treatment of distillates with sulphuric acid is carried out in lead-lined steel tanks. Separation and concentration of sludge acid requires lead lining. The tie-rods of wooden pickling vats used in the steel industry for holding sulphuric acid of 2–10% strength at 180° F. (82° C.) are of bronze or Monel metal. In the textile industries coagulating baths in the viscose rayon process contain 10–20% sulphuric acid and are usually of lead. Spinnerets are of platinum, tantalum, " noble " metal alloys or glass. Spinning machine parts are usually lead-covered. Protected aluminium has been used for pots and bobbins. Brass is suggested for stirrers and coils in the sulphonation of oils, &c., where acid above 66° Bé. is used. —F. J.

Choosing and Using Materials for Chemical Plant Construction. W. S. Calcott and Theodore R. Olive (*Chem. and Met. Eng.*, 1932, 39, 476–478).—Selection of materials for construction of chemical plant equipment combines inter-related factors of economics and technology. Elimination of obviously unfit materials from 2000 to 3000 materials available leaves a comparatively small group, the properties of which may be obtained by a search of the literature, for which some guidance is offered. The number of materials, now further reduced, should be subjected to laboratory tests, of which the ordinary, unaccelerated, total-immersion tests are recommended for most purposes of routine testing. Some general principles are given as regards carrying out such tests. The next step is to make successive runs of the proposed reaction, including in each test a sample of a possible material, and using solutions employed in the actual plant process. An indicated life of 15 years may turn out to be from 7½ to 20 years, but the metal thickness required for purely mechanical purposes, will usually provide amply for corrosion. Pitted samples should be ground down, until the pits just disappear, the total reduction in weight being reported as equivalent corrosion loss in inches penetration per year. Further tests on a semi-plant scale may be necessary in the case of very expensive equipment. Traces of impurities in the construction materials or in the process solutions may completely alter corrosion rates. Metallic microstructure and surface conditions are also important factors. Fabrication methods, mechanical properties, minimizing trouble with joints, effects of high temperatures and of agitation of solutions are also discussed. Test results should apply only to identical products of the same manufacturer, produced by the same methods and given the same heat-treatment.—F. J.

Dollars and Cents—" The Operating Cost of Corrosion." C. L. Mantell (*Chem. and Met. Eng.*, 1932, 39, 479–480).—There are several methods of arriving at the " operating cost of corrosion," the one herein attempted being to determine how much can be charged directly to corrosion over a period of time when each of several different construction materials is used. Equipment cost is considered as made up of 2 parts, *viz.* the cost of the " bogey " equipment which would satisfy the requirements of a corrosionless process, plus the additions to this cost that are occasioned by corrosion. One of the greatest difficulties is to determine the reasonable life expectancy of each material, and properly conducted, properly interpreted laboratory tests, using actual plant solutions, are acceptable as the basis of such estimates. Certain important factors in arriving at the cost of equipment in place, are discussed. Finally the operating cost of corrosion (O.C.C.) for a 10-year period is obtainable from the formula $O.C.C. = 10/L(M + F + Sh + I + R - S) - B$, where L is the expected life in years of the material, M the total cost of material, F the fabrication cost, Sh the shipping cost, I the installation cost, R the cost of removal and salvage, S the salvage or scrap value, and B the cost of the hypothetical piece of "bogey" equipment. Applying this formula, it is shown that the most expensive material is cheaper in the long run.—F. J.

Investigation of Corrosion. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 162–163).—Comments are made on the report of the American Society for Testing Materials, on "Corrosion of Non-ferrous Metals and Alloys" (cf. this *J.*, 1932, **50**, 548), pointing out that in the planning of the tests no account seemed to have been taken of recent British work on similar lines. Closer co-operation is urged.—R. G.

V.—PROTECTION

(Other than Electrodeposition.)

(Continued from pp. 23–27.)

Examination of Various Methods of Protecting Surfaces of Light Metals in the Baltic Sea. E. K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, **1932**, 16).—After 165 days in Baltic Sea water or 260 days' alternate immersion in sea-water a certain number of the metal-clad light alloy sheets showed no change in tensile properties, whereas others showed the effects of corrosion. Previous anodic oxidation reduced the resistance to corrosion unless the oxidized surface was further protected with a fat film or better still with a coat of oil-paint. Corrosion in all these cases was more marked in the alternate immersion test.—B. Bl.

X-Ray Investigations of Electrolytically-Oxidized Aluminium. E. Schmid and G. Wassermann (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1932, **4**, 100–106).—The protective oxide film produced anodically on aluminium by the Eloxal process consists of extremely fine-grained crystalline γ-aluminium oxide.—M. H.

The Electrolytic Oxidation of Aluminium. Hans Schmitt (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1932, **4**, 79–94).—Gives a survey of the work done by the Vereinigte Aluminium Werke, Lautawerk, Germany, on the surface protection of aluminium and its alloys by electrolytic oxidation (Eloxal process). The physical properties and corrosion-resistance of Eloxal films are described.—M. H.

Protection of Aluminium by Oxidation. E. Herrmann (*Bull. tech. Suisse Romande*, 1932, **58**, 304).—The M.B.V. (modified Bauer–Vogel) oxidation process is claimed to give a sufficiently firm and adherent coating of oxide to copper-free aluminium alloys. Articles are immersed for 5–10 minutes in a solution containing 5% anhydrous sodium carbonate and 1·5% sodium chromate, at a temperature of 90°–100° C. Thorough washing in running water must precede drying. The skin produced, although less strong than that formed by anodic oxidation, resists corrosion by fruit juices, alcoholic liquors, mortar, oil, or milk; it is attacked by acids, alkalis, and calcium chloride. Treatment with sodium silicate appreciably hardens the coating and increases its resistance to attack.—P. M. C. R.

Electrochemical Oxidation and the Protection of Iron and of Duralumin in Aerated Saline Solutions. Anon. (*Industrie chimique*, 1932, **19**, 806–807).—A review of recent work.—E. S. H.

The Electrolytic Oxidation of Aluminium by Means of Polarized Alternating Currents up to High Frequencies. F. Wöhr (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium,* 1932, 4, 94–98).—M. H.

The Anodic Oxidation of Duralumin. Anon. (*Aluminium Broadcast,* 1932, 3, (34), 4–5).—Reprint of a trade pamphlet. Instructions for dyeing the anodic film, and a list of dyes are included.—J. C. C.

Tinning Small Brass Stampings. A. E. (*Machinery* (*Lond.*), 1932, 41, 220). —Workshop directions are given for the hot-tinning and chemical-tinning of small brass stampings.—J. C. C.

Galvanized Railway Materials. Geo. Williams (*Railway Eng.,* 1931, 52, 393–394).—There is no generally accepted standard covering the protection of the many galvanized articles used by railways. The copper sulphate test and determination of the weight of zinc per ft.^{2} are of value, but the result obtained in the latter must be considered in the light of the purpose of the coating; if the zinc is to be the final protective coating, 2·5–3 oz./ft.^{2} are necessary, whereas if it is merely intended as a base for paint, 1 oz./ft.^{2} is sufficient. Details are given of a proposed specification. The covering of defective spots by solder is satisfactory if carried out carefully. Cut edges should be tinned, but metallic paints should on no account be used to cover bare places.—H. F. G.

A Modern Large-Capacity Galvanizing Plant. R. A. Smart (*Gas Age-Record,* 1932, 69, 627–630).—A galvanizing plant comprising 2 gas-fired pots each capable of treating 10 tons of material to be galvanized per hr. is described and illustrated. A differential control system, applicable to lead and cyanide pots, is described.—J. S. G. T.

Tentative Specifications for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses (A120–32T). —— (*Amer. Soc. Test. Mat. Tentative Standards,* 1932, 105–108; and *Proc. Amer. Soc. Test. Mat.,* 1932, 32, (I), 556–559).—Cover black and hot-dipped galvanized "standard weight," "extra strong," and "double extra strong" welded and seamless steel pipe. Pipe ordered under these specifications is intended for ordinary uses such as low-pressure service in steam, water, and gas lines, and is not intended for close bending or coiling, or for high-temperature service. The galvanized pipe shall be coated with zinc inside and outside by the hot-dip process.—S. G.

Sherardizing. Edwin Gunn (*Architect,* 1932, 131, 213).—A brief account of the Sherardizing process.—P. M. C. R.

The Parker Process for Rust-Proofing. O. W. Roskill (*Indust. Chemist,* 1932, 8, 59–61).—The process is described.—E. S. H.

The Metal Spraying Process; Its Application and Installation in the Radio Industry. Walter Hahn (*Oberflächentechnik,* 1932, 9, 203–204).—The method of application of sprayed metal coatings and their value in the wireless industry are explained. Sprayed coatings of zinc and aluminium afford better protection of iron against rusting than do paint films.—A. R. P.

Metallic Coatings. Anon. (*Ind.-Lack.-Betrieb,* 1931, 7, 254–257; *Res. Assoc. Brit. Paint Manuf. Rev.,* 1931, (22), 213).—A commentary on the various metallization processes—coating with copper, iron, chromium, cadmium, &c.—and their spheres of application.—S. G.

Metallization. Edwin Gunn (*Architect,* 1932, 132, 279).—A brief account of the process, which is stated to be applicable to any metal or alloy capable of being drawn into wire and of being melted in the air–coal gas blowpipe flame. Further application to decorative work is suggested, the treated surfaces being capable of taking a high polish.—P. M. C. R.

Notes on the Oxidation of Metallic Ships' Bottoms and the Means of Preserving them from Rust. [Use of Zinc; Protection of Bronze Screws.] H. Masseille (*Peintures, Pigments, Vernis,* 1932, 9, 106–109, 117–118; *Res.*

Assoc. Brit. Paint Manuf. Rev., 1932, (28), 238).—M. describes the use of zinc to combat galvanic effects which cause corrosion. The methods employed in the French fleet are detailed. Further research is required to produce more effective metal alloys, to define optimum size and shape of protective masses of metal, and to show how best to fix them. When paint is to be used, very thorough cleaning is necessary, and insulating coatings should be employed on bronze screws in order to reduce galvanic effects.
—S. G.

Contribution to the Problem of Protection of Metallic Surfaces. A. Soldi (*Chimica*, 1932, 8, 349–352).—The efficacy of various mixtures of lanoline, paraffin, paraffin oil, linseed oil, &c., for protecting metallic surfaces against corrosion by the atmosphere, sea-water, and acids has been determined and good results have been obtained in some cases.—G. G.

Corrosion Prevention in Ice Plants. Guy V. Thompson (*Power Plant Eng.*, 1932, 36, 167–169).—The correct use of either calcium chloride or sodium chloride brines necessitates careful checking of the p_H value. A retarder is generally necessary with new brines, especially in the case of calcium chloride; here the alkalinity requires modification, whilst old brines develop acidity. Corrosion losses are estimated in untreated tanks, and precautions in the use of sodium dichromate as retarder are enumerated.
—P. M. C. R.

[Prevention of Corrosion by Crude Oil Vapours.] Anon. (*Compressed Air Mag.*, 1932, 37, 3990).—The refining of sulphur-laden crude oils is accompanied in many cases by severe pipe-line and condenser corrosion. This is said to have been eliminated by the introduction of zinc oxide into the vapour stream.—P. M. C. R.

Non-Metallic Protective Coatings for Industrial Chemical Apparatus. Am. Matagrin (*Rev. Chim. indust.*, 1932, 41, 253–260, 281–288).—A discussion of methods of protecting metals from corrosion by non-metallic coatings, particularly enamels, caoutchouc (in various forms), synthetic resins, and lacquers.
—E. S. H.

Varnish, Patina, and Paint on Copper. H. Breau (*Moniteur de la Peinture*, 1932, 20, 105–106; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (26), 105).—For many purposes copper surfaces may be used without treatment of any kind, as the metal is not subject to corrosion to the same extent as iron and steel. Food containers made wholly or partly of copper require protection by some suitable varnish, as copper is liable to attack by fruit and meat juices, &c. Antique vases and bronzes, and highly polished copper may be protected by means of a coat of varnish; shellac is used for interior work, but is not very durable for outside exposure, for which purpose cellulose lacquers are preferred. When a patina (verdigris finish) has been made, it may be protected advantageously by a coat of varnish. The use of oil paint on copper obliterates the fine appearance of the metal itself, but when it is employed, copper affords a first-class support for the film.—S. G.

Wire Varnishing. H. Helfer (*Ind.-Lack.-Betrieb*, 1931, (22), 329–330; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1931, (24), 296).—Practical directions are given for carrying out the process of coating wire with varnish. Two special types of insulating varnish are usually employed, one a black which retains its colour and the other a lighter varnish which bakes to a reddish-brown; the latter is durable in oil.—S. G.

The Use of Metallic Varnishes in the Drum Metal-Coating Process. W. Klein (*Ind.-Lack.-Betrieb.*, 1931, 7, 281–282; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1931, (23), 237).—In a consideration of the advantages of the drum method of coating small metal wares, it is stated that aluminium is the most suitable metal to use in the varnish on account of its stability. The vehicle must be carefully chosen, with a view to the colour remaining unchanged on stoving.—S. G.

VI.—ELECTRODEPOSITION

(Continued from pp. 27–31.)

Bright Cadmium Plating. E. E. Halls (*Amer. Machinist* (*Eur. Edn.*), 1932, 76, 580–581E).—Cadmium plating has many advantages over zinc plating, especially in the brightness of its finish. Cyanide solutions containing excess alkali cyanide are usually used, and a brighter finish is obtained by: (1) barrel plating instead of vat plating; (2) mechanical burnishing; (3) modifying the plating composition by adding (*a*) colloidal organic material, (*b*) other salts; (4) acid treatment after plating. These methods are described in detail.—J. H. W.

Cadmium Plating of Iron and Steel Material. Anon. (*Metallbörse*, 1932, **22**, 226–227, 259).—The advantages and disadvantages of cadmium-plating as rust protection are discussed and brief notes are given of the composition and operation of suitable baths.—A. R. P.

[Cadmium] Plating Wire. A. E. (*Machinery* (*Lond.*), 1932, **41**, 74).—Cadmium plating is suggested as the most suitable process for rust-proofing flat steel wire.—J. C. C.

On the Rust-Protecting Action of Cadmium Deposits. Georg Buchner (*Oberflächentechnik*, 1932, **9**, 80–81).—A review of recent articles of H. S. Rawdon and of S. Wernick.—A. R. P.

Cadmium Plating as a Substitute for Tinning Prior to Soldering. E. E. H. (*Machinery* (*Lond.*), 1932, **41**, 149–153).—The use of cadmium plating as a substitute for tinning in the production of small electrical piece parts has the outstanding advantage of rapidity of operation. Cadmium-plated surfaces solder readily, and dry storage does not affect the deposit, although sulphide tarnishing may occur if the storage conditions are unfavourable. Increased consumption of solder is probable. The results of some comparative experiments on soldering dip-tinned and cadmium-plated parts are quoted, and a brief account is given of the plating process.—J. C. C.

Investigation on Hard Electrodeposited Chromium. W. Birett (*Z. Elektrochem.*, 1932, **38**, 793–799).—Experiments were carried out on electrodepositing chromium in baths containing chromic acid 200–500 and sulphuric acid 1–5 grm./litre using nickel cathodes and nickel, copper, brass, steel, and iron as base metals. The hardness of the coating varies directly with the current density and inversely with the temperature. The effect of the concentration of chromic acid and the acidity of the bath could not be accurately established by the experiments, but does not appear to be very considerable. The nature of the base metal and impurities commonly met with in practice do not markedly affect the hardness.—J. H. W.

The Electrodeposition of Chromium from Aqueous Chromic Acid Solutions. G. G. Schmidt and F. J. Weber (*Oberflächentechnik*, 1932, **9**, 189–191).—The efficiency of the deposition of chromium from chromic acid baths depends on the temperature, the current density, and the nature and concentration of the second acid present. The properties of the plate depend chiefly on the nature of the second acid; addition of boric acid and ammonium sulphate to the bath hardens the deposit but gives it a matt surface which requires polishing. Tables are given showing the effect of temperature and addition agents on the character of chromium plate.—A. R. P.

The Electrodeposition of Chromium from Tervalent Chromium Salt Solutions. I.—Chromium Chloride and Chromium Sulphate Baths. Hubert Thomas Stanley Britton and Oliver Brentwood Westcott (*J. Electrodepositors' Tech. Soc.*, 1931–32, **7**, 33–50; discussion, 172).—Reprinted from *Trans. Faraday Soc.*, 1931, **27**, 809–826. See this *J.*, 1932, **50**, 758.—S. G.

Influence of Dissolved Iron in Chromium Bath. R. J. Piersol (*Metal Cleaning and Finishing*, 1932, 4, 487–490; *C. Abs.*, 1932, 26, 5852).—A discussion of the bad effect of iron in the chromium-plating bath on the electrical conductivity and the bright-plating range. A method is described for determining the iron content of the bath.—S. G.

A Few Points on Chromium-Plating Practice. Anon. (*Machinery* (*N.Y.*), 1932, 39, 16).—Some general remarks.—J. C. C.

Protection of Aluminium Alloys by Electrolytically-Deposited Chromium. G. Gallo and D. Corbi (*Aerotecnica*, 1932, 12, 1145–1174).—Varnish films on aluminium are not really water-proof, anodic oxidation affords insufficient protection against sea-water, and electroplating of light alloys has not yet found industrial applications. G. and C., however, claim to have succeeded in increasing the resistance of light alloys, particularly Duralumin, by plating them directly with a continuous film of chromium, under the following conditions: the article is first cleaned with abrasives or by sand-blasting, then rinsed in water and plated in a bath containing 200 grm. of chromium trioxide, 3 c.c. of sulphuric acid, and 0·6 c.c. of 40% hydrofluoric acid per litre. The bath begins to work well after use for about 20 days; it is operated with a current density of 40–45 amp./dm.^{2} at 45°–47° C., and every article is plated for 7–8 minutes.—G. G.

Chromium Plating. Anon. (*Galvano*, **1932**, (1), 12–17; (2) 16–19).—A review, covering the hardness of chromium plating, the influence of occluded hydrogen on the physical properties of the deposit, reflectivity and conductivity, porosity of coatings, and effects due to variation of the temperature of the bath, current density, ratio of sulphate to chromic acid, and nature of the anodes. Various applications are discussed.—E. S. H.

Chromium Plating. C. Campbell (*Automobile Eng.*, 1932, 22, 462).—Recent developments in the process of electrodeposition of chromium on articles of iron, nickel, and other metals are considered. The use of a solution of chromic acid containing a small proportion of chromium sulphate as an electrolyte is dealt with, and the theory and practice of deposition using this electrolyte are fully discussed, and some results are given. A brief description is also given of the procedure adopted in plating, reference being made to the currents employed; the future development of chromium plating as regards reductions in time and cost is referred to.—J. W. D.

Chromium Plating for Increasing Wear Resistance. E. E. H. (*Machinery* (*Lond.*), 1932, 40, 549–553).—It is recommended that a chromium-plating shop should be run under full technical supervision. The process is discussed generally.—J. C. C.

The Production of Electrolytic Copper Sheets. Anon. (*Met. Ind.* (*Lond.*), 1932, 41, 329).—Brief description of the Cowper–Coles process of manufacturing copper and bi-metallic sheets by electrolysis on a revolving drum.—J. H. W.

The Potentials of the Electrodeposition of Mercury on Foreign Electrodes. T. Erdey-Grúz and H. Wick (*Z. physikal. Chem.*, 1932, [A], 162, 63–70).—Measurements have been made of the deposition potentials of mercury on carbon, platinum, tantalum, and gold.—B. Bl.

Electrodeposition of Nickel and Chromium [—II.] J. W. Cuthbertson (*Metallurgia*, 1932, 7, 57–58).—Cf. this *J.*, 1932, 50, 450. Single-salt solutions used in nickel-plating are considered in relation to such factors as the nickel salt to produce the nickel ions, a buffer solution, material to facilitate anode corrosion, and material to increase electrical conductivity. Seven solutions are discussed, with particular reference to their working temperature and their current density, and the importance of the control of the acidity is also indicated. The effects of temperature, aeration, and agitation on the deposit are discussed, and the need for care in the preparation of the work is emphasized.

—J. W. D.

The Structure of Nickel Plate. Eugen Werner (*Oberflächentechnik*, 1932, **9**, 77–78).—The various faults which may occur in electrodeposits of nickel are described and illustrated, and the reasons for their appearance and means for preventing it are discussed. Pits in the metal to be plated are a frequent cause of trouble, and every care should be taken in polishing to remove them, or at any rate open them out fully so that they cannot entrap plating solution. Sodium and magnesium salts in the plating bath produce denser and less porous deposits. When a high current density is employed, the bath should be operated at a higher temperature and preferably at a lower p_H. The presence of iron and free acid in low-temperature baths results in poor adherence; readily soluble anodes are essential for correct maintenance of the bath composition, and any evolution of oxygen at the anode indicates incorrect plating conditions.—A. R. P.

The Formation of Hydrogen and the Presence of Pin-Holes in Nickel Plating. V. Sacchi (*Chimica*, 1932, 8, 298–304).—To avoid the formation of pin-holes in nickel deposits, it is essential that the surface of the work and the baths be completely free from particles of foreign matters such as abrasives or dust, which act as catalysts for the formation of a very thin film of atomic hydrogen on the cathode surface: this causes a decrease in the over-voltage of hydrogen so that hydrogen is deposited simultaneously with the nickel, resulting in porous deposits. Certain impurities in the bath, *e.g.*, iron or copper, have a similar effect.—G. G.

Nickel Stripping Baths. Anon. (*Oberflächentechnik*, 1932, **9**, 80).—For the removal of faulty nickel plate, electrolytic stripping in cold, dilute sulphuric acid gives the best results; addition of arsenious acid as an inhibitor of attack on the base metal is not recommended. Cadmium deposits may be stripped in 10% ammonium nitrate solution, chromium in hydrochloric acid, copper and brass in cyanide solution or in 5–10% sodium nitrate (anodically), and zinc in hydrochloric acid with an inhibitor.—A. R. P.

Researches on Nickel Stripping Baths. H. Krause (*Oberflächentechnik*, 1932, **9**, 191–193).—Cf. Schmidt and Weber, this volume, p. 87, and this *J.*, 1932, **50**, 682. The commonest type of bath used in stripping faulty nickel plate from iron or steel is sulphuric acid of *d* 1·575, the article being made the anode and a current of 2 amp./dm.^{2} being used. Addition of arsenious acid is condemned, and, in spite of numerous tests, no satisfactory addition agent has been found. Details are given of tests made with acids of different concentration in stripping nickel plate from various base metals.—A. R. P.

On Nickel Anodes. Erich Becker (*Metallbörse*, 1932, **22**, 1293–1294, 1325–1326).—The preparation of cast, rolled, hammered, electrolytic, and sintered nickel anodes is briefly described and their advantages and disadvantages in various commercial plating baths are enumerated.—A. R. P.

Depolarized Nickel Anodes. Anon. (*Nickel Bulletin*, 1932, **5**, 218–219).—Rolled nickel anodes have hard faces which do not readily dissolve in nickel-plating solutions, and cast nickel has a tendency to become passive under the effect of the current owing to the formation of a skin of black nickel peroxide. Depolarized nickel anodes of a purity of 99·9%, to which a small addition of nickel oxide is made, do not suffer from either of these disadvantages. The other advantages of these anodes which are cast in oval section, and the control of the bath and current density, are discussed.—J. H. W.

New Platinum-Plating Process. Anon. (*Met. Ind.* (*Lond.*), 1932, **41**, 596).—A brief account is given of a process which is said to give a hard, white, non-porous, adhesive deposit of brilliant platinum.—J. H. W.

Preparing Silver for Electroplating. Anon. (*Met. Ind.* (*Lond.*), 1932, **41**, 330).—Short note describing the elimination of flaky and powdery anodes in silver plating by the use of silver of higher purity (99·97%) and by proper heat-treatment.—J. H. W.

Throwing Power of Plating Solutions with Particular Reference to Certain Zinc-Plating Solutions. B. K. Braund (*J. Electrodepositors' Tech. Soc.*, 1931–1932, **7**, 19–32; discussion, 175–176).—Reprinted from *Trans. Faraday Soc.*, 1931, **27**, 661–674. See this *J.*, 1932, **50**, 47.—S. G.

Electroplating Aluminium. Anon. (*Amer. Machinist* (*Eur. Edn.*), 1932, **76**, 1005–1006).—Chromium can be applied directly to aluminium from an ordinary chromium bath at about twice the usual current density used for plating over nickel, but an additional acid dip may be required with certain alloys. A satisfactory bath for direct zinc plating is zinc cyanide 4, sodium cyanide 4, ammonium hydrate (sp gr. 0·9) 4, and peptone $\frac{1}{8}$ oz./gall.; current density 1–5 amp./ft.^{2} for 1–10 minutes. For nickel plating, the surface should be roughened. Recipes for roughing solutions and for 2 satisfactory nickel baths and plating details for various alloys are given.—J. H. W.

Plating Rolled Zinc and Zinc Die-Castings. Anon. (*Amer. Machinist* (*Eur. Edn.*), 1932, **76**, 1133).—Details and precautions in buffing, cleaning, dipping, nickel-plating, colouring, and chromium-plating, and in nickel- and chromium-stripping are tabulated.—J. H. W.

Standards for Plated Surfaces. A. J. Round (*Brass World*, 1932, **28**, 222–223).—A table, reproduced from the bulletin of the Birmingham Jewellers' and Silversmiths' Association, 1932, September, of specifications for platinum, gold, silver, nickel, nickel-chromium, cadmium, zinc, brass, copper, and tin deposits, worked out by Messrs. B. J. Round and Sons, Birmingham, is given under the name of "Epalex" Standards and Tests.—J. H. W.

Advances in Electroplating. Herbert Kurrein (*Oberflächentechnik*, 1932, **9**, 97–99).—A review with 93 references to recent work.—A. R. P.

Throwing Power of Electroplating Solutions. Seiji Kaneko (*Kōgyō Kwagaku Zasshi* (*J. Soc. Chem. Ind. Japan*), 1932, **35**, (4); *C. Abs.*, 1932, **26**, 3995).—[In Japanese, with English summary in supplemental binding, p. 146.] Throwing power (T) is defined as $T=\{[(1/L)-A]/1/L\}\times 100$, where L and A have the same values as defined previously (*ibid.*, 1931, **34**, (4); this *J.*, 1931, **47**, 446), and $(1/L)$ is the value of A when ϵ (current efficiency) $=1$ and $\delta v_1/\delta I=0$ ($v_1=$ potential drop at cathode and $I=$ current density). By substituting the value of A (cf. *ibid.*, 1931, **34**, (4); this *J.*, 1931, **47**, 446) $T=\dfrac{(1/\rho L)(\delta v_1/\delta I)-(I/\epsilon)(\delta\epsilon/\delta I)}{1+(1/\rho L)(\delta v_1/\delta I)}\times 100$ ($\rho=$ specific resistance). $(1/\rho)(\delta v_1/\delta I)$ is the characteristic quantity independent of distance, and it is suggested that this will give a better measure of throwing power.—S. G.

Protective Properties of Colloids and their Behaviour in the Electrolytic Deposition of Metals. P. A. Jacquet (*Nature*, 1932, **130**, 812–813).—The protective action of colloids, as measured by the gold number, is parallel to the effect of the colloids on the electrodeposits of copper. The highly protective colloids (gelatin and serum albumin) modify considerably the stress in copper, whilst those of lower protective power (gum arabic and gum tragacanth) have a relatively small influence.—E. S. H.

New Aids for the Supervision of Large Continuously-Operating Plating Baths. Carl Hütter (*Oberflächentechnik*, 1932, **9**, 87–88).—An automatic apparatus for continuously measuring the p_H of plating solutions and for adding the necessary acid or alkali to maintain a constant p_H is described with reference to illustrations and a wiring diagram.—A. R. P.

Practical Plating. Plating Shop and Plant.—I, II. E. A. Ollard (*Met. Ind.* (*Lond.*), 1932, **41**, 255–256, 375–376, 425–426, 497–499, 545–546, 548–549).—A discussion of the design of the plating shop as regards drains and floor, light, ventilation, draughts, heating, and general structural alterations; position of plating shop and general layout and of details of the plant under the headings (1) generators; (2) busbars; (3) vats for acid solutions; (4) vats for alkaline solutions; (5) chromium vats and exhaust; (6) pumps and circulating devices; (7) filters; (8) agitating devices and moving cathodes; (9) barrels; (10) various accessories.—J. H. W.

Electrodeposited Protective Coatings and Their Use in the Wire and Cable Industry. Erhard Bertl (*Elektrotech. Z.*, 1932, **53**, 579).—Numerous tests made by the leading firms of the cable industry have proved that a homogeneous electrodeposited coating of pure lead 0·009 mm. thick is sufficient protection against corrosion if not subjected to mechanical stress. A protective layer 0·3 mm. thick is sufficient for cable-covering wires and cable iron strip. For less strongly stressed wires and strips a layer of lead 0·1–0·15 mm. thick suffices. Tin can now be deposited in a lustrous, adherent form. Tin–lead alloys can be also deposited, without objection, in engineering practice.—B. Bl.

Application of Electro-Deposited Metals to Mechanical and Marine Engineering. C. H. Faris (*Trans. Liverpool Eng. Soc.*, 1931, **52**, 42–60; discussion 61–70).—Cf. this *J.*, 1931, **47**, 666. A description is given of the Fescol process for producing nickel coatings up to $\frac{1}{4}$ in. in thickness, and of the results of tests showing the strength of the bond between the nickel and the base to exceed 18–19 tons per in.^{2}. Many applications of the process are described, *e.g.* to pistons of high-pressure steam engines, pump plungers for handling caustic soda, and ammonia compressor rods. The advantages of nickel over other, more commonly used, constructional materials are noted; the chief are resistance to wear and corrosion. For these reasons the process has been adopted as standard for the cylinder liners of high-speed Diesel engines for airship and locomotive work; for rolls for paper mills; ships' propellers; impellers for centrifugal pumps; filter press plates; and for many purposes where superheated steam is used. Although originally employed only for repair work, the process is now applied for much new work. Nickel may be deposited on all kinds of iron and steel (including "stainless"), bronze, and gun-metal. The process is used also for depositing copper, cobalt, zinc, and, more particularly, cadmium, lead, and chromium. Lead coatings up to $\frac{1}{8}$ in. thick are used for chemical plant, whilst chromium deposits are employed either for decoration, when they are applied over nickel to produce a hard, impervious coating, or as "engineering chromium"; in this case deposits up to 0·01 in. thick, having a Brinell hardness of 600–750, are used. For machining deposited nickel, tungsten [? tungsten carbide] tipped tools are necessary, as steel tools rapidly become dull and tear away the nickel and base metal. In general, grinding is to be preferred to turning.—H. G.

Electro-Deposition and the Metallic State.—I, II. L. B. Hunt (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 147–149, 164–165).—(I) The study of variations in structure of electrodeposited metals offers advantages in dealing with metallographical problems, since in certain respects crystal formation can be controlled by the conditions of deposition. The results of various investigators on electrodeposition and adsorption are discussed in relation to recent concepts of crystal boundary conditions. (II) The concepts drawn from consideration of electrodeposited metals are applied to cast metals, the intercrystalline boundary being viewed as an oriented layer of metal ions vibrating between positions of minimum potential energy on the contiguous lattices. The layer would thus constitute a separate two-dimensional phase in which metal ions may to some extent be replaced by molecules of impurities. The relation of the hypothesis to those of other workers is discussed. It may be applied tentatively to the explanation of "equi-cohesive temperatures," boundary migration in grain-growth, and twinning.—R. G.

The Scientific Bases of Galvanoplastics. J. Salauze (*Mem. et Compt. rend. Soc. Ing. civils France*, 1932, **9**, 446–506).—The principles and applications of galvanoplastics are considered under the following headings: (1) potential: definition, polarization, penetrability, deposition of metals electro-positive to hydrogen (nickel, cadmium, zinc), hydrogen-ion concentration; (2) formation of the deposits: theory (crystal building), influence of the cathodic metal on the crystallization of the deposit, influence of the different factors of the electrolyte; (3) baths: quality, cyanide baths, summary of the principal baths (gold, silver, copper, nickel, cadmium, zinc, chromium); (4) preparation of the work: mechanical and chemical treatment, testing the deposit (analysis, corrosion-resistance, adherence, hardness, microstructure). —J. H. W.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electro-Deposition and Electro-Refining.)

(Continued from p. 32.)

On the Question of the Overvoltage of Hydrogen. T. Erdey-Grúz and H. Wick (*Z. physikal. Chem.*, 1932, [A], **162**, 53–62).—The hydrogen overvoltage on lead, tantalum, and carbon electrodes with a very clean surface has been determined. The behaviour of lead and tantalum is different from that of other metals; this is explained on the basis of the discharge theory of E.-G. and Volmer.—B. Bl.

The Theory of Passivity. XVII.—Comparison of the New Theory of E. Müller and K. Schwabe with the Cover Theory (Bedeckungstheorie) of W. J. Müller, with Experimental Results of an Investigation on Passivity. W. J. Müller (*Z. Elektrochem.*, 1932, **38**, 850–860).—As a result of experiments on the passivity of copper in saturated copper sulphate solutions, it is claimed that in the work of E. M. and K. S. the current density–potential curves only partly explain the phenomenon of passivity, whilst, on the other hand, the cover theory agrees completely with all the observed facts and the character of the phenomenon. The theory of E. M. and K. S. requires an accumulation of soluble salt on the metal, as opposed to the thin and adherent layer required by W. J. M.'s theory. In general, the "saturation-passivity" and "relative-passivity" (*Einbezugspassivität*) theory is not in accord with the results of the experiments.—J. H. W.

VIII.—REFINING

(Including Electro-Refining.)

(Continued from pp. 32–35.)

The Refining of Lead Dross and Other Metallic Waste. Anon. (*Maschinenkonstrukteur*, 1932, **65**, 137–138).—Three types of remelting plant are described for the reclamation of metallic dross. The first, for small-scale operation, gives a yield of metal approaching 65% of the weight of dross; the second is adapted for rather heavier work, and should give a yield of 78% with lead and tin dross, 90% with other soft metals and alloys. Both furnaces are coke-fired. The third type is adapted for large-scale operation, and burns tar-oil. The preparation of dross for re-melting requires some care; important points are the removal of iron and, where possible, the pulverization of the material. The importance of pyrometric control is emphasized.—P. M. C. R.

Refining Platinum Metals.—III,–IV. Martin Schwitter (*Brass World*, 1932, **28**, 228–229, 247–248).—Cf. *J.*, this vol., p. 33. (III.—) Osmiridium is extracted from precious metal sweeps by comminution and sifting; the coarse material is heated to redness for 2–3 hrs. with excess zinc in a graphite crucible and granulated, and the zinc dissolved in hydrochloric acid. The residue and the fines are distilled for osmium and ruthenium, the latter being held up in cool hydrochloric acid and the former passing over. The remainder of the distillate is treated with hot, strong hydrochloric acid, diluted and filtered.

Iridium and platinum are precipitated with ammonium chloride and heated to a good red heat. The mixture contains about 1% rhodium. It is melted with excess lead, granulated, and treated in succession with dilute nitric acid, boiling sulphuric acid, aqua regia, sodium hydroxide, strong hydrochloric acid, and hot water. (IV.—) The contents of the second receiver in the previous operation are transferred to the first receiver and boiled under gentle aspiration until all the osmium has passed over as tetroxide. The solution is then made strongly ammoniacal and slowly heated to dryness, at the end from a slightly (hydrochloric) acid solution. The osmium-paste is heated in a silica crucible under hydrogen to a bluish powder or sponge. The solution containing ruthenium is evaporated to dryness with ammonium chloride, brought to red heat, ground, and treated with strong hydrochloric acid. The solution containing rhodium is filtered, boiled, and made alkaline with caustic soda, the precipitate decanted, dissolved in aqua regia, and evaporated almost to dryness, diluted, and excess sodium nitrite added, then sodium carbonate. After boiling and standing, it is made faintly acid, ammonium chloride is slowly added, and the precipitated rhodium–ammonium–nitrate filtered, washed, dissolved in hydrochloric acid, made ammoniacal, acidified with formic acid, and boiled until all the rhodium is precipitated as metal. The treatment of the residues and secondary solutions is briefly described.—J. H. W.

ELECTROLYTIC METHODS

Electrolytic Refining of Copper, Using the Complex Salt of Cuprous Chloride. —VIII,–IX. The Behaviour of Silver Present in the Crude Copper of the Anode. Naoto Kameyama and Shoji Makishima (*Kōgyō Kwagaku Zasshi* (*J. Soc. Chem. Ind. Japan*), 1931, **34**, (11); *C. Abs.*, 1932, **26**, 5850).—[In Japanese, with English summaries in supplemental binding, pp. 462–465.] (VIII—) The behaviour of silver in the cuprous chloride bath was investigated. The alkali chloride in the bath (about 4 mols. per kg. of water) dissolves appreciable quantities of silver chloride to form a complex salt. Here the silver will not act in the same way as in a sulphate bath. Solubility of silver chloride in potassium chloride solutions was determined at 25° and 50° C. The activity of silver ions was determined from the e.m.f. of the cell $Ag | 0{\cdot}01 N AgNO_3 || \text{saturated } NH_4NO_3 | KCl$, or process electrolyte with saturated $AgCl|Ag$. Solubility of silver increases rapidly with temperature or increase of cuprous chloride content, but the single potential of silver becomes less "noble." The potential of the silver electrode is about 100 mv. more noble than that of the copper, independent of temperature and electrolyte composition. Silver should be unattacked on the anode surface, but any Cu^{++} in the electrolyte gives the reaction $Ag + Cu^{++} \longrightarrow Ag^+ + Cu^+$, and silver goes into solution. Silver in solution should deposit simultaneously with copper. (IX—) Actual tests with anodes of pure silver, partly silvered copper plate, silver and copper plates side by side and connected, and cast copper–silver alloys, showed that most of the current passes through the copper surface, but the silver in the anode dissolves and deposits on the cathode. A diaphragm will not prevent this, nor will the addition of sulphur, ferrous sulphide, nickel, tin, sulphur dioxide, stannous chloride, $Fe(CN)_6^{IV}$, ferrous chloride, hydroxylamine, formaldehyde, or hydroquinone, or superposition of a.c. on the d.c., or bromides, cuprous iodide, or β-iodopropionic acid. Circulation of the bath through an outside layer of cuprous iodide removes silver as silver iodide.—S. G.

Electrolytic Refining of Copper, Using Complex Salt of Cuprous Chloride. X.—Behaviour of Antimony. Naoto Kameyama and Shoji Makishima (*Kōgyō Kwagaku Zasshi* (*J. Soc. Chem. Ind. Japan*), 1932, **35**, (8); *C. Abs.*, 1932, **26**, 585).—[In Japanese, with English summary in supplemental binding, pp. 369–371.] The electrolyte used was sodium chloride 4 mols.; cuprous chloride 0·8 mol., hydrochloric acid 0·5 mol., gelatin 1 grm., water 1000 grm., and the conditions were: temperature 50° ± 1° C., current density 2·3 amp./dm.^{2}, time 30–70 hrs., mechanical stirring, and passage of small quantities of carbon dioxide to displace atmospheric oxygen. Various amounts of tartrate were added to the electrolyte, and various amounts of antimony to the electrolyte or anode. The physical properties of the cathode deposit were good, and the cathode never contained antimony higher than $0{\cdot}000x\%$. The electrolytic potential of antimony in the bath is higher than that of copper. Antimony accumulates in the bath or goes to the anode.—S. G.

IX.—ANALYSIS

(Continued from pp. 35–37.)

Chemical Spectrum Analysis. W. Gerlach (*Forschungen u. Fortschritte*, 1932, **8**, (31), 397).—New applications and results of spectrographic analysis are described.—J. W.

On the Sampling of Zinciferous White Metals. Wolfgang Boehm and Wolfgang Jorre (*Metall u. Erz*, 1932, **29**, 217–218).—Even by rapid cooling of zinciferous bearing metals with an Sn or Pb base, considerable segregation occurs, so that accurate sampling of bars is difficult. Probably the best procedure is to saw longitudinally right through the ingot and to dissolve a large sample, *e.g.* 10 or 20 grm., for analysis, taking aliquot parts for the various determinations. If drillings are taken from a number of places in the ingot they should all be carefully remelted, the metal cast in a chill mould, and the ingot sawn or filed to get a large quantity of fine material.—A. R. P.

Assay of Rubber-Insulated Conductors [Consisting of Tinned Copper Wires]. A. R. Matthis (*Ann. Chim. analyt.*, 1932, [ii], **14**, 201–203).—A quantity of wire such that the surface of tinned Cu is exactly 1 dm.^{2} is wound on a piece of glass rod and the bare Cu at the ends is covered with wax. The rod is then rotated for 5 minutes in NH_4OH (*d* 0·910) at 30 r.p.m. in such a way that one half of the wire is passing below the liquid while the other half is passing through the air. The amount of Cu dissolved is then determined by electrolysis or by colorimetry; it is a function of the corrosion-resistance of the tinned coating.—A. R. P.

Effect of Platinum Metals in Assaying [A Discussion on J. L. Byers' Paper on "Surface Effects on Assay Beads Caused by Metals of the Platinum Group"]. R. F. Wood. A. M. Smoot. F. E. Carter. T. A. Wright. E. E. Bugbee. J. L. Byers (*Min. and Met.*, 1932, **13**, 364–366).—Cf. this *J.*, 1932, **50**, 441. A. M. S. states that Ru produces a blue incrustation and Rh an iridescent film on Au beads; Os and, to a smaller extent, Ru and Ir are lost by volatilization during cupellation and Ru, Rh, and Ir separate completely or almost completely from solution in Au when the Au solidifies, Ir sinking to the bottom and Ru and Rh rising to the top; the presence of more than one Pt metal often complicates the effects produced. T. A. W. points out the possibility of interference by impurities, especially Bi in the Pb. E. E. B. suggests that the method is only qualitative but is useful in that the appearance of any of the effects noted by J. L. B. is an indication of the probable presence of Pt metals in the bead but not necessarily of their nature or amount.—A. R. P.

A Peculiar Adsorption- and Peptization-Reaction of Calcium Oxalate; Colour-Test for Calcium in the Presence of Strontium. F. L. Hahn (*Ber. deut. chem. Ges.*, 1932, [B], **65**, 207–209).—Ca may be recognised in the presence of Sr by a peculiar colour-reaction when the oxalates are precipitated after addition of an ammoniacal solution of chinalizarin.—P. M. C. R.

On the Copper-Reactive Group $HO-\overset{|}{\underset{|}{C}}-\overset{|}{\underset{|}{C}}-\overset{|}{C}=N-OH$. Fritz Ephraim (*Ber. deut. chem. Ges.*, 1931, [B], **64**, 1210–1214).—Cf. *ibid.*, 1930, [B], **63**, 1928. The oximes corresponding with certain series of aldehydes and ketones are found to give characteristic precipitates with Cu salts, as does salicylaldoxime, but the latter body is considered the most satisfactory reagent on account of the intensely coloured precipitate obtained. The relative solubilities of the complex metallic salts of these series are reviewed.—P. M. C. R.

On the Copper Reagent Salicylaldoxime. F. Ephraim (*Ber. deut. chem. Ges.*, 1931, [B], **64**, 1215–1218).—See also *ibid.*, 1930, [B], **63**, 1928; and preceding abstract. The separation of Cu by salicylaldoxime requires some modification in the presence of Fe^{III}; the metallic solution should be acidified with HCl instead of with CH_3COOH, thus avoiding the characteristic red coloration due to Fe. The separation and identification of salicylaldoxime compounds with certain metals other than Cu are described.—P. M. C. R.

Colorimetric Tests for Precious Metals. W. E. John and E. Beyers (*J. Chem. Met. Min. Soc. S. Africa*, 1932, **33**, 26–27).—The solution is treated with $SnCl_2$ and then shaken with $(C_2H_5)_2O$. Purple of Cassius, due to any Au present, forms a black scum at the top of the aqueous phase. Platinoid metals give orange or red colours, which collect in the ether layer. If Fe is present, it gives no colour when completely reduced. If reduction is incomplete, the dirty-brown colour produced masks the test for platinoid metals.—E. S. H.

Analytical Evaluation of Catalytic Reactions; Detection of Palladium in the Presence of Other Metals of the Platinum Group. F. Feigl and P. Krumholz (*Ber. deut. chem. Ges.*, 1930, [B], **63**, 1917–1919).—Pd may be detected in the presence of Ir, Os, and Ru salts by its activation of CO and the subsequent reducing action of the latter on phospho-molybdic acid. Pt and Rh give a similar but much weaker and less sensitive reaction. The solution, from which Au, Hg, and Fe salts should have been removed, is rendered weakly acid (acidity $N/10$ to $N/2$) and heated to boiling with 5% phospho-molybdic acid solution. CO is then rapidly passed through the solution, and a blue or green coloration is shown; the reaction is very sensitive, an appreciable coloration being given in 5 minutes with a Pd concentration of 1 part in 40 million parts. —P. M. C. R.

2 : 7-Diamino-Fluorene as a Reagent for Zinc, Cadmium, and Copper. Julius Schmidt and Walter Hinderer (*Ber. deut. chem. Ges.*, 1931, [B], **64**, 1793–1796).—2 : 7-Diamino-fluorene, preferably used as the hydrochloride in 1% solution in alcohol, gives characteristic precipitates of very low solubility with solutions of the chlorides or nitrates of Zn, Cd, and Cu. Sulphates must not be present, as the base forms an insoluble sulphate. The metallic solution should be ⅔ alcoholic. White precipitates are obtained with Zn and Cd salts, whilst Cu^{II} solutions give a bluish-green coloration and a dark blue flocculent precipitate. The Cu reaction is considered more sensitive than the ferrocyanide test. The preparation of the reagent and the exact conditions of its use are fully described.—P. M. C. R.

Volumetric Determination of Aluminium. J. Clarens and J. Lacroix (*Bull. Soc. chim. France*, 1932, [iv], **51**, 668–670).—The HCl solution is treated with KOH, using methyl orange as indicator until a sudden decrease in the intensity of the red colour occurs. Methyl red is then added and the boiling solution is titrated with KOH until the colour changes to yellow; 1 c.c. of N-KOH = 0·009 grm. of Al. Ca does not interfere, but if Mg is present, part may be precipitated with the $Al(OH)_3$; the titrated solution should therefore be titrated with N-HCl until red, and the c.c. of acid used deducted from the c.c. of KOH used in the first titration.—A. R. P.

A New Method for the Determination of Bismuth. C. Mahr (*Z. anorg. Chem.*, 1932, **208**, 313–317).—Bi is precipitated from HNO_3 or H_2SO_4 solutions by a 10% solution of $K_3Cr(SCN)_6$ as brick-red, crystalline $BiCr(SCN)_6$ which may be dried and weighed or its SCN content may be titrated. Mo, Cr, Al, Fe, Mn, Ni, Co, Mg, alkaline-earth metals, and alkali metals do not interfere, and the method may be used for very small amounts of Bi.—M. H.

A New Reagent for the Qualitative and Quantitative Estimation of Copper. Fritz Ephraim (*Ber. deut. chem. Ges.*, 1930, [B], **63**, 1928–1930).—Cu may be quantitatively precipitated from CH_3COOH or aqueous solution in the presence of any other metal by the addition of the (acetic) acid solution of salicylaldoxime, when the bright greenish-yellow Cu salt is set free as a voluminous flocculent precipitate, which readily collects on stirring and filters easily. The reaction is perceptible as a definite opalescence at a Cu concentration of 1 part in 500,000 parts. Full directions for qualitative detection and for quantitative estimation are given: characteristic reactions of salicylaldoxime with other metals, especially in alkaline solution, are described.—P. M. C. R.

Volumetric Determination of Tungsten. B. G. Mokeev (*Uchenuie Zapiski Kazan Gosudarst. Univ.* (*Sci. Rep. State Univ. Kazan*), 1930, **90**, 1022–1024; *C. Abs.*. 1932, **26**, 5870).—[In Russian.] Volumetric determination of W by the method of Kanchev, *i.e.* precipitation of W with benzidine chloride and titration of the precipitate with 0·1*N*-NaOH, gives results varying with the WO_3 contents of the samples. Totally unsatisfactory results are obtained with samples containing less than 0·2–0·3 grm. WO_3.—S. G.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

(See also "Testing" and "Pyrometry.")

(Continued from p. 37.)

The Choice of System in Microphotography. J. Flügge (*Z. wiss. Mikroskopie*, 1931, **48**, 367–369).—The achromic micro-objective is generally combined with much too strong eye-pieces, usually ×6. Much better results are, however, obtained with much weaker eye-pieces, *e.g.* less than ×3. With apochromatic objectives stronger eye-pieces are permissible. With a shorter camera somewhat stronger eye-pieces are permissible (*e.g.* up to ×6).—B. Bl.

Some Remarks on the Metallurgical Microscope Using Polarized Light. L. Tronstad (*Z. tech. Physik*, 1932, **13**, (9), 408–410).—The angle of incidence and the azimuth (referred to the plane of incidence) of linearly polarized light are affected by the change in the light after reflection from the surface of metals, hence it is necessary to find by the use of suitable epiphragms the angle of incidence with metallurgical microscopes using linearly polarized light in order to obtain uniform results.—J. W.

Test of the Large Metallurgical Microscope of Carl Zeiss, Jena. C. Benedicks and P. Sederholm (*Z. wiss. Mikroskopie*, 1931, **48**, 99–109).—B. Bl.

The New Leitz Binocular Microscope. K. John (*Z. wiss. Mikroskopie*, 1931, **48**, 482–483).—A description is given of the Leitz binocular microscope with vertical objective and tubes inclined at 45°.—B. Bl.

Increasing the Accuracy in the Measurement of the Smallest Visible Magnitudes with the Screw Micrometer Eyepiece. Heinrich Quastler (*Z. wiss. Mikroskopie*, 1932, **49**, 195–207).—Conditions are given under which it is possible to measure diameters of less than 1 μ with an error of not more than 0·023 μ.—B. Bl.

The "Metaphot" as a Universal Instrument for Microscopic, as well as for "Micro- and Macro-Photographic" Work in Transmitted and Reflected Light. H. Pfeiffer (*Z. wiss. Mikroskopie*, 1932, **49**, 100–102).—The construction of the instrument, which is also built as a metallurgical microscope, is different from the usual arrangement of the individual parts on an optical bench. The light passes from the object vertically through the objective downwards to a mirror, from which it is reflected at an angle into the eyepiece or on to the ground glass disc. The camera length, which cannot be altered, is 50 cm. The instrument is manufactured by the Emil Busch A.-G., Rathenow.—B. Bl.

XI.—PHYSICAL AND MECHANICAL TESTING AND RADIOLOGY

(Continued from pp. 38–39.)

Discussion on the Zürich Congress by the Association Française pour l'Essai des Matériaux [French Association for Testing Materials]. L. Guillet, J. Galibourg, and E. Dupuy (*Rev. Mét.*, 1932, **29**, 377).—Cf. this *J.*, 1932, **50**, 625. The papers on tests at elevated temperatures are reviewed by Galibourg, those on impact tests by Dupuy, and a general discussion follows.—H. S.

Simple Methods of Testing Materials for Medium-Size and Small-Scale Works. H. Franz (*Anz. Berg.-Hütten-u. Masch.*, 1932, **54**, (94), 4–5).—The application of simple methods of testing, such as the Brinell and Rockwell hardness tests, and the bending test, in small works is discussed.—B. Bl.

Workshop Methods of Testing Materials. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1931, **7**, 83).—A series of simple tests is described, including the identification of gold, the detection of hair-cracks in steel and porosity in aluminium, rapid tests on wire and sheet, and the recognition of several alloys by their characteristic ring.—P. M. C. R.

Mechanical Tests of Aircraft Structural Components. I. J. Gerard (*J. Roy. Aeronaut. Soc.*, 1932, **36**, 673–690; discussion, 690–703).—Attention is directed to the relation between failing load and geometrical proportions in aircraft members. A new form of compression test on strip materials, in which the strip is bent transversely into the arc of a circle of 180° with two flat tangential extensions at each straight edge of the test-piece, is described. The extensions are 0·1 in. wide, and engage in a jig which prevents premature buckling but does not appreciably restrain axial shortening. Methods for the strength testing of aircraft wings, spars, hulls, and fuselages are described. —H. S.

Small Extensometer for Use on Both Light and Heavy Structures. Anon. (*Iron Age*, 1932, **130**, 464).—Short account of a "scratch" extensometer for recording tension-compression strains and also pure shear strain. The instrument is only 4 in. long and weighs less than 1 oz. The record is scratched by a diamond point on a moving steel target.—J. H. W.

The Hardness of Metals at High Temperatures. J. Ferdinand Kayser (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 173).—A description of a new method of determining the hardness (Brinell) of metals at high temperatures. The test-piece is in the form of a small cone (120°) which rests on an anvil and is subjected to a load of 35 kg. for a period of 10 days. The anvil, cone, and plunger are surrounded by a resistance furnace for maintaining the desired temperature. The apex of the cone flattens under load, reaching a constant form in about 100 hrs., and the hardness number is derived from the load divided by the area of the flattened surface of the cone. Investigation has shown that the values are in close agreement with those of Brinell hardness tests carried out in the usual manner. Above 700° C. practically all metals appear to have a Brinell hardness of less than 10.—R. G.

The Hardness of Metals at High Temperatures. Anon. (*Metallurgia*, 1932, **7**, 29).—See preceding abstract.—J. W. D.

Rapid Erosion Tests Clarify Wear of Metals. T. F. Hengstenberg (*Steel*, 1932, **91**, 21–23).—The testing apparatus described consists essentially of an impeller disc into the rim of which are inserted two test-pieces at opposite points. As the disc revolves, the specimens strike 2 continuous jets of water. Most metals behave similarly at fairly low speeds, but at high speeds a great variety of behaviour in shown.—E. S. H.

XII.—PYROMETRY

(Continued from p. 40.)

Practical Notes on the Installation and Upkeep of Thermo-Couple Pyrometers. F. J. Brookes (*Met. Ind.* (*Lond.*), 1932, 41, 535–537, 559–561, 585–586).—The theory underlying heat measurement of thermo-couple pyrometers and the construction of these instruments and of indicators and recorders are described, and the desired characteristics and limitations of base and rare metal thermo-couples are outlined. The lay-out, connections, and operation of an installation consisting of 12 thermo-couples, 2 indicators, and a double drum recorder, and the testing of such an installation, are described. Freezing liquids as standard checks and the checking of the resistance pyrometer " bridge," and of indicators and recorders are explained. —J. H. W.

Industrial Dilatation Pyrometers. P. Chevenard (*Rev. Mét.*, 1932, 29, 442–448).—Pyrometers developed by Joumier for industrial use at temperatures up to 1000° C. and intermittently up to 1100° C., and types having dial indicators and recording mechanism, are described, as well as the adaptation of a pyrometer of this type for regulation of temperature.—H. S.

The Reduction of Platinum Resistance Thermometers to the International Temperature Scale. G. S. Callendar (*Phil. Mag.*, 1932, [vii], 14, 729).—Methods for the reduction of observations of platinum resistance changes with temperature to corresponding gas-scale temperatures, designed to save time and to eliminate the use of log. tables are described.—J. S. G. T.

Pyroversum Pyrometer. Anon. (*Machinery* (*Lond.*), 1932, 39, 633).—An illustrated description of an optical pyrometer designed on the principle of a foot-candle meter, in which extinction of the object under test is secured with an opacity wedge. A standard candle is supplied in order that preliminary tests may be made to establish the scale corrections necessary to account for the personal factor.—J. C. C.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 40–42.)

The Evolution of the Modern Foundry. J. E. Hurst (*Iron and Steel Ind.*, 1932, 6, 67–68, 92).—In a description of developments which have taken place in foundry practice since the year 1775, due to the evolution of machinery and to modern methods of melting and foundry technique, reference is made to the changes in non-ferrous foundries during that period.—J. W. D.

International Foundry Exhibition in Paris. Anon. (*Alluminio*, 1932, 1, 308–309).—An illustrated description with especial reference to the light alloy castings exhibit.—G. G.

A New Form of Phosphorus Deoxidizing Agent. Willi Claus (*Z. ges. Giesserei-Praxis: Das Metall*, 1932, 53, 377–378, and *Rev. Fonderie moderne*, 1932, 26, 349–350).—Hitherto it has been necessary when deoxidizing with phosphorus, to use phosphor–copper or phosphor–tin. These materials are expensive, and zinc and lead in combination with yellow phosphorus are unsuitable. If, however, powdered zinc and powdered phosphorus are compressed together, a comparatively cheap and eminently suitable deoxidizer for use with metals and alloys with high melting-points results. Comparative tests on a bronze deoxidized with such a mixture containing 10 and 20% phosphorus and with 10% phosphor–copper showed at least as good results with the zinc mixture as regards the mechanical properties without any qualifying disadvantages.—J. H. W.

XIV.—SECONDARY METALS: SCRAP, RESIDUES, &c.

(Continued from pp. 42–43.)

Converting the Scrap of a Non-Ferrous Tube Mill into Valuable Stock. Gilbert Evans (*Metallurgia*, 1932, **7**, 55).—An effective method of dealing with scrap ends of non-ferrous tubes such as condenser tube ends for further drawing-in to small diameter and thin walls to meet the requirements of radiator tubes for motor-car engines, optical tubes, lubricating connections, and similar purposes. The construction of a battery of high-speed benches constructed for drawing-in such tube cuttings is fully described.—J. W. D.

XV.—FURNACES AND FUELS

FURNACES

(Continued from pp. 44–46.)

Babbitt Melting Rig. James F. Hobart (*Power Plant Eng.*, 1932, **36**, 637–638).—Accidental spilling of Babbitt metal in a forge fire is stated to make welding operations impossible owing to the presence of volatile oxides. A small separate melting furnace for white metal is described, and adjustments are recommended for cases where such a furnace cannot be used.—P. M. C. R.

Industrial Furnaces for Gas. XVII.—Ovens in the Electrical Industry and for Heat-Treating. Lawrence E. Biemiller (*American Gas J.*, 1932, **137**, (4), 25–27).—Cf. this *J.*, 1932, **50**, 130, 270, 713. Gas-fired ovens for japanning and enamelling wires, for tempering springs, for moulding insulators, and for heat-treating of zinc and aluminium are briefly referred to.—J. S. G. T.

Principles of Recuperation Applied to Industrial Gas Furnaces. E. A. Luscombe (*Amer. Gas J.*, 1932, **137**, (6), 9–12, 29).—Results of extensive series of tests of two industrial gas-fired furnaces employing recuperation and operating at temperatures between 1400° F. and 2500° F. (760° C. and 1371° C.) are summarized and discussed. To obviate the hazard of pre-ignition, 1000° F. (538° C.) is recommended as the maximum safe air-temperature to be used with pre-mixing burner systems. In average recuperative installations, it appears to be uneconomical to employ air temperatures in excess of 60% of the flue gas temperature. A short bibliography is appended.—J. S. G. T.

Electric Furnace Heating. George Turner (*Metallurgia*, 1932, **7**, 1–2, 4).—The advantages of electric heat-energy for heat-treatment operations depend on the design of furnace used, and a number of furnaces specially designed to meet the requirements of various operations and products are briefly discussed. These included an induction melting furnace of 600 kg. capacity used for the melting of brass, copper, and cupro-nickel alloys; a resistance-heated hearth-type furnace for melting aluminium and its alloys; a continuous strip annealing and pickling plant consisting of electrically-heated annealing furnace, cooling tank, electrically-heated bosh, washing machine, electrically-heated drying furnace, and strip-cooling device all arranged in line; a furnace for the bright-annealing of copper and brass sheets; and an automatic bath-hardening furnace, effective in producing non-oxidized components.—J. W. D.

Electrical Heating in Industry. W. Pfister (*Bull. Assoc. Suisse Elect.*, 1932, **23**, (1), 15–23).—A fully illustrated account of electrically-heated boilers is followed by a list of the purely metallurgical applications of electric heating, under the following headings: (1) annealing, with special reference to rolling, wire-drawing, coinage, pressing and stamping, and enamelling; (2) hardening; (3) melting. Several types of melting furnace are described.—P. M. C. R.

XX.—JOINING

(Continued from 53–56.)

The Influence of Small Notches in the Shaft of Duralumin Rivets. M. Abraham (*Jahrb. deut. Versuchsanst. Luftfahrt*, **1931**, 21*).—Transverse notches, indentations, and longitudinal ridges are not eliminated when the rivets are hammered into position, but are liable to become dangerous only if several unfavourable conditions occur simultaneously.—B. Bl.

Solder and the Art of Wiping Cable Splices. H. Baillard (*Bell Laboratories Record*, 1932, **11**, 43–47).—As a result of an elimination test made by expert splicers, a wiping solder containing tin 38 and lead 62% was standardized by the American Telephone and Telegraph Co. in 1919. This selection was based on the analyses of joints made from melts of 50 : 50 solder " tempered " by the splicers with lead. Increasing the lead content is held to produce coarse-grained, porous joints. The presence of antimony in excess of 0·3% is said to decrease the cohesiveness, more than 0·005% zinc to produce lumpiness, more than 0·10% bismuth to depress the freezing-point unduly, and copper to be harmless up to 0·10% and even beneficial in the presence of antimony. [*Note by abstractor :* These conclusions are not all in accordance with British experience.] A solder containing cadmium 9 and tin 24% was found satisfactory, but with the present price of tin has no longer an economic advantage.—J. C. C.

Riveting and Welding of Aluminium. F. V. Hartman and C. M. Craighead (*Metal Stampings*, 1932, **5**, 545–548, 568).—A discussion of riveting and welding methods employed in fabricating aluminium products spun, stamped, or formed from sheet, extruded tubing, &c. The rivets should be of the same alloy as the sheets to be joined. Whilst aluminium can be welded readily by any ordinary method, the most generally satisfactory is fusion welding with the oxy-hydrogen or oxy-acetylene torch.—J. H. W.

Aluminium Welding Electrode. Anon. (*Aviation*, **1932**, June, 286).—A 5% silicon–aluminium alloy is used for metallic- or carbon-arc welding of sheet or castings in aluminium. The welding-rods are provided with a coating of flux which prevents excessive oxidation and dissolves aluminium oxide.
—H. S.

Arc-Welding Aluminium and Its Alloys. Anon. (*Aluminium Broadcast*, 1932, **3**, (38), 11–13).—An account of the Arcos process of arc-welding aluminium and its alloys. Coated electrodes of aluminium (Alumend electrodes) or aluminium–silicon alloy (Alsilend) are used.—J. C. C.

Welding Fractured Aluminium Alloy Castings. A. Eyles (*Amer. Machinist* (*Eur. Edn.*), 1932, **76**, 491E).—Workshop instructions for welding aluminium alloy castings.—J. H. W.

Investigation of Electrically Spot-Welded Specimens of Duralumin. K. Schraivogel (*Jahrb. deut. Versuchsanst. Luftfahrt*, **1932**, 13).—The shear strength of spot-welded Duralumin sheets 3 mm. thick is 15 kg./mm.^{2} immediately after removal from the machine, but rises to 19 kg./mm.^{2} after another ageing treatment.—B. Bl.

Appropriate Methods for Welding Duralumin and Zinc Sheet. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1932, **8**, 97–98).—A description of the properties and composition of Duralumin is followed by an enumeration of the precautions to be observed in welding; the use of a flux containing 5% of silicon is recommended, so as to retard the solidification of the weld. The advantages of subsequent heat-treatment are emphasized, and relevant details are given. The (acetylene) welding of zinc sheet is then described, with special emphasis on the use of a very small excess of acetylene in the flame.
—P. M. C. R.

XXI.—INDUSTRIAL USES AND APPLICATIONS

(Continued from p. 56.)

Bearing Materials. Anon. (*J. Commerce* (*Ship and Eng. Edn.*), **1932**, Sept. 22, 1 and 3).—In a description of bearing materials used in marine engineering special reference is made to their various applications, and it is stated that for ordinary purposes and under normal running conditions white-metal alloys yield excellent results. A useful table of bearing pressures for various materials is also given.—J. W. D.

Aluminium in the Food Industry. Anon. (*Food Technology*, 1932, **2**, 72–73).—A review.—E. S. H.

New Motor Delivery Vans for Milk in Rome. Anon. (*Alluminio*, 1932, **1**, 312–314).—Motor vans of two types made from aluminium and light alloys are described; one type is used for collecting the milk in the country and the other for delivering it in the city.—G. G.

Aluminium as a Constructional Material for Transport Tanks. Kurt Riecius (*Metallwirtschaft*, 1932, **11**, 426–429).—The legal requirements for the use of aluminium for railway tank wagons and tank lorries are summarized. Motor fuels do not attack aluminium so long as they contain less than 3% of alcohol. With a higher alcohol content corrosion is only slight and there is no danger of reducing the strength of the tank.—v. G.

Aluminium Plant for Spirit Varnishes and Cellulose Lacquers. J. Brock (*Paint and Colour Record*, 1931, **1**, 137; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1931, (**24**), 288).—The various types of aluminium plant suitable for spirit and cellulose varnish production are detailed, with illustrations.—S. G.

Rendering Automobile Tyres Puncture Proof [with Aluminium Discs]. Anon. (*Aluminium Broadcast*, 1932, **3**, (38), 16).—Aluminium discs, ⅜ in. in diam. and 5 to 10 mils. thick, introduced into automobile tyres are forced against any hole by the escaping air and form an efficient seal.—J. C. C.

Piston Manufacture. Anon. (*Automobile Eng.*, 1932, **22**, 549–553).—Methods employed in the production of a piston made up of two parts are described. The head is machined from a die-casting in aluminium alloy, whilst the skirt is machined from a tube of case-hardened steel, both parts being spigoted together. The construction, while allowing the lightness usually associated with alloy pistons, gives also the superior wearing qualities of the ferrous metals.—J. W. D.

Aluminium Alloys for Pistons. N. F. Bolchovitinov (*Liteinoe Delo* (*Foundry Practice*), **1932**, (2), 7–8).—[In Russian.] The basic requirements to which aluminium alloys for pistons must conform are: sufficient hardness at temperatures up to 400° C., low coeff. of expansion, and high thermal conductivity. The alloys considered most suitable for this purpose contain: (1) "SAE 34" (American): copper 10, magnesium 0·25, iron 1·2%, rest aluminium; (2) "SAE 32" (American): copper 10, magnesium 2, iron 1·2, silicon 0·6%, rest aluminium; (3) alloy "No. 132": silicon 14, nickel 2·3, magnesium 1, copper 0·8, and iron 0·7%, rest aluminium; (4) "Y" alloy (English): copper 4, nickel 2, magnesium 1·5%, rest aluminium.—N. A.

Duralumin Pit Cages. Marcel Pubellier (*Rev. Ind. minérale*, 1931, (**259**), 313–314; discussion, 314–315; and (summary) *Colliery Guardian*, 1932, **144**, 694).—Duralumin may advantageously replace steel in winding cages on the grounds of (1) reduction in dead weight and consequently in maintenance costs; (2) increase in useful load; (3) increase in depths worked. Instances are quoted of the successful use of these cages, resulting in considerable economy.—P. M. C. R.

The Design of Aluminium Alloy Travelling Cranes. E. C. Hartmann (*Metal Stampings*, 1932, **5**, 595–598).—Cf. this *J.*, 1932, **50**, 181. Describes the principles and practices to be followed in the application of aluminium alloys to the manufacture of travelling cranes.—J. H. W.

Aluminium Window Panes are Newest Feature in Germany. Anon. (*Daily Metal Reporter*, 1932, 32, (195), 6).—Aluminium "glass," produced in Germany from metallic aluminium, is said to be a suitable material for windows, glass roofs, and skylights. It eliminates the yellow rays of the sun, and, while partly transparent, retains some metallic properties.—P. M. C. R.

Metallized Papers. Anon. (*World's Paper Trade Rev.*, **1932**, June 2; and (abstract) *Aluminium Broadcast*, 1932, 3, (33), 15).—Metallized cardboard coated with aluminium foil having a thickness of about 0·01 cm. should be distinguished from cardboard coated with silver or aluminium paper.—J. C. C.

Advantages and Disadvantages of Aluminium Paints. H. A. Gardner (*Amer. Paint Varnish Manuf. Assoc. Circ.* No. **412**, 1932, 181–207; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (28), 214).—A high-grade mixing liquid is essential for carrying aluminium powder. Aluminium paint has been used satisfactorily as primer on refractory woods and also for a complete surface coating of timber at saw-mills. Aluminium paints are inferior to high-grade basic or chromate paints for the inhibition of rust on steel and are inferior to moderate chalking white paints in preventing heat absorption by tanks containing volatile liquids. Aluminium paints are not so good as white paints for diffuse reflection of light, and the latter are preferable in factory interiors.
—S. G.

Aluminium Paints. Anon. (*Farbe u. Lack*, 1931, 36, 544; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (25), 10).—The particular advantages claimed by American producers for aluminium powders are contested. It is considered that: an aluminium ground is not superior to a lithopone ground; aluminium paints adhere to damp surfaces no longer than other paints; it is not certain that aluminium combines with water glass to the extent necessary when applied to cement and concrete, &c. Aluminium has its place as an impervious top coat, as a protection against sunlight, and as a coating for radiators and pipes. A disadvantage is its slow drying.—S. G.

Aluminium Paint. Anon. (*Peintures, Pigments, Vernis*, 1931, 8, 1551–1552; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1931, (22), 184).—The use of aluminium paints on ships is rapidly increasing. Such paints are extremely resistant to corrosion, and on account of their high opacity and reflecting power are also resistant to the destructive action of ultra-violet light. The lightness of aluminium paints, which weigh only about 1 kg./litre, is also a very great advantage for this type of work, and as regards appearance, internal lighting, and ease of application they compare favourably with other types of paint.
—S. G.

Aluminium Powder and Coloured Bronzes in the Paint Industry. H. Rabate (*Peintures, Pigments, Vernis*, 1932, **9**, 40–50, 61–68, 79–84, 97–105; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (26), 47, 141, 145).—(I.) The manufacture and characteristics of aluminium powder are described. Coloured "bronzes" in a range of shades may be obtained from various alloys of copper and zinc, and may also contain tin and lead according to the alloy from which the powder is made. Many such alloys are described in detail. Tinted bronzes are obtained by oxidizing ordinary bronze powder or by tinting aluminium powder with dyestuffs, those employed being mainly from the azo, thiazol, and acridine series, and derivatives of di- and tri-phenylmethane. (II.) Linseed oil, preferably boiled or blown, may be used as a medium for aluminium paints, but more impermeable and durable films are given by tung oil. Other media, very suitable for many purposes, are oil varnishes, cellulose lacquers, asphalt varnishes, and potassium and sodium silicates. The paints are made by simple mixture of powder and medium, grinding on a palette for a few minutes. Recipes and instructions for making aluminium

paints of all kinds are included, together with details of application conducive to good results. The drying of these paints depends entirely on the medium used. (III.) Some requisite characteristics of bronzing varnishes are given together with numerous formulæ. (IV.) The chief characteristics of aluminium paints are described. They are easy to prepare and to apply, the surface covering power is high, and the opacity is very high indeed. The reflecting powers for visible light, ultra-violet radiation, and heat are high; data are given comparing aluminium paints with others in this respect. Aluminium paints are poor radiators and have good heat-resisting powers.
—S. G.

Aluminium as a Pigment for Paint. Anon. (*Decorators' and Painters' Mag.*, 1931, **30**, 562; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1931, (**21**), 107).—The many desirable properties of aluminium are due to the formation of a metallic layer. It is useful as a water-proofing agent and as a primer over creosote or bituminous preparations. Tung oil is considered the best medium.—S. G.

Rubber–Aluminium Heat-Resisting Paint. C. F. Willard (*Rubber Age* (*N.Y.*), 1931, **28**, 352; *Rubber Res. Abs.*, 1931, **9**, (1), 42).—Cf. this *J.*, 1932, **50**, 374). Aluminium powder is mixed with a rubber solution made up from devulcanized rubber. Iron plates painted with this paint may be heated to a bright red heat (950°), and when the metal cools down the paint is unaffected and retains its bright silvery colour. Its covering power is good, and it can be used to resist heat where other aluminium paints will not stand.—S. G.

Aluminium Powder and Fire-Resisting Paint. Anon. (*Rev. Aluminium*, 1932, **9**, 1821–1824).—An account of the application of aluminium powder as a fire-resisting paint is given.—J. H. W.

Aluminium Inks and Paints. Anon. (*Paint Manuf.*, 1931, **1**, (8), 215; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1931, (**24**), 287).—A series of dyeing processes makes it possible to obtain the whole range of metallic tints using, as the base, aluminium powder which should be 97% pure. The flakes, after degreasing, are treated with a mordant and an inorganic fixer and then shaken in a concentrated solution of coal-tar colour. The metallic powder should be mixed into the vehicle just before use. Inks generally contain about 40% of powder and a minimum amount of drier, the actual formulation depending on the kind of paper and the character of the design. A long wood oil varnish base yields the best aluminium paints with 2¾ to 2½ lb. of powder per gall. A special high-temperature-resistant aluminium bituminous paint consisting of 3 parts aluminium, 5 parts rosin, and 5 parts petroleum tar when applied to hot metal gives protection up to 900° F. (482° C.). Other typical uses of aluminium powder are described, as also is a test for the "leafing" quality.
—S G.

How to Use Metallic Inks. J. Maff (*Amer. Ink Maker*, 1931, **9**, (11), 25; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1931, (**24**), 288).—In using metallic inks the rollers should be set high to pass lightly over the form. Packing should be soft and cushiony, and a very light compression should be used. Recipes which are given for mixtures of varnish and gold–bronze or aluminium powder include notes on the difficulties met with when using papers of different absorbent qualities.—S. G.

Beryllium and Its Alloys. Anon. (*Rev. Chim. Indust.*, 1932, **41**, 278–281). —A review of the applications of beryllium and its alloys, especially those with copper, cobalt, and nickel.—E. S. H.

Low-Melting-Point Alloys Developed [Bendalloy]. Anon. (*Automotive Ind.*, 1932, **66**, 881).—The use of Bendalloy, a bismuth–tin–lead–cadmium alloy, is described. The melting point is stated to be 77·4° C. and tubes filled with Bendalloy before bending can easily be charged and emptied. A somewhat similar alloy ("Sealalloy") is used for making liquid-proof joints between glass and metal tubing.—P. M. C. R.

On Possible Applications of Beryllium Alloys in Machine Construction. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1931, 7, 124).—The beryllium alloys, combining lightness, strength, and high resistance to corrosion, seem especially suitable for use in the pharmaceutical and food industries. The properties of beryllium are enumerated, and some of its alloys, especially the beryllium–bronzes, are considered. The cast bronzes containing 2·5% of beryllium have an ultimate tensile stress of 88 kg./mm.^{2}, with an elongation of 36%; correct treatment produces from this a spring material, with an ultimate stress of 135 kg./mm.^{2} and an elongation of about 2%; these values can be modified as required by varying the heat-treatment. Springs of this material, whether of spiral or laminated form, showed marked superiority to steel springs of corresponding type.—P. M. C. R.

Tentative Specifications for Seamless Copper Tubing, Bright-Annealed (B 68–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 239–241; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 679–681).—Cover annealed copper tubing suitable for use in refrigerators, oil lines, gasoline lines, &c., where tubing absolutely free from scale or dirt is required. The tubing shall be made from copper that has been deoxidized; it shall be bright-annealed after the last drawing operation or after cold-coiling, if coiling is required; and it shall be thoroughly recrystallized and have an average grain-size not exceeding 0·040 mm. in diam. The material shall conform to the following requirements as to chemical composition: copper, 99·90% min.; phosphorus, 0·10% max. The sample for chemical analysis shall consist of drillings, millings or clippings taken from each lot of 5000 lb. or fraction thereof, and shall be divided into 3 equal parts, each of which shall be placed in a sealed package for (1) seller; (2) purchaser; (3) umpire. The minimum requirements as to physical properties are: tensile strength, 30,000 lb./in.^{2}; elongation, 40% on 2 in. The material shall be capable of expanding on a hardened and ground, tapered steel pin having an inclined angle of 60°, to the following amounts (expansion of outside diam., %): up to 1 in. outside diam. 40%; over 1 in., 30%.—S. G.

Tentative Specifications for Fire-Refined Copper Other than Lake (B 72–32T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 223–225; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 663–666).—Cover fire-refined copper, other than Lake, and not usually electrolytically refined. Fire-refined copper, other than Lake, is intended for use in rolling into sheets and shapes for mechanical purposes, and is not intended for electrical purposes or wrought alloys. The requirements as to chemical composition for all shapes are (%): copper + silver, 99·7000 min.; arsenic, 0·1000 max.; antimony, 0·0120 max.; bismuth 0·0020 max.; iron, 0·0100 max.; lead, 0·0100 max.; nickel, 0·1000 max.; oxygen, 0·0750 max.; selenium, 0·0400 max.; tellurium, 0·0140 max.; tin, 0·0500 max. The chemical analysis is to be carried out in accordance with "Standard Methods of Battery Assay of Copper" (B 34). Wire-bars, cakes, slabs, and billets shall be substantially free from shrink holes, cold sets, sloppy edges, concave tops, and similar defects in set or casting. This requirement does not apply to ingots or ingot bars, in which case physical defects are of no consequence.—S. G.

Copper in the Electrical Industry. H. C. Jennison (*Engineering J.*, 1931, 14, 137).—Very brief note of an address, mentioning the drawing of a 1 in. diam. copper bar to a diam. of 0·002 in., without annealing.—H. F. G.

The Manufacture of Copper Firebox Plates. W. F. Brazener (*J. Inst. Loco. Eng.*, 1932, 22, 447–500; and (abstract) *Locomotive*, 1932, 38, (477), 181).—A full account is given of the operations of melting, poling, casting and rolling arsenical copper for firebox plates. The advantages claimed for 2% nickel–copper alloy, deoxidized copper, and silver–copper for this purpose are outlined. Some interesting examples of "gassed" plates are illustrated in the discussion.—J. C. C.

The Development of Standard Sheet DIN 1705. —— Schwietzke (*Z. ges. Giesserei-Praxis : Das Metall*, 1931, **52**, 4–5).—Abstract of a paper read before the Fachausschuss für Werkstoffe im Verein Deutsche Ingenieure. Standard bronze is an alloy of copper and tin alone. If it is deoxidized with lead, it has the characteristics of a phosphor-bronze. Red brass is an alloy of copper, tin, and zinc and, if necessary, lead. Special bronzes contain at least 78% of copper; only copper–zinc alloys are brasses. The compositions, specifications, and mechanical properties of various bronzes and brasses are given. Bismuth, aluminium, magnesium, and sulphur must be present only in traces in these alloys, and arsenic only up to 0·2%.—J. H. W.

Applications of Standard Alloys of Brass and Bronze in the German Industry and the Rôle of the Gesamtverband Deutscher Metallgiessereien as Intermediary between the Manufacturer and the Consumer. D. Reiff (*Z. ges. Giesserei-Praxis : Das Metall*, 1931, **52**, 9; discussion, 9–10).—Abstract of a paper read before the Fachausschuss für Werkstoffe im Verein Deutsche Ingenieure. Standardization of non-ferrous alloys tends to raise the price, but nevertheless the Gesamtverband Deutscher Metallgiessereien is in favour of it. To ascertain current practice, the society sent a questionnaire to a number of manufacturers on the manufacture of brass and bronze articles; the answers received are here summarized.—J. H. W.

Notes on the Applications of Brass and Bronze in the German Railways, and the Testing of these Alloys in the Foundry Trade. —— Reitmeister (*Z. ges. Giesserei-Praxis : Das Metall*, 1931, **52**, 10; discussion, 10–12).—Abstract of a paper read before the Fachausschuss für Werkstoffe im Verein Deutsche Ingenieure. In the original paper, the tests applicable to brasses and bronzes are summarized. The chemical composition alone is no criterion of the value of an alloy. The mechanical properties can be improved by adding oxides to neutralize the injurious effects of over-reduction. For the detection of faulty material, the deep-etching process of F. W. Graham and L. A. Meiss is recommended. In the discussion, the use of X-ray analysis, the resistance to corrosion of the alloys, and the composition of special bronzes for marine work, armatures, electrical machinery, and automobiles are discussed.—J. H. W.

Use of Tin–Bronze with High Lead Content for Bearings. R. Schulze (*Giesserei u. Masch. Zeit.*, 1932, **5**, (6/7), 10–11).—The use of bronzes containing high percentages of lead is advocated for bearing purposes. Results are given indicating that losses due to friction are less than normal, principally owing to the fact that lead is insoluble in copper and remains as rounded globules. These work out and produce an extended film of lead. The alloys must be cast from temperatures above 1000° C. into green-sand moulds. An addition of 1–2·5% nickel increases the hardness considerably. Alloys containing up to 20% lead, together with copper 75% and tin 5%, are recommended.—W. A. C. N.

The Metal Constituents in Bright Gold. I.—The Heat-Resisting Metals. II.—The Fastening Effect of Bismuth. III.—Metals Other Than Bismuth and Rhodium. Akira Nakatsuchi (*Kōgyō Kwagaku Zasshi* (*J. Soc. Chem. Ind. Japan*), 1931, **34**, (5); *C. Abs.*, 1931, **25**, 4992).—[In Japanese, with English abstracts in supplemental binding, pp. 164–165, 165–166, 166.] (I)—Balsam gold, used to decorate ceramic ware, shows grain-growth if heated above 500° C. Rhodium is the best preventative up to 768° C., but a slight excess causes the metal film to blacken and grain. Aluminium, thorium, and tin can be used for temperatures up to 700° C.; iron, chromium, antimony, ruthenium, nickel, cobalt, and iridium up to 650° C.; alkali metals, strontium, barium, lead, cadmium, uranium, silver, manganese, palladium, and platinum have a slight effect; zinc, magnesium, bismuth, copper, and calcium have no effect. (II)—Bismuth resinate causes a gold film to adhere to the surface of pottery. Too much produces grain-growth and a greyish-white colour. The best results are obtained by the addition of rhodium also and then slowly heating to 760° C. (III)—If the mixture gold, rhodium and bismuth gives grain-growth this may be prevented by the addition of chromium, aluminium, iron and ruthenium. As much as 1·27% chromium darkens the film.—S. G.

On the Production and Uses of Indium. Anon. (*Metallwirtschaft*, 1932, **11**, 476–477).—A review.—v. G.

Metals in the Government Printing Office. M. W. von Bernewitz (*Min. and Met.*, 1932, **13**, 324).—Excerpts from the report of the (American) Public Printer are quoted showing the quantities of the various type metals used, their composition and sphere of usefulness.—A. R. P.

Metal Spraying [Lead] as Finish for Stone and Iron. W. G. Raffé (*Brit. Indust. Finishing*, 1931, **2**, (13), 16; *Res. Assoc. Brit. Paint. Manuf. Rev.*, 1931, (20), 98).—An account of Schoop's metallization process for the application of lead to stone or iron.—S. G.

Lead Water Supply Line 200 Years Old is Found. Anon. (*Daily Metal Reporter*, 1932, **32**, (210), 4).—A lead water-pipe, installed not later than 1733, has been discovered in a good state of preservation in Gross Sedlitz, Saxony. The pipe was evidently cast in a pipe-shaped mould, since it is seamless. Iron couplings joining pipe sections were almost entirely destroyed by corrosion. —P. M. C. R.

Lead Poisoning from Drinking-Water. F. Tödt (*Zentr. Gesundheitstech.*, 1931, **3**, 8–10; *C. Abs.*, 1932, **26**, 5680).—Cf. this *J.*, 1932, **50**, 379. Lead from water-pipes is especially soluble in soft water, and because of its accumulation in the body may cause poisoning. A lead content of not more than 0·3 mg./litre is allowed in Germany. The limits in America are 0·025–0·1 mg./litre. —S. G.

Pipe-Jointing Compounds and Materials. D. W. Robinson (*Southwest Water Works J.*, 1932, **14**, (2), 17–19; *C. Abs.*, 1932, **26**, 4396).—Methods of preparation of joints and advantages and disadvantages of lead, Leadite, Hydrotite, Mineralead, and Portland cement are given.—S. G.

Investigations on Aircraft Braking. Franz Michael (*Z. Flug. u. Motor.*, 1931, **22**, 302–312).—On account of its low sp. gr., Elektron (cast) is preferred as material for braking screws and disc wheels.—P. M. C. R.

Tentative Specifications for Low-Carbon Ferro–Molybdenum (A145–32T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 194–195; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 638–639).—Unless otherwise specified, the material shall be furnished crushed to a size of 1 in. or less. The requirements as to chemical composition are: carbon, 0·25% max.; molybdenum, 55·00–65·00%; silicon 1·50% max.; sulphur, 0·25% max.; phosphorus, 0·10% max.; copper, 0·25% max. The sampling shall be carried out in accordance with the procedure for high-carbon ferro-chromium, chromium metal, low-carbon ferro–manganese, and manganese metal described in "Standard Methods of Sampling Ferro-Alloys" (A103). The chemical analysis is to be carried out in accordance with the procedure for ferro–molybdenum in "Tentative Methods of Chemical Analysis of Ferro–Tungsten and Ferro–Molybdenum" (A104–32T).—S. G.

The Use of Pure Nickel in Food Preparation. Anon. (*Canning Trade J.*, 1932, **2**, 69–75).—A review of nickel apparatus suitable for preliminary treatment of foodstuffs, refrigeration, emulsification, mixing and stirring, boiling *in vacuo*, filtering, fruit-juice processing, conveying, distillation, and packaging.—E. S. H.

Tentative Specifications for Ferro–Tungsten (A144–32T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 190–191; and *Proc. Amer. Soc. Test.*

Mat., 1932, 32, (I), 636–637).—Unless otherwise specified, ferro-tungsten shall be furnished crushed to a size of 1 in. or less. The requirements as to chemical composition are: tungsten, 75·00–85·00%, as specified; carbon, 0·75% max.; phosphorus, 0·06% max.; sulphur, 0·06% max.; silicon, 1·00% max.; manganese, 1·00% max.; copper, 0·15% max.; arsenic, 0·10% max.; antimony, 0·08% max.; tin, 0·10% max.; sum of arsenic, antimony and tin, 0·20% max. The sampling is to be carried out in accordance with the procedure for high-carbon ferro-chromium, chromium metal, low-carbon ferro-manganese, and manganese metal described in "Standard Methods of Sampling Ferro-Alloys" (A103). The chemical analysis is to be carried out in accordance with the procedure for ferro-tungsten in "Tentative Methods of Chemical Analysis of Ferro-Tungsten and Ferro-Molybdenum" (A104–32T).—S. G.

The Protection of Concrete by Means of Metallic Coatings [Zinc and Lead]. R. Grün (*Zement*, 1931, 20, 855–858; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (37), 192).—These tests have been carried out on cubes of concrete coated by means of bitumen, zinc and lead. The application of metallic coatings has been effected by spraying metallic powders through a blowpipe. The cubes so treated have been kept in 5% hydrochloric acid or in a 5% solution of ammonium sulphate, or 10% magnesium sulphate. Examination of results proves that bitumen applied with care constitutes a good coating; it protects the concrete against the action of salt solutions and even of free acids. The mechanism of corrosion is explained by lack of adhesion of the coating, or by diffusion of the solution through the film of bitumen. In the first case the corrosive solution penetrates through cracks and detaches the bitumen. In the second case, the film of bitumen functions as a semi-permeable membrane and diffusion of salt solutions takes place according to the law of osmosis; the destruction of the coating is preceded by the formation of blisters. The metallic coats applied by spraying have a surprising protective power against corrosive waters and free acids. The smoother the surface of the concrete the greater the efficiency.—S. G.

Notes on the Oxidation of Metallic Hulls and the Means of Preserving Them from Rust. Galvanic Effects on the Sterns of Boats [Use of Zinc Plates]. H. Masseille (*Peintures, pigments, vernis*, 1932, 9, 106–109; *C. Abs.*, 1932, 26, 5057).—The use of zinc plates as a means for preventing the corrosion of the hulls of ships is discussed, with diagrams.—S. G.

The Effect of Metals on the Vitamin Content of Milk. Martin Schieblich (*Deut. Nahr. Rundschau*, 1932, 19, 150; *C. Abs.*, 1933, 27, 143).—Milk was pasteurized in copper, aluminium, and nickel vessels and a small amount of these metals was taken up. Copper destroyed vitamin C, while aluminium had no effect. Nickel had no effect on the vitamins A, B, and C.—S. G.

Material Questions in the Construction of Aeroplanes. Paul Brenner (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1932, *V*1–*V*12).—Duralumin has given excellent service in the construction of land aeroplanes and the corrosion difficulties met with in seaplane construction can be effectively overcome by using plated alloys or by artificial oxidation of the surface as well as by structural precautions. Magnalium, which is free from copper, will probably give excellent service in seaplane floats. The disadvantage of low endurance strength in aluminium alloys is practically counterbalanced by their relative small sensitivity to local stress concentration at points where there is a sudden change in cross-sectional area, or where there are notches. Magnesium alloys, taking into account the difference in weight, have just as good, and sometimes better, mechanical properties than Duralumin. Their endurance strength is good, but their sensitivity to notches is greater than that of Duralumin. Owing to their poor resistance to sea-water, they cannot be used in building seaplanes.—B. Bl.

XXII.—MISCELLANEOUS

The Work of S. F. Schemtschushny on Metal Alloys. S. A. Pogodin (*Izvestia Instituta Fiziko-Khimicheskago Analisa* (*Annales de l'Institut d'Analyse Physico-Chimique*), 1931, 5, 21–27).—[In Russian.] The 29 papers of S. on metal alloys are briefly summarized and a cross-reference given to the complete list of his works on p. 7 of the issue.—M. Z.

[A Review of Some of the Main Features in Metallurgical Developments during the Present Century.] Robert Hay (*Met. Ind.* (*Lond.*), 1932, **41**, 394).—Chairman's address to the Scottish Local Section of the Institute of Metals, comprising a review of modern methods of extracting base metals from their ores, the production of new alloys, and the consumption of gold.—J. H. W.

Research and Development in Metallurgy. C. E. MacQuigg (*J. Franklin Inst.*, 1932, **213**, 583–604).—A general paper, dealing with advances in both ferrous and non-ferrous metallurgy. The value of research to industry is emphasized.—S. V. W.

Restoration of Antique Bronzes. Umberto Cialdea (*Mouseion*, 1931, **16**, 57–65; *Tech. Studies Field of Fine Arts*, **1**, (1), 41; *C. Abs.*, 1932, **26**, 5890).—An outline of the principal methods used for restoring antique bronzes.—S. G.

The Copper Situation. Arthur Notman (*Canad. Min. Met. Bull.*, 1932, (**245**), 353–367).—A discussion of the economics of the copper industry.—E. S. H.

Copper. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 129–130).—A discussion of the difficulties likely to arise in the event of British Empire preference duties being applicable to all qualities of copper.—R. G.

The Magnesium Industry in France. F. Ravier (*Chimie et Industrie*, 1931, **26**, 1263–1270; **27**, 31–40).—Magnesium is compared with aluminium from the physical, chemical and economic points of view. A full historical account is given of the development of the metal, from its discovery by Bussy in 1830 until the present day. The methods for the separation of magnesium are divided into groups. In the first the uneconomical decomposition of anhydrous magnesium chloride by sodium is considered. In the second are those processes which involve the reduction of oxygen compounds of magnesium at high temperature by a metal which is only slightly attacked at that temperature, *e.g.* tungsten and molybdenum, and a final reduction by hydrogen. The method is difficult to carry out on a large scale. The third group is confined to the electrolytic methods by which the major portion of the metal is produced at the present time—from chloride and fluoride baths. A special discussion is devoted to the factors influencing the percentage production, *e.g.* impurities, humidity, construction of the cell, and the operating details. The temperatures of solidification of various bath compositions are tabulated side by side with their essential physical properties. Illustrations of various furnace arrangements accompany the article.—W. A. C. N.

Nickel. G. C. Bateman (*Engineering J.*, 1931, **14**, 42).—Brief report of an address on the history of the nickel industry.—H. F. G.

Production of Compact Tungsten Metal. N. M. Zarubin and I. P. Molkov (*Zvetnye Metally* (*The Non-Ferrous Metals*), 1931, **6**, 1232–1258; *C. Abs.*, 1932, **26**, 4280).—[In Russian.] A general description of the process.—S. G.

Lead Poisoning and Its Importance from the Point of View of the Zinc Industry. —— Urtel (*Z. Oberschles. Berg-u. Hütt. Ver. Katowice*, 1931, **70**, 177–181; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (**25**), 39).—Lead is frequently found as an impurity in zinc compounds, and workmen handling zinc oxide and zinc are liable to poisoning from this source. The chief symptoms are enumerated, and the use of respirators recommended.—S. G.

XXIII.—BIBLIOGRAPHY

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[This directory of the products of the members of the Association of British Chemical Manufacturers—whose combined capital exceeds £200,000,000—is printed in six labguages: English, French, German, Italian, Portuguese, and Spanish. It should prove invaluable to overseas purchasers.]

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XXIV.—BOOK REVIEWS

(Continued from pp. 60–61.)

Die Ungünstige Lage der Fertigwarenindustrie in N[icht]-E[isen] Metallen und Ihre Gründe. Von —— von Schoenbeck. Cr. 4to. Pp. 138. 1930. Berlin: NEM-Verlag, Matthäikirchstr. 10, W. 10. (R.M. 8).

This book is an attempt to review the position of the German non-ferrous metal industry at the end of 1929 with special reference to those industries manufacturing small metal articles from tin soldiers and other toys to hollow-ware of all kinds. Most of the information published has been gathered from the replies to questionnaires sent to Chambers of Commerce and individual manufacturers and the position of the different industries is summarized in 35 short articles. This review is prefaced by a historical sketch of the development of the industries in the Nürnberg–Fürth and Lüdenscheid–Iserlohn districts and by statistics of the imports and exports for the years immediately preceding and succeeding the War, and is followed by discussions of the costs of production before and after the War, the effect of tariffs and taxes on sales at home and abroad, and the causes of the great decline in this branch of the non-ferrous metal industry. Since the book was written there is little doubt that conditions have changed very considerably, yet non-ferrous manufacturers and economists will find much of interest to themselves in studying this careful analysis of the effect of adverse economic conditions on a once-flourishing industry.—A. R. POWELL.

Einführung in die Praktische Metallographie. Von Bernward Garre. (Breitensteins Repertorien, Nr. 76.) Cr. 8vo. Pp. 52, with 53 illustrations in the text. 1932. Leipzig: J. A. Barth. (Br. R.M. 4.20.)

In this small book a successful endeavour has been made to give an introduction to a study of metallography and to its applications in industrial work. Divided into three principal sections, it touches on all the fundamental points in connection with general principles, and with the ferrous and the non-ferrous metals and alloys. A very notable feature is the clarity of the diagrams. Some of them are unusual in character, but exhibit the features they are intended to explain more clearly than in the vast majority of other books. Sketches of the normal structures to be expected are inserted below related points on the equilibrium diagrams. For elementary instructional purposes the book is well worthy of perusal.—W. A. C. NEWMAN.

Proceedings of the Thirty-Fifth Annual Meeting [of the American Society for Testing Materials], held at Atlantic City, N.J., June 20–24, 1932. Med. 8vo. Volume 32. **Part I.—Committee Reports; New and Revised Tentative Standards.** Pp. 1071, illustrated. **Part II.—Technical Papers.** Pp. 824, illustrated. 1932. Philadelphia, Pa.: American Society for Testing Materials, 1315 Spruce St. (Paper, $5.00; half-leather, $7.00, per part.)

Part I of the 1932 *Proceedings* contains the annual reports of the many committees of the Society and the technical papers and standards appended thereto. The annual address of the President, entitled "Research and the American Society for Testing Materials," and the report of the Executive Committee are also included.

The reports of the standing, research, and sectional committees which function in the *ferrous metals* field include such subjects as the following: steel; wrought iron; cast iron; malleable iron castings; ferro alloys; iron–chromium, iron–chromium–nickel, and related alloys; heat-treatment of iron and steel; corrosion of iron and steel; zinc coating of iron and steel; magnetic properties; fatigue of metals; effect of temperature on the properties of metals. Papers appended to reports in this group include a summary of present-day knowledge of corrosion-fatigue of metals and on the significance and limitations of fatigue test results, a correlation of tension, creep and fatigue tests of 0·17 per cent. carbon steel at elevated temperatures, and a co-operative study of Charpy notched-bar impact properties, magnetic properties and structural stability of the 18 per cent. chromium, 8 per cent. nickel, "stainless" steels under different conditions of treatment.

The reports of the *non-ferrous* committees cover their activities in the following fields: copper wire; corrosion of non-ferrous metals and alloys; electrical heating, electrical-resistance, and electric-furnace alloys; copper and copper alloys, cast and wrought; die-cast metals and alloys; light metals and alloys, cast and wrought. A paper analyzing the data on physical properties of aluminium-base die-casting alloys is appended to the report on die-cast metals and alloys. The 1932 report of the Committee on Corrosion of Non-Ferrous Metals and Alloys describes its very extensive test programme and includes detailed descriptions of recommended practices for several laboratory accelerated corrosion tests.

Reports covering non-metallic materials include refractories, coal, and coke.

Other reports involve methods of testing, metallography, and nomenclature and definitions. Part I also includes the 85 tentative standards issued or revised in 1932, as well as the many tentative revisions in standards.

Part II includes many papers dealing with important problems and subjects relating to the ferrous and non-ferrous metals industries. Ten extensive papers are grouped in the Symposium on Steel Castings, covering statistics, specifications, design, physical and mechanical properties, corrosion, heat-treatment and welding of both carbon-steel and alloy-steel castings. This symposium comprises 250 pages.

The 82-page report of the extensive research investigation on embrittlement of hot-galvanized structural steel is given. Other papers cover mechanical and magnetic properties of 1·21-per cent. carbon tool steel, testing of rope wire and wire rope, fatigue of shafts with keyways, and effect of zinc coatings on the endurance properties of steel. There are papers on factors affecting the Preece test for zinc coating and mechanism of deformations in grey iron.

Papers of interest to members of the Institute of Metals are: S. Epstein: "Embrittlement of Hot-Galvanized Structural Steel"; W. H. Swanger and R. D. France: "Effect of Zinc Coatings on the Endurance Properties of Steel"; H. H. Walkup and E. C. Groesbeck: "Some Factors Affecting the Preece Test for Zinc Coatings"; C. L. Clark and A. E. White: "Influence of Recrystallization Temperature and Grain-Size on the Creep Characteristics of Non-Ferrous Alloys"; H. B. Gardner and C. M. Saeger, Jr.: "Factors Affecting the Physical Properties of Cast Red Brass (85 Cu, 5 Zn, 5 Sn, 5 Pb)"; H. K. Herschman and J. L. Basil: "Mechanical Properties of White-Metal Bearing Alloys at Different Temperatures"; W. H. Bassett, Jr., and C. J. Snyder: "Method of Preparation of Lead and Lead Alloy Cable Sheath for Microscopic Examination"; N. B. Pilling: "Effect of Cold-Working on the Izod Notched-Bar Impact Value of Monel Metal"; M. F. Sayre: "Thermal Effects in Elastic and Plastic Deformation"; H. F. Moore, J. C. Othus, and G. N. Krouse: "Full-Load Calibration of a 600,000 lb. Testing Machine"; R. L. Templin: "An Automatic Autographic Extensometer for Use in Tension Tests of Materials."

Abstracts of all of the above papers, and of those committee reports and tentative standards of interest to members of the Institute of Metals, have already been published in this *Journal*. Abstracts of some of the discussions will be published shortly.

The volumes fully maintain the high standard of the previous publications of the American Society for Testing Materials.

Chemical Encyclopædia. A Digest of Chemistry and Its Industrial Applications. By C. T. Kingzett. Fifth edition. Med. 8vo. Pp. viii + 1014. 1932. London: Baillière, Tindall, and Cox. (40*s*. net.)

The scope and character of this book are now so well known as not to require further description (cf. reviews of earlier editions in this *J*., 1924, **32**, 729, and 1928, **39**, 737). In compiling this edition the author claims to have meticulously revised and rigorously condensed or, where necessary, amplified certain sections, and to have introduced a considerable amount of new matter, so that it contains 200 more pages than its predecessor. Compared with the third edition, the metallurgical sections are improved, and many erroneous statements have been eliminated from the old matter, but other errors have been introduced with the new matter, so that there are still numerous quaint statements to be found throughout these sections. For example, another new method of making alumina (Pederson's) is stated to depend "upon the reduction of bauxite to aluminium oxide by means of iron ore instead of coal, crude iron being obtained as a by-product"; under the heading "Aluminium–Bronzes" the first sentence reads, "One consists of 9 parts of copper and 1 part of zinc, resembling gold in appearance"; many beryllium compounds "such as the fluorides (BeF and BeF_2)" are said to "resemble the corresponding aluminium compounds"; iridium tetroxide is said to be produced by heating the hydroxide in nitrogen at 350° C.; nickel is stated to be "best known as a black powder, but can be obtained as a bright, lustrous, white, ductile, malleable but tenacious metal of very hard character"; Stellite is a "hard, star-like, brilliant alloy"; uranium is stated to be the heaviest known element and to have an indefinite number of oxides. The author is very cautious in the statements he makes about radioactivity and associated phenomena; nearly all are made with the use of the words "surmized that," "stated that," "supposed to be" "regarded as," and the like; thus under uranium, appears the sentence, "As an element, uranium is the more interesting, as by some sort of molecular disintegration it is surmized to give rise to the production of not only radium and helium, but also some peculiar radium emanations (distinct in some respects from radium), and a peculiar form of lead." In most of the other headings of a metallurgical nature similar erroneous, misleading, or obscure statements may be found which detract greatly from the usefulness and reliability of the book to the non-chemical reader, to whom, presumably, the book should be of greatest value.

From what has been said, it will be seen that the author has still a long way to go before he produces the ideal Chemical Encyclopædia; he would do better to consult good text-books rather than articles of a review nature from the weekly trade press when compiling future editions.

—A. R. Powell.

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

1933 MARCH Part 3

I.—PROPERTIES OF METALS

(Continued from pp. 65–68.)

On the Recrystallization of Aluminium and of Some Age-Hardening Aluminium Alloys. H. Hanemann and R. Vogel (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1932, 4, 3–23).—Recrystallization diagrams have been prepared for hot-working aluminium and some aluminium alloys with copper 4–6, silicon 0·2–2, iron 0·2–0·4, and manganese 0–0·7%. All the alloying elements raise the recrystallization temperature of aluminium; small quantities of manganese tend to restrain, and increasing silicon content accelerates, recrystallization. With a low rate of hot-deformation a coarse grain structure develops during working, and this persists even after a high degree of deformation. Grain-growth is restrained in the direction of application of the deformation force, and the development of the unrestrained recrystallization structure depends on the destruction of the material surrounding the original grains; rolling being more efficient in this respect than pressing. The intergranular material is less effective in strongly worked metal than in cast metal. In forging age-hardenable aluminium alloys the following points should be borne in mind if coarse grain-growth is to be avoided: (1) the critical range of reduction is 5–20%, hence the forging temperature should be as high as possible, so that the minimum work is required to obtain the maximum deformation; (2) the forging should be done with the smallest number of powerful blows; (3) lapping of the surface must be avoided. In extrusion a low rate should not be used.—B. Bl.

Beryllium and Its Alloys (Collection of Translations of Foreign Articles). A. M. Botchvar and A. K. Grazianov (*Zhurnal Prikladnoi Chimii* (*Journal of Applied Chemistry*, 1932, 5, (2), 285).—[In Russian.] A brief review, edited by B. and G., of a collection of translated articles on beryllium: the "beryllium problem" is stated to have become an important one in the U.S.S.R., and requires solution.—M. Z.

The Anomaly of the Electric Resistance of Pure Bismuth. C. Drucker (*Z. physikal. Chem.*, 1932, [A], 162, 305–317).—The temperature coeff. of electrical resistance of extruded bismuth wires containing as impurity only 0·001% of copper and silver (measured with an accuracy of 0·2–1%) shows anomalies not only with respect to its absolute magnitude and sign, but also with respect to the temperature. The magnitude of the anomalies decreases with increasing extrusion temperature. Wires prepared at 100° C. or lower show a sharp jump in the negative coeff. to more negative values above this temperature; this jump disappears after heating at 130° C. In wires prepared at 100° or 225° C. the anomaly almost disappears when they are tempered above their extrusion temperature. Which assumptions are also necessary to explain the complex phenomena remains to be decided.—B. Bl.

Diamagnetism of Thin Films of Bismuth. C. T. Lane (*Nature*, 1932, 130, 999).—No variation could be found in the magnetic susceptibility of thin films of bismuth ranging from 0·2 to 15·0 μ, prepared by an evaporation process.—E. S. H.

New Revision of the Atomic Weight of Chromium. I.—Preparation and Analysis of Chromyl Chloride. F. González Núnez (*Anal. Soc. españ. Fis. Quim.*, 1932, 28, 579–586).—From the ratio CrO_2Cl_2 : 2Ag the atomic weight of chromium is calculated as 52·012 and 52·019 (volumetric), and, from the ratio CrO_2Cl_2 : 2AgCl, as 52·022 and 52·029 (gravimetric).—A. R. P.

On the Transformation of Cobalt. G. Wassermann (*Mitt. Material., Sonderheft* 21, 1933, 33–38).—See this *J.*, 1932, 50, 338.—J. W.

Enrichment of Copper with Cuprous Oxide during Heating. M. I. Sacharowa (*Zvetnye Metally* (*The Non-Ferrous Metals*), 1931, 949–964; *Chem. Zentr.*, 1932, 103, II, 3614).—[In Russian.] Variations in the casting temperature of copper between 1090° and 1240° C. and of the mould between 0° and 400° C. have practically no effect on the distribution of the cuprous oxide eutectic in the ingot, but affect only the crystal structure, which, however, apart from the effect of the eutectic, can cause trouble during rolling if it is too coarsely crystalline. A fine crystalline structure, on the other hand, facilitates a homogeneous distribution of the eutectic. On heating, the cuprous oxide coagulates into a coarse network. The scale which forms on the metal on heating in an oxidizing atmosphere is almost exclusively cuprous oxide, and under favourable conditions (at 700°–800° C.) may penetrate to 1/10 the thickness of the ingot.—A. R. P.

An Egyptian Axe-Head of Great Antiquity. (Sir) H. C. H. Carpenter (*Nature*, 1932, 130, 625–626).—An Egyptian axe-head, estimated to be about 6000 years old, was found to be coated with a thick patina of malachite and azurite; under this coating was a layer of cuprite, beneath which was the copper-coloured metal. The metal gave the following analysis: copper 97·35, nickel 1·28, arsenic 0·49, lead 0·17, iron 0·15, manganese 0·06%. Traces of tin and antimony were detected; the remaining 0·5% consisted of oxygen combined in the form of cuprite. It does not appear that the small quantities of metals were added for hardening purposes, but that they were present in the raw materials. Metallographic examination leads to the conclusion that the axe was cast roughly to shape, and then either cold-hammered and annealed or hammered when hot; afterwards, the axe was severely cold-hammered near the edge. Brinell hardness tests gave a value of 73 on the flat and a maximum of 85 on the cutting edge, confirming previous views on the permanence of cold-working (cf. this *J.*, 1931, 47, 375).—E. S. H.

The Influence of Impurities on the Properties of Lead. R. S. Russell and J. Neill Greenwood (*Proc. Australian Inst. Min. Met.*, 1932, 87, 135–166).—Three samples of lead were used in the tests: (*A*) commercial refined lead containing copper 0·0002, bismuth 0·0023, cadmium 0·0002, antimony 0·0040, iron 0·0007, zinc 0·0005, and silver 0·0003%; (*B*) specially purified (by fire-refining) lead containing copper 0·0002, bismuth 0·0009, cadmium 0·0001, antimony 0·00041, iron 0·00020, zinc 0·00023, and silver 0·00055%; and (*C*) electrolytically-refined lead obtained by electrolysis of (*A*) in an acid solution of lead perchlorate and containing copper 0·0001, bismuth 0·0004, antimony 0·00011, iron 0·00036, and zinc 0·00023%. The specimens were rolled to 2·5–20% reduction in thickness and annealed at 18°–175° C.; the grain-size was then examined after etching with a 7·5% solution of ammonium molybdate in 3*N*-nitric acid for 10 seconds. The results showed that *C* was much more susceptible to the effects of deformation and annealing than *A* and *B*; thus *C* recrystallized completely in 1·5 hrs. at 18° C. after a reduction in thickness of 5%, whereas *A* and *B* only partly recrystallized in 24 hrs. at 18° C. after a 20% reduction. These differences in behaviour are ascribed to differences in the composition, which, however, are extremely small, the total impurities in the samples amounting to only 0·008, 0·003, and 0·002%, respectively.—A. R. P.

Characteristics of Lead. G. W. Thompson (*Dutch Boy Quarterly*, 1931, 9, (2), 13–14).—A summary of the properties of refined, common, and chemical lead, and the effect of adding antimony, tin, or alkali metals.—E. S. H.

Changes in the Tensile Properties of Magnetostrictive Metals [Nickel] Caused by Longitudinal, Circular, and Screw-Shaped Magnetization. Tullio Gnesotto (*Atti R. Istituto Veneto Sci., Venezia*, 1932, 91, II, 615–632; *Chem. Zentr.*, 1932, 103, II, 3843).—Cf. this *J.*, 1932, 50, 340. Longitudinal and screw-shaped magnetization of nickel facilitates torsion. The change in strength of nickel wires produced by longitudinal magnetization decreases with increasing previous torsion.—A. R. P.

Changes in the Longitudinal and Circular Magnetization in Twisted Nickel and Iron Wires Produced by a Superimposed Constant Alternating Field. Angelo Drigo (*Atti R. Istituto Veneto Sci., Venezia,* 1932, **91**, II, 681–696, 933–974; *Chem. Zentr.*, 1932, **103**, II, 3843–3844).—Deformation by torsion of nickel that is subjected to a longitudinal alternating field of constant width causes changes in the longitudinal magnetization, the course of which at low Θ values depends on whether the torsion has been effected in a longitudinal field. Changes in the longitudinal magnetization produce magnetization changes of different sign in nickel and iron wires twisted in the same direction; this confirms the assumption that the electromagnetic effects which are associated with the torsion of ferromagnetic metals are derived from magnetization changes which are produced by a kind of magnetic anisotropy due to the torsion.—A. R. P.

Changes in the Electrical Resistance of Magnetostrictive Metals in Magnetic Fields. Tullio Gnesotto (*Atti R. Istituto Veneto Sci., Venezia,* 1932, **91**, II, 697–727; *Chem. Zentr.*, 1932, **103**, II, 3844).—At room temperature the electrical resistance of carefully demagnetized iron increases in a transverse magnetic field whereas that of nickel decreases, but in a longitudinal field it increases in both cases. If the specimens retain some residual magnetism, however, the electrical resistance falls both in transverse and longitudinal magnetic fields. These electromagnetic effects are ascribed to changes in the crystal lattice.—A. R. P.

The Effects of Changes in the State of Tension of Magnetostrictive Cylinders [of Nickel] in Magnetic Fields. Tullio Gnesotto (*Atti R. Istituto Veneto Sci., Venezia,* 1932, **91**, II, 905–916; *Chem. Zentr.*, 1932, **103**, II, 3844).—The magnetization cycles of nickel are more strongly affected by tensile stress than is the case with iron. With nickel wires the changes of longitudinal and circular magnetization are smaller with increasing tension up to 15 kg. the greater the constant field. The longitudinal effect of alternating field is appreciably greater with nickel than with iron.—A. R. P.

Changes in the Longitudinal Magnetization of Twisted Nickel Wires Produced by a Circulating Alternating Field Acting in a Constant Longitudinal Field. Giulia Alocco (*Atti R. Istituto Veneto Sci., Venezia,* 1932, **91**, II, 1101–1124; *Chem. Zentr.*, 1932, **103**, II, 3844).—The sudden changes in magnetization suffered by nickel wire in a circulating alternating field can be restrained by the simultaneous application of a constant longitudinal field of suitable strength. The dependence of this effect on the tension and torsion of the wire and on the frequency of the circulating alternating field has been investigated and correlated with the magnetostrictive properties of the metal. —A. R. P.

Tin and Its Alloys. Anon. (*Tin*, **1932**, Dec., 5–7).—An account is given of the principal properties of tin and its more important alloys, particularly the copper–tin alloys and white metals.—J. H. W.

Fault-Like Translation of Zinc Crystals. E. Schmid and M. A. Valouch (*Mitt. Material., Sonderheft* 21, 1933, 60–64).—See this *J.*, 1932, **50**, 342.—J. W.

Researches on the Hydrogen Content of Zinc with Especial Reference to Electrolytic Zinc. P. Röntgen and F. Möller (*Metallwirtschaft,* 1932, **11**, 685–687, 697–699).—The hydrogen content of zinc cannot be satisfactorily determined by heating or melting the metal in a vacuum, by dissolution in sulphuric acid or in copper sulphate solution, or by amalgamation with mercury.—v. G.

Report of Joint Research Committee [of A.S.T.M. and A.S.M.E.] on Effect of Temperature on the Properties of Metals. H. J. French and N. L. Mochel (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 148–152; and *Amer. Soc. Mech. Eng. Preprint,* **1932**).—See this *J.*, 1932, **50**, 531.—S. G.

Factors Affecting Choice of Working Stresses for High-Temperature Service. P. G. McVetty (*Amer. Soc. Mech. Eng. Preprint*, 1932, Dec., 1–4).—Discusses the various methods proposed to determine safe working loads for high-temperature service. The structural stability of the alloys during tests is of importance, as the metal in the final stages of the test may have become different from what it was when the test is commenced. Published creep test data will therefore not admit of extrapolation, and in using such data it is necessary to bear in mind the possibility of a large effect of even slight overheating during service. The effects of vibration and impact on the creep properties have not been investigated, but may prove to be of extreme importance.—W. P. R.

Rate of Creep of Metals. P. H. (*Rev. gén. Sci.*, 1932, 43, 418–419).—A short article on the theory of the flow of metals at elevated temperatures. Two methods of investigation are used: (1) determination of the elongation as a function of time at constant temperature and constant stress; (2) determination of the time-temperature function giving a constant elongation under constant load. The first method supplies data useful to the engineer for design purposes, but the latter method is more likely to give results which will explain the true mechanism of creep.—W. P. R.

The Fracture of Machine Parts by Fatigue. L. Persoz (*Revue spéciale*, 1932, 7, 551–578).—The various types of failure due to fatigue to which machine parts are liable to be subjected are discussed, and the mechanical properties of a number of straight carbon and alloy steels and of copper-aluminium alloys are tabulated. The results of alternate torsion tests are given, and the variation in the endurance limit with temperature is discussed.—J. H. W.

Recent American Researches on "Fatigue of Metals."—I. Anon. (*Metallurgist (Suppl. to Engineer)*, 1932, 8, 157–158).—A review and discussion of papers contributed to the Annual Meeting of the American Society for Testing Materials, 1932.—R. G.

Strength of Cohesion. W. Kuntze (*Mitt. Material., Sonderheft* 20, 1932, 1–62).—The paper contains 10 sections some of which have already been published, on the theory, the properties determined experimentally in steel and different non-ferrous alloys, and the practical application of tensile tests on cylindrical test-pieces having a triangular notch turned out right round the specimens. The value of this work in carrying out a systematic investigation of triaxial tensile stresses is discussed, and the present state of our knowledge of this subject reviewed. (1) *Elastic transverse tension and spatial stresses* (pp. 7–9). Measurements of the elastic transverse tension in the apex of the notch show that the specific transverse tension is a linear function of the relative notch area f and notch angle α, so that in the limiting case when $f = 0$ and $\alpha = 0$ equal elastic tensions and tensile stresses prevail. If the elasticity is taken as known, the state of stress of plane isotropic substances can, with a suitable shape of test-piece, be determined from the elastic tension in the direction of the smaller principal stress. (2) *Plasticity and tenacity* (pp. 9–17). See this J., 1932, 50, 174. (3) *Influence of stress inhomogeneity on the tenacity* (pp. 18–21). The "undisturbed" tenacity values can be determined by graphical means of the maximum load conditions in notched tensile tests. In accordance with the elastic tension, the tenacity rises linearly with decreasing notch angle and with decreasing notch area. (4) *Effect of deformation inhomogeneity on the fracture tenacity* (pp. 21–25).—As the angle and area of the notch increase in cylindrical notched tensile tests the deformation which occurs up to the maximum load and up to fracture steadily decreases. The uneven stress distribution in the notch section magnifies the maximum load inhomogeneously and reduces the deformation at fracture. The effective tenacity calculated from the maximum load and the deformation produced by it can thus be corrected, and is then, in the case of cylindrical notched test-pieces, a hyperbolic function of the relative magnitude of the cross-section of the notch.

(5) *Cohesion and shear resistance law under spatial tensile stress* (pp. 25–30). The regularities of the resistance to flow in the notch and in the constricted area are represented by the Mohr stress circle method, and from this the maximum load, shear strength at the beginning of flow, and the mechanism of slip planes are discussed. (6) *Practice of the notched tensile test* (pp. 31–37). See this *J.*, 1932, **50**, 368. (7) *Method for the technical determination of cohesion* (pp. 37–41). See this *J.*, 1932, **50**, 754. (8) *Evaluation of a material according to the appearance of the fracture of notched specimens* (pp. 41–43).—From the appearance of the fracture of aluminium, Duralumin, magnesium, and copper the deformation, cause of failure, and influence of inhomogeneities are discussed. (9) *Problem of fatigue in metals* (pp. 43–45). See this *J.*, 1932, **50**, 149. (10) *Importance and application of the notched tensile test* (pp. 45–60). The influence of recent investigations on the cohesion strength as a material constant on the opinions of the cause of fracture, on the testing of materials, and on a more sensible calculation of the dimensions of constructional parts, is reviewed.—J. W.

Strength of Cohesion. W. Kuntze (*Z.V.d.I.*, 1933, **77**, 49–50).—To be able to judge the stresses which a material will bear without failure not only must the maximum stress be known (which up to the present has been sufficient), but also the spatial state of stress which depends on the shape of the body and on the forces acting on it. The behaviour of a material is thus conditional on the juxtaposition, partly in the same and partly in different grains, of the slip planes which are formed during working and on shear and cleavage processes. Static and alternating stresses are not to be distinguished qualitatively from one another; under static stresses slip, and under alternating stresses shear processes, predominate.—v. G.

Wear of Metals Due to Abrasion. C. R. Weiss (*Mech. World*, 1932, **92**, 28–29).—In order to classify the abrasion-resisting properties of various metals and alloys used in industrial machinery, particularly such as are used for handling powdered materials or for working in a dust-laden atmosphere, more than 1400 tests were made with apparatus which is here described and illustrated. A few of the results are given, and it is claimed that these should be valuable as guides in the selection of materials to suit a specific purpose. —F. J.

Impurities in Metallurgical Products. Their Influence on Structure and Properties. Léon Guillet (*Génie civil*, 1932, **101**, 137–140).—The importance of impurities—intentional and unintentional—in metals has been recognized of late, and their influence on the properties of metals has been carefully studied. If the impurity is soluble in the solid state, it may affect the rate at which recrystallization proceeds, or it may have a profound influence on the temperature of recrystallization. Thus 0·05% of iron causes silver to recrystallize at room temperatures, whilst the addition of 0·1% of copper will mask the effect of the iron. If the impurity is insoluble in the metal, its effect will vary according to the manner in which the constituent impurity occurs. An important effect of insoluble impurities is illustrated in the case of cadmium in zinc, which represses the macroscopic columnar type of crystallization and confers on the zinc a structure consisting of equiaxed grains. The effect of impurities on the corrosion-resisting properties requires further study; in certain cases—for example copper in iron—the impurity has a beneficial effect; copper in aluminium, on the other hand, decreases the resistance of the metal to corrosion.—W. P. R.

On Melting under Pressure.—II. Ernst Jänecke (*Z. physikal. Chem.*, 1932, [A], **162**, 286–288).—Since van Laar has formulated an expression for the melting curves of a substance which, contrary to his earlier work, does not lead to a maximum melting point under infinitely high pressure, the interpolation expressions given in the earlier paper (cf. this *J.*, 1932, **50**, 343) no longer give an approximately correct impression of the conditions of equilibrium between the solid and liquid states of a substance at high pressures.—B. Bl.

Viscosity of Metals at High Temperature. G. Ranque and P. Henry (*Usine*, 1931, 40, (51), 29).—Abstract of a paper presented to the Académie des Sciences. See this *J.*, 1932, 50, 149.—H. W. G. H.

Gases in Metals. L. L. Bircumshaw (*Metallurgist* (Suppt. to *Engineer*), 1932, 8, 185–187).—A review of the results of recent work on the subject.—R. G.

On the Dependence of Wettability of Solid Substances on the Duration of Contact. Agnes Pockels (*Kolloid-Z.*, 1933, 62, 1–2).—Surfaces of silver, tin, and platinum, which are not usually wetted by water, are wetted after contact with water for several days. This property is lost when the metals are subsequently exposed to the air for an equal time. It is probable that an adsorption layer, which is formed at the surface of the metal in air, is removed slowly by the water.—E. S. H.

A Photographic Method of Deriving the Optical Constants of Metals. S. E. Williams (*Proc. Phys. Soc.* (*Lond.*), 1933, 45, 49–69).—A diffraction grating comprising alternate strips of glass and metal of known dimensions is used to obtain reflected diffraction spectra the relative intensities of which depend on the optical properties of the strips. With gratings cut from sputtered platinum films, the values of the optical constants k and n of platinum for radiation given by the doublet of the mercury arc were found to be $k = 1{\cdot}40$, $n = 1{\cdot}67$.—J. S. G. T.

Report of the Atomic Weights Commission of the International Union of Chemistry. G. P. Baxter, Mme. M. Curie, O. Hönigschmid, P. Lebeau, R. J. Meyer (*Ber. deut. chem. Ges.*, 1932, [A], 65, 33–42).—The Commission accepts revised values for the atomic weights of krypton and xenon. A table of atomic weights, related to that of oxygen as 16, is given, and investigations recently completed, are summarized. The metals dealt with are silver, lithium, cæsium, germanium, selenium, tellurium, tungsten, rhenium, ruthenium, and osmium.—P. M. C. R.

Electric Supra-Conduction in Metals. J. C. McLennan (*Nature*, 1932, 130, 879–886).—A general review of the work done on superconductive metals and alloys, the action of magnetic and alternating electrical fields, absorption of β-particles, experiments with simultaneous d.c. and a.c., &c.—E. S. H.

Theory of Super-Conductivity. R. de L. Kronig (*Z. Physik*, 1932, 78, 744–750).—The more important qualitative features of the phenomenon of super-conduction are derived from the consideration of a lattice distribution of the electrons in a uniformly charged positive medium, the conducting electrons exerting Coulomb forces on one another.—J. S. G. T.

Interpretation of Certain Experiments Relating to Super-Conduction. M. v. Laue (*Physikal. Z.*, 1932, 33, 793–796).—Read before the VIII Deutsche Physikertag, September, 1932. v. L. discusses mathematically the results obtained by Haas and Voogd indicating the effect of a magnetic field on the critical temperature of super-conduction, and results obtained by Sizoo.—J. T.

Theory of Diamagnetism of Conducting Electrons. R. Peierls (*Physikal. Z.*, 1932, 33, 864).—Read before the VIII Deutsche Physikertag, September, 1932. Landau's theory of the diamagnetism of free electrons is amplified (see *Z. Physik*, 1930, 64, 629, 637; this *J.*, 1930, 44, 476) and the anomalous behaviour of bismuth is considered to be attributable to the electrons not being perfectly free.—J. S. G. T.

Effect of Elastic Stresses Upon the Form of the Magnetization Curve. N. Akulov, A. Helfenbein, and N. Byczkov (*Z. Physik*, 1932, 78, 808–814).—The magnetic susceptibility of ferromagnetic materials in weak magnetic fields is shown, theoretically and practically, to be altered by longitudinal stress. The initial susceptibility, α, increases or decreases with the traction, F, according as the magnetostriction effect in weak fields is positive or negative. The value of $d^2(1/\alpha)/dF^2$ is always positive.—J. S. G. T.

Ferromagnetic Single Crystals. Richard Gans (*Physikal. Z.*, 1932, **33**, 924–928).—Magnetic saturation, the magnetic characteristics of isotropic ferromagnetic materials, the change of electrical resistance due to magnetization and magnetostriction are discussed practically and theoretically.—J. S. G. T.

A Magneto-Mechanical Effect. N. Akulov and E. Kondorsky (*Z. Physik*, 1932, **78**, 801–807).—A mathematical theory enabling the magnetostriction effect in an elastically-strained single crystal to be determined for any direction of the stress and of the magnetic field is developed. One consequence of the theory is that Hook's law, *i.e.* the law of proportionality of longitudinal strain to stress, is not necessarily valid in the case of ferromagnetic materials. The phenomenon of the increase of Young's modulus with magnetization (*Z. Physik*, 1902, **3**, 380) referred to by Honda, Shimizu, and Kuskabe is explained along these lines.—J. S. G. T.

Propagation of Large Barkhausen Discontinuities.—II. K. J. Sixtus and L. Tonks (*Phys. Rev.*, 1932, [ii], **42**, 419–435).—The propagation of large Barkhausen discontinuities (cf. Sixtus and Tonks, *Phys. Rev.*, 1931, [ii], **37**, 930–958; this *J.*, 1931, **47**, 371) in nickel–iron alloy (containing 14·75% nickel, 0·11% maganese and traces of carbon, phosphorus, sulphur, and silicon) has been studied. Both wires and strips were used, and experiments were carried out under different conditions of tension, torsion, impressed field, variation of jump magnitude, and temperature. The effects of annealing, and of etching the wire were also studied. The results are very complicated, but show that uniform crystal orientation is not necessary for the occurrence of the jump, since complete reversal of the whole wire is observed when only a small fraction of the wire contains uniform orientation produced in the process of manufacture. If λ is the length of the discontinuity, and v the velocity of propagation, a preliminary theory requires λ/v to be proportional to a^2, where a is the radius of the wire, but experiment shows that it is proportional to a rather than to a^2, the missing power of a being replaced by the empirical constant 0·035 cm., which applies to both torsion and tension experiments. The value 0·035 cm. is roughly the radius above which propagation does not occur. Propagation was observed up to 350° C., the slope of the v–H curves increasing with temperature (H is the longitudinal main field impressed on the wire). Propagation was affected by etching the surface of the wire; experiment showed that this was not due to absorption of hydrogen, but possibly to the release of surface strains, since cracks appeared in the surface.—W. H.-R.

Photo-Electric Emission from Different Metals. H. C. Rentschler, D. E. Henry, and K. O. Smith (*Rev. Sci. Instruments*, 1932, **3**, 794–802).—A method for preparing photo-electric cells of any metal which can be made in wire form is described. The method appears to give metal surfaces characterized by their true photo-electric effect. Results obtained with thorium, uranium, zirconium, calcium, tungsten, tantalum, and barium are discussed. Results obtained with barium cells suggest that activated oxide-coated cathodes contain something which has a lower work-function than that of pure barium.
—J. S. G. T.

Theory of the Thermoelectric Effect at Low Temperatures. Wolfgang Kroll (*Z. Physik*, 1933, **80**, 50–56).—An expression for the thermo-e.m.f. in a circuit at low temperatures is derived in accordance with a theory due to Bloch and Nordheim.—J. S. G. T.

Oblique Initial Emission of Thermo-Electrons from Rough Crystalline Metal Surfaces. H. Seemann (*Z. Physik*, 1932, **79**, 742–752).—The emission of electrons from heated tungsten wire in directions other than normal to the axis of the wire, owing to the crystalline structure of the surface of the wire (approximating in character to the surface of a round file) is investigated experimentally.—J. S. G. T.

Reflection of Ultra-Violet Rays. A. Furniss (*Brit. J. Physical Medicine*, 1932, 7, (2), 29–30; and (abstract) *Aluminium Broadcast*, 1932, 3, (32), 19).—Discusses the reflection of ultra-violet rays by metals.—J. C. C.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 69–75.)

On the Influence of Cadmium and Lead on the Properties of Aluminium. B. Blumenthal and M. Hansen (*Metallwirtschaft*, 1932, **11**, 671–674; and *Mitt. Material.*, *Sonderheft* 21, 1933, 87–93).—In melting aluminium alloys with up to 7·4% cadmium or 1·5% lead, thorough stirring is necessary to obtain an even distribution of the cadmium or lead, and the alloys must be rapidly cast and cooled to prevent segregation. Both types of alloy can be readily rolled, drawn, and forged both hot and cold. The tensile strength, elongation, and hardness of aluminium–cadmium alloys are only slightly affected by the cadmium content. These alloys can, however, be appreciably hardened by quenching and ageing; their electrical conductivity is, even with 7% cadmium, only 3% less than that of pure aluminium. Up to 1·5% lead has no effect on the mechanical properties of aluminium or on its corrodibility in sea-water or in the air, but improves considerably its ease of working on the lathe or with the drill.—v. G.

[Contribution] to the Knowledge of the Binary Systems of Aluminium with Cadmium, Lead, and Bismuth. M. Hansen and B. Blumenthal (*Mitt. Material.*, *Sonderheft* 21, 1933, 19–20).—See this *J.*, 1932, **50**, 151.—J. W.

The Normal and Inverse Segregation of Aluminium–Copper Alloys in Relation to the Rate of Solidification. H. Bohner (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1932, 4, 27–30).—Alloys of aluminium with 5–6% copper show normal segregation at low rates of cooling; as the rate is increased the extent of segregation becomes greater, until with a certain definite rate normal segregation is suddenly replaced by inverse segregation, the extent of which is decreased by further increase in the rate of cooling.—M. H.

Equilibrium Relations in Aluminium–Copper–Magnesium and Aluminium–Copper–Magnesium Silicide Alloys of High Purity. E. H. Dix, jr., G. F. Sager, and B. P. Sager (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, 99, (Inst. Metals Div.), 119–129; discussion, 130–131).—For abstract of the paper, see this *J.*, 1932, **50**, 222. The discussion in which *M. L. V. Gayler*, *R. S. Archer*, and *E. H. Dix, jr.*, took part, ranges round the question as to whether Mg_2Si can be considered as an unalterable component in aluminium alloys containing magnesium and silicon. Recent evidence suggests that this is not the case.—A. R. P.

The Physical Properties of Aluminium-Base Die-Casting Alloys. A. J. Field (*Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 285–291).—Appendix to Report of Committee B-6 [of A.S.T.M.] on Die-Cast Metals and Alloys (see this *J.*, 1932, **50**, 581). The tensile strength and percentage elongation for both flat and round test-pieces, the Rockwell "E" hardness and Charpy impact values are tabulated with the analyses of 12 aluminium-base alloys of the following nominal compositions: (*a*) copper 4%; (*b*) copper 10%; (*c*) copper 14%; (*d*) silicon 5%; (*e*) silicon 12%; (*f*) copper 2, silicon 3%; (*g*) copper 4, silicon 5%; (*h*) copper, 1·5, silicon 1, nickel 2·25%; (*j*) copper 4, silicon 1·75, nickel 4%; (*k*) silicon 2, nickel 5%; (*l*) copper 2, silicon 8%; (*m*) copper 8, silicon 1·5%. Specimens from different sources show wider variations in properties than the analyses would suggest; such variations must be ascribed to divergent foundry methods. Round test-pieces, possessing the greater soundness, give more closely representative results than flat ones. Graphs are given illustrating the relation between: (*a*) tensile strength and hardness; (*b*) impact strength and hardness.—P. M. C. R.

Experiments with Magnalium Sheets (Tensile Tests). K. Schraivogel (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1931, 21*).—Magnalium (aluminium alloy) sheets 0·5–2 mm. thick had in the annealed state a tensile strength of 30–36 kg./mm.^{2} with an elongation of 15–22%, and in the polished state a tensile strength of 38–42 kg./mm.^{2}, an elongation of 8–11%, and a modulus of elasticity of 7300 kg./mm.^{2}. The yield-point (0·2% elongation) was 50% of the tensile strength in the first case, and 75–80% in the second case.—B. Bl.

D.2. A New Non-Heat-Treatable Alloy. Anon. (*Light Metals Research*, 1933, **2**, (19), 2 pp.).—This aluminium alloy is not so strong as Duralumin or as corrosion-resistant as "MG 7," but is more ductile and readily worked. It is not susceptible to intercrystalline corrosion. Typical tensile properties are:

	Annealed.	Hard-Rolled.	Extruded.
Maximum stress, tons/in.^{2} . .	12·5	19·5	13·5
Proof stress, tons/in.^{2} . . .	6·6	18·5	7–8
Elongation, per cent. . . .	24	5	20

—J. C. C.

Special Light Alloys for Aircraft. W. C. Devereux (*Aircraft Eng.*, 1933, **5**, (47), 6–12).—Typical castings in the "R.R." alloys are described, with particular reference to aircraft engine parts. The short range of solidification and low linear contraction of the alloys constitute distinct advantages. Hot-shortness tests on a number of aluminium castings are described. Diagrams are given indicating the properties of the alloys at elevated temperatures. Reference is made to frictional properties, and tests are described. The results of Wöhler fatigue tests, short endurance deflection-fatigue tests, and impact-fatigue tests in the Amsler machine are given. Troubles arising with the wrought alloys from the use of a dummy of too large a size for stamping, and from overheating are described, and attention is directed to the possibility of producing extruded sections having non-uniform structure, particularly in the portion last leaving the die.—H. S.

On the Reducibility of Beryllium Oxide. Wilhelm Kroll (*Wiss. Veröff. Siemens-Konzern*, 1932, **11**, (2), 88–92; and (translation in full) *Light Metals Research*, 1932, **2**, (17), 15–20).—Attempts to obtain beryllium alloys by the "Thermit" reduction of mixtures of beryllia with copper, nickel, or iron or their oxides, using calcium, magnesium, aluminium, silicon, lithium, or cerium as reducing agents, proved abortive.—A. R. P.

The Ternary System Cobalt–Chromium–Tungsten. W. Köster (*Z. Metallkunde*, 1933, **25**, 22–27).—The constitution of the ternary system cobalt–chromium–tungsten up to 80% chromium and 50% tungsten was investigated by means of the thermal investigation of sections through the ternary model and microscopical observations of alloys in the cast and slowly-cooled states. The Brinell hardness and age-hardening of the cobalt-rich alloys were determined. The age-hardened alloys (maximum hardness about 600 kg./mm.^{2}) with 20–50% tungsten and up to 20% chromium possess good cutting properties, even at high temperatures.—M. H.

Joule Magnetostrictive Effect in a Group of Cobalt–Iron Alloys. S. R. Williams (*Rev. Sci. Instruments*, 1932, **3**, 675–683).—Full report of a paper read before the American Physical Society on February 25, 1932, of which only an abstract was published in *Phys. Rev.*, 1932, [ii], **40**, 120. Cf. this *J.*, 1932, **50**, 729.—J. S. G. T.

Aluminium–Bronze. Freeman Horn (*Met. Ind.* (*Lond.*), 1932, **41**, 618).—Short note on an aluminium alloy containing copper 10–12%, referred to by C. J. Elliott in *Met. Ind.* (*Lond.*), 1932, **41**, 511, as "Aluminium–Bronze," remarking that this term applies to a copper alloy containing aluminium 10–12% and having a tensile strength of up to 35 tons/in.^{2}.—J. H. W.

Copper–Beryllium Bronzes. J. Kent Smith (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 65–76; discussion, 76–77).—For abstract of the paper, see this *J.*, 1932, **50**, 224. In the discussion *C. H. Greenall* states that it is possible to measure the hardness of sheet metal by means of a Rockwell tester using a 150-kg. load and a $\frac{1}{16}$-in. ball penetrator and taking the reading on the B scale. *O. W. Ellis* stresses the importance of determining the heat conductivity of alloys to be used in electrical machinery. —A. R. P.

The Equilibrium Diagram of the Copper-Rich Copper–Silver Alloys. Cyril Stanley Smith and W. Earl Lindlief (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 101–114; discussion, 114–118).—For abstract of the paper, see this *J.*, 1931, **47**, 651. In the discussion, *R. F. Mehl, D. Stockdale, N. W. Ageew, K. R. Van Horn,* and *C. S. Smith* discuss the mechanism of the age-hardening effect in copper alloys with a low silver content. C. S. S. states that quenched alloys are stable at room temperature for an indefinite period and no sign of hardening occurs on tempering below 200° C. After 4 hrs. at 200°–250° C. a slight hardening effect is observed, but the main increase in hardness does not occur until visible pearlitic precipitation commences at 300° C.; maximum hardness is reached at 400°–500° C. when visible precipitation is complete, and above 550° C. the hardness rapidly decreases to the value for the quenched alloy.—A. R. P.

Tin–Bronzes. F. C. Thompson (*Tin*, 1932, Nov., 12–14).—The failures in producing tin–bronze castings are usually due to neglect to diminish the oxidation of the tin by the use of a suitable flux or the addition of a little zinc, to lack of control of the pouring temperature, and to failure to allow for the shrinkage on solidification. The alteration in the properties of these alloys as the tin content is increased is discussed. With higher percentages of tin, the cold-working properties disappear and the hardness increases. Compared with other non-ferrous alloys, bronzes retain their hardness much better at the higher temperatures. The addition of up to 0·5% of lead greatly improves the machinability of pure copper–tin alloys. For higher resistance to wear, as in bearing bronzes, the tin content lies between 7% and 14%. In these alloys, even small quantities of zinc are definitely detrimental, but lead up to 5–10% is permissible.—J. H. W.

Effect of Antimony on the Mechanical Properties of a Bearing Bronze. C. E. Eggenschwiler (*Mech. World*, 1932, **92**, 384).—Abstract from *U.S. Bur. Stand. J. Research.*, 1932, **8**, 625. See this *J.*, 1932, **50**, 537.—F. J.

Bronzes Used in Railway Work. R. Loiseau (*Usine*, 1931, **40**, (34), 31–35). —See this *J.*, 1932, **50**, 52.—H. W. G. H.

Age-Hardening Copper–Titanium Alloys. F. R. Hensel and E. I. Larsen (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 55–62; discussion, 62–64).—For abstract of the paper, see this *J.*, 1931, **47**, 652. In the discussion *P. G. McVetty* discusses the effect of age-hardening on the creep of alloys at high temperature and the embrittling effect of hardening in some alloys. *E. E. Schumacher* and *W. C. Ellis* point out the necessity for excluding air during the melting of titanium–copper alloys to prevent the formation of "slushy" metal. *F. R. Hensel* compares, in a table, the mechanical properties of titanium–copper alloys with those of Corson alloys (copper hardened with Ni_2Si). The tensile properties of the titanium alloys are much superior to those of the Corson alloys, but their electrical resistivity is 3 times as great.—A. R. P.

On the Transformations in Copper–Zinc and Silver–Zinc β-Alloys. M. Straumanis and J. Weerts (*Mitt. Material., Sonderheft* 21, 1933, 23–26).—See this *J.*, 1932, **50**, 158.—J. W.

The Separation of the α-Phase in β-Brass. M. Straumanis and J. Weerts (*Mitt. Material., Sonderheft* 21, 1933, 26–33).—See *J.*, this volume, p. 12.—J. W.

The Influence of Third Metals on the Constitution of Brass Alloys. IV.—The Influence of Aluminium. A Contribution to the Knowledge of the Ternary System Copper–Zinc–Aluminium. O. Bauer and M. Hansen (*Mitt. Material., Sonderheft* 21, 1933, 3–18).—See this *J.*, 1932, **50**, 225, 426–427.—J. W.

The Influence of Third Metals on the Constitution of Brass Alloys. V.—The Influence of Manganese. A Contribution to the Knowledge of the Ternary System Copper–Zinc–Manganese. O. Bauer and M. Hansen (*Z. Metallkunde*, 1933, **25**, 17–22).—Cf. this *J.*, 1929, **42**, 451; 1930, **43**, 469; 1931, **47**, 12–13, 140–141; 1932, **50**, 225, 426, 427. Earlier investigations on the constitution of the ternary system are critically reviewed. The constitution of the copper–zinc–manganese alloys with copper 70–50, and manganese 0–6%, has been studied by thermal and micrographical investigation of sections through the ternary model for a constant manganese content of 0·53, 1·26, 2·24, 4·20, and 5·78%, respectively. (1) The solidification is quite analogous to that of the binary copper–zinc series of alloys. Within a certain range of concentration the peritectic reaction α + melt $\rightleftarrows$ β takes place over a very narrow temperature interval. The temperature of the peritectic reaction in the copper–zinc system (905° C.) is decreased as the manganese content increases; the lowering is 45° C. for 5·5–7% manganese, according to the copper content. (2) The influence of manganese on the structure of the brasses is characterized by the fact that the limiting curves of the (α + β) region are displaced to lower copper concentrations, and that in alloys which contain the β solid solution, with manganese contents above 4–4·7% and at temperatures below about 375° C., a manganese-rich phase makes its appearance, owing to the decrease in solid solubility of manganese in β-brass.—M. H.

The Beta to Alpha Transformation in Hot-Forged Brass. Robert S. Baker (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 159–162; discussion, 162–164).—For abstract of the paper, see this *J.*, 1932, **50**, 730. In the discussion, the following took part: *R. F. Mehl, A. J. Phillips*, and *R. S. Baker*. The β–α change under the conditions described in the paper is a suppressed constitutional change similar to the austenite–ferrite change in quenched iron–carbon alloys. The Widmanstätten structure obtained by direct conversion of β-brass into α-brass is extremely complex, and it is often possible to find as many as seven crystal orientations of α within a single β-grain. Greater ductility is obtained by extrusion above 825° C. followed by rapid cooling and subsequent annealing, than by cold extrusion. The transformed areas of the 60·3% copper, 1·75% lead brass used in the tests had a Rockwell B hardness (100-kg. load, $\frac{1}{16}$-in. ball) of 52–54, which fell to 0–2 after 1 hr. at 450° C., whilst the untransformed areas (α + β before annealing) gave corresponding values of 57–60 and 19.—A. R. P.

On the Alloys of Gallium with Zinc, Cadmium, Mercury, Tin, Lead, Bismuth, and Aluminium. N. A. Puschin, S. Stepanović, and V. Stajić (*Z. anorg. Chem.*, 1932, **209**, 329–334).—These binary gallium systems have been studied by thermal analysis. Zinc and tin are completely miscible with liquid gallium; the eutectic points are about 5% zinc and 25° C. and about 8% tin and 20° C. Mercury and gallium are completely immiscible in one another just above the melting points of the metals. Lead, cadmium, and bismuth, have only a limited range of miscibility with gallium in the liquid state; the melting point of lead is lowered by 5% gallium to 317° C., that of cadmium by 12–13% gallium to 258° C., and that of bismuth by 11% gallium to 225° C. No determinations were made of the composition of the gallium-rich melts in any of these systems. The freezing point of gallium (29·9° C.) is not appreciably lowered by additions of lead, cadmium, and bismuth. Gallium and aluminium form 3 compounds, with melting points as follow: Ga_2Al (290° C.), GaAl (376° C.), and $GaAl_2$ (464°).—M. H.

On the System Gold–Manganese. H. Moser, E. Raub, and E. Vincke (*Z. anorg. Chem.*, 1933, **210**, 67–76).—A study of the constitution of the binary system gold–manganese (97% manganese) by means of thermal and microscopic methods gave an equilibrium diagram similar to that obtained by Parravano and Perret (cf. this *J.*, 1915, **14**, 236). Between 0 and 40% manganese a series of solid solutions (γ) exists above 700° C., the liquidus and solidus curves have a minimum at 12% manganese and 977° C., and a maximum at the composition corresponding with the formula AuMn (21·8% manganese) and 1237° C. Between 5% and 15% manganese the gold-rich γ-solid solutions transform below 700° C. to form a hard intermediate phase (δ). At 1130° C. the monotectic reaction: melt with 55% $\rightleftharpoons$ melt with 50% + β-manganese solid solution with about 75% Mn takes place, and at 1073° C. a eutectic (44%) crystallizes which consists of the γ-solid solution (40%) and the β-manganese solid solution (about 74%). The β-manganese solid solution with 83% manganese decomposes at about 570° C. into γ (35%) and α-manganese.—M. H.

The Heat of Formation of Lanthanum and Magnesium, and Lanthanum and Aluminium Compounds. G. Canneri and A. Rossi (*Gaz. Chim. Ital.*, 1932, **62**, (3), 202–211).—The heats of formation of LaMg, $LaMg_2$, $LaAl_2$, and $LaAl_4$ have been determined.—G. G.

Arsenic in Lead Bearing Metals. Ch. Ackermann (*Z. Metallkunde*, 1932, **24**, 306–308).—An improvement takes place in the mechanical properties of 80 : 11 : 9 and 80 : 15 : 5 lead–antimony–tin alloys, and of more complex lead-rich bearing metals with the addition of arsenic if the arsenic content is less than about 0·8%. A higher arsenic content results in a further increase in the hardness and compression strength and also in a considerable decrease in the specific shock strength.—M. H.

Hardenable Lead Alloys. B. Garre and F. Vollmert (*Z. anorg. Chem.*, 1933, **210**, 77–80).—Additions of the compounds Ag_3Sn (up to 7%), $AgCd_4$ (up to 5%), and Ag_2Cd_3 (up to 2%) to lead result in a lowering of its freezing point and in a considerable increase in its Brinell hardness (being determined for additions up to 2%), especially after quenching. All alloys consist of solid solutions. The Brinell hardness of quenched alloys with 0·5% $AgCd_4$, Ag_3Sn, and Ag_2Cd_3 is respectively about 20%, 57%, and 70% higher than that of the slowly-cooled state. A new method of etching lead-rich alloys is described.—M. H.

Intermetallic Compounds Formed in Mercury. I.—The Tin–Copper System. Alexander Smith Russell, Peter Victor Ferdinand Cazalet, and Nevill Maxsted Irvin (*J. Chem. Soc.*, **1932**, (1), 841–851).—Stable compounds of tin and copper with or without mercury are formed in mercury at room temperature. All the compounds have valency electrons equal to 6, 9, or 12, or some simple multiple of these numbers, and to this extent are similar to the compounds in the tin–copper, zinc–copper, and aluminium–copper systems round the β-phase range.—S. V. W.

Intermetallic Compounds Formed in Mercury. II.—The Zinc–Copper System. Alexander Smith Russell, Peter Victor Ferdinand Cazalet, and Nevill Maxsted Irvin (*J. Chem. Soc.*, **1932**, (1), 852–857).—The methods of formation and decomposition of ZnCu, $ZnCu_3Hg_2$, Zn_2Cu_5, Zn_2Cu_6Hg, and CuHg, compounds formed in mercury at ordinary temperatures or at 100° C. have been studied. The relations of these to each other and to similar compounds of tin, copper, and mercury are briefly described.—S. V. W.

Intermetallic Compounds Formed in Mercury. III.—The Zn–Fe System and Part of the Sn–Fe System. Alexander Smith Russell and Henry Anthony Montague Lyons (*J. Chem. Soc.*, **1932**, (1), 857–866).—Five new compounds of Fe and Zn and two of Sn and Fe are formed in mercury at ordinary temperature. General conclusions regarding the valency electrons of compounds of the Sn–Cu, Zn–Cu, Zn–Fe, and Sn–Fe systems are drawn.—S. V. W.

Intermetallic Compounds formed in Mercury. IV.—Summary of Work on the Sn–Cu, Sn–Fe, Zn–Cu, Zn–Fe, Cd–Cu, Hg–Cu, Mn–Cu, and Zn–Mn Systems. Alexander S. Russell, T. R. Kennedy, J. Howitt, and H. A. M. Lyons (*J. Chem. Soc.*, **1932**, (II), 2340–2342).—The title indicates the scope of this paper.—S. V. W.

The Solubilities of Copper, Manganese, and some Sparingly Soluble Metals in Mercury. Nevill Maxsted Irvin and Alexander Smith Russell (*J. Chem. Soc.*, **1932**, (1), 891–898).—Of the metals of atomic numbers 22–29 and of molybdenum, tungsten, and uranium, copper and manganese alone have solubilities in mercury greater than 1 in 10^7, their values being 0·0020% and 0·0010%, respectively.—S. V. W.

A New Metal [Illium] for Instruments. W. D. Staley (*Instruments*, 1932, **5**, 65, A22).—Illium is a corrosion-resisting alloy containing nickel, chromium, copper, molybdenum, and tungsten as principal constituents. It has a tensile strength of 60,000 lb./in.^{2}, and is slightly harder to machine than cast steel. It has been used for calorimeter bombs, crucibles, and pyrometer tubes.
—J. C. C.

Some Developments in High-Temperature Alloys in the Nickel–Cobalt–Iron System. C. R. Austin and G. P. Halliwell (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 78–96; discussion, 97–100).—For abstract of the paper, see this *J.*, 1932, **50**, 18. In the discussion, in reply to questions, G. P. Halliwell stated that alloys with 46–49% nickel, 29–24% cobalt, 6–8% iron, 10–18% chromium, and 2·2–2·4% titanium developing only a thin oxide film after 4000 hrs. at 600° C. Alloys with less than 10% iron and a relatively low titanium content forge readily, and once the cast structure is broken down the alloys can be readily drawn into fine wire. Most of the hardened alloys retain their hardness for many thousands of hours at high temperature, and could be used for oil-cracking machinery. C. R. Austin suggests that marked age-hardening properties are obtained only when both nickel and cobalt are present, little hardening being obtained in the absence of cobalt. Cobalt, at high temperatures, confers on nickel a strength independent of ageing. The hardening constituent in the ageing would appear to be Fe_3Ti.—A. R. P.

The Properties of Monel Metal and Similar Copper–Nickel Alloys. O. Bauer, J. Weerts, and O. Vollenbruck (*Metallwirtschaft*, 1932, **11**, 629–633, 643–649),—Metallographic, mechanical, and chemical tests have been made on natural Monel metal (A), and on two synthetic so-called "Nicorros" alloys, (C) containing, like (A), 0·12% carbon in solid solution and (B) containing 0·3% carbon, most of which was present as precipitated graphite. In all cases the small contents of iron, cobalt, and manganese were in solid solution. In the form of rolled sheet 6·5 mm. thick (A) has the highest tensile strength and yield-point; after annealing for 30 minutes at 1050° C. no appreciable difference could be found between the three alloys in the direction of rolling, but perpendicular thereto (B) showed a smaller elongation and reduction in area. (B) also showed an irregular behaviour in tensile tests on rolled specimens, and the impact values of notched bars of rolled or annealed specimens were only half those of the other two alloys; its hardness after annealing as well as after quenching and tempering was greater than that of the other alloys in a similar state. The density of (A) was 8·87, of (B) 8·86, and of (C) 8·82; stretching reduced these values by 0·008, 0·015, and 0·003, respectively. (A) and (C) after annealing could be readily drawn and rolled, whereas (B) was much less easily worked after annealing in air and somewhat less easily worked after annealing in a vacuum. Cold-rolling reduced the rate of chemical attack in all cases, (*B*) in all cases being more readily attacked then (*A*) or (*C*). Artificial is thus equivalent to natural Monel metal only when the carbon content is kept so low that it is also retained in solid solution.—v. G.

Technical Properties of Copper–Nickel Alloys Containing Beryllium. Georg Masing and Waldemar Pocher (*Wiss. Veröff. Siemens-Konzern*, 1932, 11, (2), 93–98).—The hardness and mechanical properties of various nickel–copper alloys containing beryllium have been determined after various heat-treatments. The best quenching temperatures are 800° C. for alloys with 0–30% nickel, 900° C. with 50% nickel, 950° C. with 70% nickel, and 1050° C. with 90% nickel; the ageing temperature rises from 350° to 550° C. with increasing proportions of nickel. A hardness of 321 Brinell units with a tensile strength of 115 kg./mm.^{2} and an elongation of 13% is readily obtained with the 1 : 39 : 60 beryllium–copper–nickel alloy after ageing at 500° C. for 10 hrs.; the corresponding values for the 1 : 19 : 80 alloy aged at 500° C. for 21 hrs. are 288, 100 kg./mm.^{2}, and 4%. No deterioration in these properties occurs after prolonged heating at 400°–450° C.—A. R. P.

The Alloys of Palladium with Iron. A. T. Grigoriev (*Z. anorg. Chem.*, 1932, 209, 295–307).—The liquidus curve falls to a very flat minimum at about 1300° C. and 55 atomic-% palladium; it corresponds with the crystallization of an uninterrupted series of solid solutions of γ-iron and palladium. Two transformations occur in the solid state, *viz.*, the $\gamma \longrightarrow \alpha$ iron transformation in alloys containing up to about 25 atomic-% palladium (the temperature of which falls with increasing palladium content), and the formation of the compound $FePd_3$ at 810° C. The microstructure of slowly-cooled alloys and of alloys quenched from 1000° C. consists of homogeneous solid solutions despite the occurrence of transformations. The existence of a series of solid solutions at high temperatures and of the compound $FePd_3$ at lower temperatures has been confirmed by measurements of the Brinell hardness and temperature coeff. of electrical resistance of quenched and slowly-cooled alloys.—M. H.

On Alloys of Platinum with Nickel. N. S. Kurnakow and W. A. Nemilow (*Z. anorg. Chem.*, 1933, 210, 13–20, and (in Russian) *Izvestia Platinago Instituta* (*Ann. Inst. Platine*), 1932, 8, 17–21).—The constitution of the system nickel–platinum was studied by means of thermal analysis (for the liquidus curve between 0 and 77·5% platinum by weight), microscopic investigation, and measurements of the Brinell hardness and temperature coeff. of electrical resistance after annealing at 1100° C. with subsequent slow cooling. Results indicate that nickel and platinum form a continuous series of solid solutions which are stable down to room temperature, *i.e.*, no compound or solid solution with a regular arrangement of the atoms is formed.—M. H.

On Alloys of Platinum with Copper. N. S. Kurnakow and W. A. Nemilow (*Z. anorg. Chem.*, 1933, 210, 1–12, and (in Russian) *Izvestia Platinago Instituta* (*Ann. Inst. Platine*), 1932, 8, 5–16).—The investigation of the constitution by means of thermal analysis, microscopic investigation, and measurements of Brinell hardness and electrical properties both after quenching at 800°–900° C. and annealing at 650°–750° C. with subsequent slow cooling, has shown that, in accordance with Johansson and Linde (cf. this *J.*, 1928, 39, 539), a continuous series of solid solutions exists above 800° C. and that 2 transformations take place with fall in temperature, *viz.*: (1) the formation of the compound CuPt (which forms solid solutions with copper and platinum) in alloys between 40 and 60 atomic-% platinum near 800° C.; and (2) a transformation near 500° C. in alloys with about 20–25 atomic-% platinum, which seems to be characterized by the formation of another compound (Cu_4Pt or Cu_3Pt) or a solid solution with regular distribution of the atoms. The latter transformation could not be observed by thermal analysis and microscopic examination.
—M. H.

The System Silver–Copper–Cadmium. M. Keinert (*Z. physikal. Chem.*, 1932, [A], **162**, 289–304).—This ternary system has been investigated by micrographic methods. Since the systems silver–cadmium and copper–cadmium are similar to one another in almost every respect solid solutions are formed in the ternary system between the binary γ-phases, and between the binary ε-phases. [$\gamma = Ag_5Cd_8$–Cu_5Cd_8.] Again the four components in the quasi-quaternary system Ag_5Cd_8–Cu_5Cd_8–Ag_5Zn_8–Cu_5Zn_8 appear to be isomorphous. Complicated reactions occur between the β and β' phases the nature of which could not be completely elucidated. The course of the eutectic curves is briefly outlined. Precipitation-hardening tests on supersaturated ternary solid solutions at the silver corner of the system have confirmed the results of Fraenkel and Nowack (*Z. Metallkunde*, 1928, **20**, 243; cf. this *J.*, 1928, **40**, 625).—B. Bl.

Relation of Crystal Orientation to Bending Qualities of a Rolled Zinc Alloy. Gerald Edmunds and M. L. Fuller (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 175–185; discussion, 185–189).—For abstract of the paper, see this *J.*, 1932, **50**, 735. In the discussion, the following took part: *E. M. Wise, W. P. Davey, W. H. Finkeldey, A. J. Phillips, H. O'Neill, G. Edmunds, F. Wever,* and *E. Schmid* and *G. Wassermann*. Sheet zinc obtained by breaking down slabs to 0·056 in. in the roughing mill and then completing the reduction to 0·040 in. in the finishing rolls frequently shows good bending properties on one side of the strip and complete failure on the other, but this defect may be eliminated by stopping the first stage at 0·075 in. and completing the rolling in the finishing rolls using fairly moderate reductions. In the production of large zinc crystals by annealing near the melting point the large crystals are often coated with a layer of fine crystals which is thicker on one side than on the other. Electronic diffraction is suggested as a method for determining the orientation of the metal from the surface to the centre of the rolled strip. The results of E. and F. on strip agree with those previously found by E. S. and G. W. on drawn zinc wire.—A. R. P.

Average Strength Data for Non-Ferrous Alloys. Anon. (*Machinery* (*N.Y.*), 1933, **39**, 312A).—Average tensile properties of standard aluminium alloys and brasses are tabulated.—J. C. C.

On Internal Stresses. Otto Mies (*Schmelzschweissung*, 1931, **10**, 213–215).—The importance of internal stresses in technical construction is illustrated by simple examples, *e.g.*, the season-cracking of brass rods and the bending of a rod and of a strip of sheet.—B. Bl.

Immiscible Metals. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 178–179).—A brief review, pointing out the lack of knowledge concerning the nature of immiscibility between some metals. The behaviour of two metals in this respect does not appear to be related to their similarity in physical characteristics, and the effect of the addition of a third metal cannot be predicted. The subject is a promising one for fundamental research.—R. G.

Investigation on the Shape and Arrangement of Ferromagnetic Segregates by Means of the Magnetic Balance. E. Gerold (*Z. Metallkunde*, 1932, **24**, 255–257).—The shape and arrangement of ferromagnetic segregates in a non-magnetic ground-mass can be determined by means of magnetization curves obtained with the aid of a magnetic balance. The shape of the curve depends on the position of the specimen in the magnetic field; if the curves for transverse and longitudinal positions coincide, the ferromagnetic phase occurs in separate particles completely surrounded by non-magnetic material, *e.g.*, in the case of copper containing 2% iron. If the two curves do not coincide, the ferromagnetic phase is present as a tenuous film surrounding grains of the non-magnetic substance. From the characteristic irregularities of the curves of cold-worked specimens conclusions can be reached as to the structural changes produced by the rolling or drawing process.—B. Bl.

On the Theory of Formation of Segregate Structures in Alloys. C. H. Mathewson and D. W. Smith (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, 99, (Inst. Metals Div.), 264–271; discussion, 271–273).—For abstract of the paper, see this *J.*, 1932, 50, 479. In the discussion, *C. S. Barrett, R. F. Mehl, O. T. Marzke*, and *C. H. Mathewson* took part. Additional evidence is cited against the theory of Hanemann and Schröder as to the shape and orientation of segregates in alloys; this evidence implies that perfusion, diffusion, lattice strains, and concentration gradients are of no importance in determining either the principal surfaces between matrix and segregate in alloys or the orientation of the segregate lattice with respect to the matrix.—A. R. P.

Contribution to the Thermodynamics of Concentrated Solutions.—II. Communication: Calculation of the Complete Curves of Crystallization in Binary Eutectic Systems. Ernst Kordes (*Z. physikal. Chem.*, 1932, [A], 162, 103–127).—Cf. this *J.*, 1932, 50, 353. An equation is given by the aid of which the complete crystallization diagram of a binary eutectic system can be calculated. Two constants in the equation are derived from the latent heats of fusion and the melting points of the two components, and the third refers to the heat developed in mixing the components in the liquid state. This third constant may be determined for any system by measuring the temperature of crystallization of a highly concentrated mixture. The validity of the equation is independent of the nature of the components—whether they are metals, salts, molecular compounds, or aqueous solutions. The calculations can be extended to include systems with a miscibility gap in the liquid state. —B. Bl.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 75–76.)

Metallography. —— Muhr (*Draht-Welt Export-Ausgabe*, 1932, (8), 77–81). —[In German, English, and French.] A brief but comprehensive statement of the essential factors governing the choice, preparation, and examination of metal sections, as well as the necessary apparatus.—A. B. W.

The Importance of the Structure for the Permanent Deformation of Crystals. E. Seidl (*Mitt. Material., Sonderheft* 21, 1933, 46–49; and (abstract) *Fortschritte Min. Krist. u. Petr.*, 1931, 26, (1)).—Macroscopic observations on the deformation and fracture of coarsely crystalline metal specimens are described.—J. W.

On the Recrystallization and Recovery after Cold-Working of Pure Aluminium and Some Age-Hardening Aluminium Alloys of Al–Cu Base. H. Bohner and R. Vogel (*Z. Metallkunde*, 1932, 24, 169–175).—The recrystallized structure of aluminium and its alloys is, even after repeated recrystallization, strongly dependent on the previous thermal and mechanical treatment, *e.g.*, nature, rate, degree, and temperature of deformation, as well as on small changes in the chemical composition and on the size and orientation of the original structure. The surface of stretched metal behaves somewhat differently from the core, and the time required to produce a coarse secondary grain structure on annealing is appreciably greater than that necessary to produce a fine-grained recrystallization structure. The critical deformation range is greater with pure aluminium than with age-hardenable copper–aluminium alloys. The recrystallization temperature and critical deformation range of the latter are lowered by increasing the silicon content, but remain unaffected by replacement of part of the silicon with magnesium. Manganese increases the critical deformation range. When Silumin or copper–aluminium alloys containing small quantities of silicon, magnesium, manganese, chromium, or titanium are quenched from 500° C., stretched, and again annealed to produce secondary recrystallization, an oriented chequered structure is formed under certain conditions between the Lüders slip lines developed by the deformation. On annealing a deformed alloy the mechanical and electrical properties characteristic of the selected annealing temperature are obtained by crystal recovery before recrystallization commences, and the time required for this recovery to take place is also dependent on numerous factors, hence in constructing recrystallization diagrams the previous history of the metal must be taken into account.—B. Bl.

Studies upon the Widmanstätten Structure. III.—The Aluminium-Rich Alloys of Aluminium with Copper, and of Aluminium with Magnesium and Silicon. Robert F. Mehl, Charles S. Barrett, and Frederick N. Rhines (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 207–229; discussion, 229–233).—For abstract of the paper, see this *J.*, 1932, **50**, 485. In the discussion, *J. W. Greig, E. Posnjak* and *H. E. Merwin, G. Doan, R. F. Mehl,* and *F. N. Rhines* took part. G., P., and M. illustrate similar types of Widmanstätten structure observed on oxidized natural magnetite and in decomposed solid solutions derived from synthetic mixtures of ferric and ferrosoferric oxides. D. states that from considerations based on the principle of Guertler's "Klärkreuz" method, and from the fact that the existence of the quasi-binary system Mg_2Si–aluminium has been proved to be a real one, the compound Al_3Mg_2 cannot coexist in equilibrium with Mg_2Si in any of the alloys on the line joining the aluminium corner of the ternary diagram with the Mg_2Si point. In reply, R. argues as follows in support of the possible formation of Al_2Mg_3: when a saturated solid solution of Mg_2Si in aluminium is kept just below the melting point for some time, then cooled somewhat, the solute atoms will aggregate into particles of whatever second phase is most readily formed, and this appears to be Al_2Mg_3; subsequently, however, the silicon atoms in solution react with this compound to form stable Mg_2Si with the rejection of aluminium into the matrix. If this explanation is correct, the separation of Al_2Mg_3 from an alloy of aluminium and Mg_2Si is a case of metastable equilibrium.—A. R. P.

An X-Ray Study of the Nature of Solid Solutions [Aluminium–Silver]. Robert T. Phelps and Wheeler P. Davey (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 234–245; discussion, 245–263).—For abstract of the paper, see this *J.*, 1932, **50**, 164. In the discussion, *J. S. Marsh*; *C. S. Barrett*; *T. D. Yensen*; *R. S. Dean* and *J. Koster*; *F. N. Rhines*; *A. Stansfield*; *H. E. Stauss*; *Yap, Chu-Phay*; and *W. P. Davey* took part. With reference to the theory put forward as to the nature of metallic solid solutions J. S. M. points out that copper–palladium solid solutions after rapid cooling have a perfectly random distribution of atoms in the face-centred cubic lattice, but after annealing at 400° C. the equiatomic alloy develops a regularly oriented CsCl type of lattice. C. S. B. shows that the authors' observed values for the density of aluminium–silver alloys and the calculated values of Westgren and Bradley lie on the same straight line. R. S. D. and J. K. in a lengthy contribution give tables showing that the percentage difference between atomic radii for pairs of metals known to form unbroken series of solid solutions never exceeds 15%, but that the converse of this statement is not true; tables are also given showing the diffusion constants for various metals in lead at 140°–315° C., and the mechanism of the diffusion of thallium in lead is explained. Calculations show that considerable movement must take place at room temperature, and D. and K. therefore postulate that the state of affairs in a true solid solution is essentially kinetic; this would account for Tammann's reaction limits. Although the solute atoms migrate slowly from place to place at room temperature, this movement is sufficient to prevent their detection by the usual X-ray methods; hence the chief difference between a solid solution and a compound is that the migrating atoms may shift from one crystallographic position to another in the solution, whereas in the compound shifts can take place only between like atoms; in the solid solution the distribution of the solute will be uniform, and the influence of such a statistical arrangement on the formation of intermetallic compounds is discussed with special reference to Ag_3Al. The remainder of the discussion is concerned with the interpretation of the low density of silver alloys with 2–5% aluminium and with the authors' reply to the points raised.—A. R. P.

Comparison of the Intermetallic Compound $AuCd_3$ Crystallized from Molten Alloys with that Precipitated from Solution. P. A. Thiessen and J. Heumann (*Z. anorg. Chem.*, 1932, **209**, 325–327).—The crystal structure of the precipitated $AuCd_3$ formed by immersing cadmium in auric chloride solution is identical with that of the same compound produced from molten alloys of the two metals.—M. H.

The Transformations in the System Gold–Copper and Their Fundamental Importance for the Transformations in Solid Metallic Phases. L. Graf (*Z. Metallkunde*, 1932, **24**, 248–253; discussion, 253–254).—The mechanism and kinetics of the transformation: cubic face-centred lattice with irregular distribution of the atoms $\rightleftarrows$ tetragonal lattice with regular distribution of the atoms which occurs in the gold–copper alloy with 50 atomic-%, was studied by X-ray analysis. With fall in temperature the transformation occurs in 2 steps, *viz.*: (1) change of the lattice symmetry from cubic to tetragonal; and (2) transition from an irregular distribution of the atoms to a regular distribution. The first step takes place completely and with great velocity, the second, however, occurs rather slowly and incompletely. Thus a so-called "intermediate state" is formed which is characterized by a tetragonal lattice with inhomogeneously-distributed areas of regularly-arranged atoms within a coherent grain. The "intermediate state" has a special X-ray diagram and is characterized by an electric resistance and a tensile strength which are considerably higher than those of the final state. The thermodynamic conditions of the transformation and the coupling between the change of the lattice symmetry and the rearrangement of the atoms are discussed.—M. H.

Remarks on the Rolling Texture of Zinc. M. A. Valouch (*Mitt. Material., Sonderheft* 21, 1933, 64–65).—See this *J.*, 1932, **50**, 363.—J. W.

The Rolling Texture of Zinc and Magnesium. V. Caglioti and G. Sachs (*Mitt. Material., Sonderheft* 21, 1933, 42–46).—See this *J.*, 1932, **50**, 363.—J. W.

Changes in Structure and Crystal Orientation Produced by Cold-Rolling. K. L. Dreyer (*Kalt-Walz-Welt* (Suppt. to *Draht-Welt*), 1932, (1), 5–8).—A description of Tammann's work on the relations between distribution of grain orientation and progressive cold-rolling for copper (cf. this *J.*, 1927, **37**, 379), aluminium (cf. this *J.*, 1927, **38**, 367), and for iron.—A. B. W.

Precision Measurements of Crystal Parameters. E. A. Owen and E. L. Yates (*Phil. Mag.*, 1933, [vii], **15**, 472–488).—The following respective values of the lattice parameters (A), and densities (grm./c.c.) at 0° C. and 20° C. of 10 elements, each possessing cubic symmetry, have been determined from precision X-ray measurements: gold, $4{\cdot}0699 \pm 0{\cdot}0003$, $19{\cdot}30_9$, $19{\cdot}29_4$; platinum, $3{\cdot}9158 \pm 0{\cdot}0003$, $21{\cdot}45_9$, $21{\cdot}44_7$; palladium, $3{\cdot}8824 \pm 0{\cdot}0003$, $12{\cdot}03_6$, $12{\cdot}02_7$; rhodium, $3{\cdot}7957 \pm 0{\cdot}0003$, $12{\cdot}42_0$, $12{\cdot}41_4$; lead, $4{\cdot}9396 \pm 0{\cdot}0003$, $11{\cdot}35_7$, $11{\cdot}33_9$; iridium, $3{\cdot}8312 \pm 0{\cdot}0005_5$, $22{\cdot}65_6$, $22{\cdot}65_0$; iron, $2{\cdot}8607_5 \pm 0{\cdot}0002$, $7{\cdot}87_1$, $7{\cdot}86_8$; aluminium, $4{\cdot}0406_5 \pm 0{\cdot}0002$, $2{\cdot}70_0$, $2{\cdot}69_7$; copper, $3{\cdot}6077_5 \pm 0{\cdot}0002$, $8{\cdot}93_9$, $8{\cdot}92_9$; silver, $4{\cdot}0772_4 \pm 0{\cdot}0002$, $10{\cdot}51_1$, $10{\cdot}49_8$.—J. S. G. T.

Precision X-Ray Method in Alloy Research. J. Weerts (*Mitt. Material., Sonderheft* 21, 1933, 75–79).—See this *J.*, 1932, **50**, 486.—J. W.

On the Importance of X-Ray Interference Lines in the Study of Metals. E. Schmid (*Mitt. Material., Sonderheft* 21, 1933, 70–74).—See *J.*, this volume, p. 18.—J. W.

IV.—CORROSION

(Continued from pp. 77–81.)

The Corrosion of Aluminium and Its Alloys. —— v. Zeerleder (*Technique moderne*, 1930, 22, 731).—Abstract of a paper read before the 6e. Congrès International des Mines, de la Métallurgie et de la Géologie Appliquée, June, 1930. Methods are enumerated for determining general corrosion and local corrosion.—H. W. G. H.

Comparative Experiments with [Two] Duralumin Sheets of Different Origin (Examination of the Resistance to [Sea-Water] Corrosion). E. K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1931, 19*).—B. Bl.

Improving Plant Performance by Condenser Maintenance. Anon. (*Power Plant Eng.*, 1932, 36, 201–202; and (abstract) *Mech. World*, 1932, 91, 292).—Methods of fitting condenser tubes with or without the use of ferrules are described and illustrated.—P. M. C. R.

Corrosion of Chemical Lead. P. F. Thompson (*Proc. Australian Inst. Min. Met.*, 1932, (87), 193–206).—From potential measurements in 63% sulphuric acid of 3 samples of lead containing less than 0·01% of impurities it appears that iron derived from the casting moulds or tools used in working the metal may be the cause of corrosion when the metal is used for lining sulphuric acid chambers.—A. R. P.

Eighth Report of the Corrosion Committee of the Société Suisse de l'Industrie du Gas et des Eaux; the Union d'Entreprises Suisses de Transport; the Direction Générales des Télégraphes, and the Association Suisse des Electriciens. Anon. (*Bull. Assoc. Suisse Élect.*, 1932, 23, 275–277).—An account of investigations undertaken in 1931 covering the corrosion of live rails, the influence of welded joints, attack on electric cables, the distribution and leakage of current, soil resistance, and underground corrosion of pipe materials (cast iron, wrought iron, steel, lead).—P. M. C. R.

Electrolysis. Anon. (*Indust. Australian*, 1932, 38, 370).—A survey of the causes and prevention of electrolytic corrosion on underground structures, especially on lead and iron piping. Jointed pipes composed of several short lengths are practically unaffected, probably on account of the high electrical resistance introduced by the joints. Humidity and composition of soil are of great importance, another factor being electrical leakage from neighbouring conductor systems. Methods of combating this type of corrosion must balance the expense involved against the cost of damage; some protective measures are outlined.—P. M. C. R.

Fogging on Polished Nickel. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1932, 53, 519–520).—A brief review of the investigations and conclusions of W. H. J. Vernon on behalf of the Atmospheric Corrosion Committee of the British Non-Ferrous Metals Research Association. See full account of this work, this *J.*, 1932, 48, 121–136.—J. H. W.

Potential Measurements and Dissolution Tests with Tin–Copper and Zinc–Copper Alloys. O. Bauer, O. Vollenbruck, and G. Schikorr (*Korrosion. Bericht über die I. Korrosionstagung, Berlin*, 1931, 73–81; discussion, 81–82).—For abstract of the paper see this *J.*, 1932, 50, 544. In the discussion *M. Werner* quotes figures obtained for the rate of corrosion of copper in *N*-hydrochloric acid and in *N*-acetic acid with and without the addition of copper chloride and acetate; the results entirely confirm the conclusions of B., V., and S.—A. R. P.

On the Effect of Anions on the Rate of Solution of Zinc in Acids. Erich Müller and Johannes Förster (*Z. Elektrochem.*, 1932, 38, 901–906).—By measuring the volume of hydrogen evolved after periods of 1–10 minutes in contact with acids of strength of 1–30*N*, the rate of solution of zinc in the following has been observed and plotted as smooth curves: sulphuric, hydrochloric, hydrobromic, perchloric, chloric, and orthophosphoric acids. —J. H. W.

Oxidation of Zinc. I.—Influence of Nickel on the Oxidation of Zinc. A. Oliviero and O. Belfiori (*Annali Chim. Applicata*, 1932, **22**, 484–493).—Minute quantities of nickel in zinc promote the corrosion of the latter in water, especially warm water, with evolution of hydrogen.—G. G.

Progress Report on Exposure Tests of Plated Coatings. P. C. Strausser (*Monthly Rev. Amer. Electroplaters' Soc.*, 1932, **19**, (2), 15–18; discussion, 18–27; and (summary) *Met. Ind.* (*N.Y.*), 1932, **30**, 150–152).—An outline of the programme of work involving exposure of 7000 plates at many localities in the United States. The plates being tested comprise nickel, copper, chromium, zinc, and cadmium, and combinations of two or more of these of varying thicknesses and produced from different baths.—A. R. P.

The Effect of Elementary Iodine on Metals. N. Floresco (*Bul. Fac. Stiinte Cernauti*, 1929, **3**, 24–30; *C. Abs.*, 1932, **26**, 4002).—Qualitative investigation of the effect of iodine on the metals antimony, aluminium, magnesium, zinc, iron, and a description of the resulting phenomena.—S. G.

What Metals are Suitable for Mayonnaise Plants? Anon. (*Canning Age*, 1932, **13**, 566, 568, 582–583).—Data are given for the rate of corrosion of chromium–nickel–iron alloys, Monel metal, nickel, silver, and tin in hot and cold vinegar and in salad dressing. For mayonnaise plant Inco chrome-nickel and 18 : 8 chromium–nickel–iron alloy are recommended; nickel and Monel metal are less suitable; pure silver and tin are resistant to corrosion but are subject to tarnish.—E. S. H.

Seasonal Variation in Rate of Impingement Corrosion. Alan Morris (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 274–280; discussion, 280–281).—For abstract of the paper, see this *J.*, 1932, **50**, 28. In the discussion by *J. R. Freeman, jr.*, *E. M. Wise*, and *A. Morris* it is stated that mechanical abrasion by suspended matter in estuarine water is only a minor factor in impingement corrosion of condenser tubes.—A. R. P.

Influence of Stress on Corrosion. D. J. McAdam, jr. (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 282–318; discussion, 319, 322). —For abstract of the paper, see this *J.*, 1931, **47**, 344. In the discussion by *B. P. Haigh*, *T. M. Jasper*, *T. S. Fuller*, *E. M. Wise*, and *D. J. McAdam, jr.*, stress corrosion of steel alone is dealt with.—A. R. P.

The Theories of Passivity and Corrosion. Ernest S. Hedges (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 188–190).—A review, summarizing the available knowledge on the subject and discussing its practical utility.—R. G.

The Passivity of Metals. VII.—The Specific Function of Chromates. T. P. Hoar and U. R. Evans (*J. Chem. Soc.*, **1932**, (II), 2476–2481).—The power possessed by chromates of inhibiting corrosion by potassium chloride has been studied by immersing samples of mild steel in various corroding media. —S. V. W.

Mechanism of Rusting in Drops of Water. Erich Baisch and Max Werner (*Korrosion. Bericht über die I. Korrosionstagung, Berlin*, **1931**, 83–98; discussion, 98–101).—Corrosion tests on iron and copper alloys by the drop method have confirmed the validity of Evans' theory of the mechanism of corrosion and disproved that of Maass and Liebreich.—A. R. P.

Corrosion as a Physico-Chemical Problem. H. Mark (*Korrosion. Bericht über die I. Korrosionstagung, Berlin*, **1931**, 1–3; discussion, 3–4).—Corrosion, adsorption, and catalysis are related branches of physical chemistry in that the phenomena in all cases are dependent on the nature of the surface; in the first case the surface is kept to a minimum to reduce the rate of attack, whereas in the other two cases the maximum surface is desirable to obtain the greatest effect. Polished platinum has a real surface of 2–3 times, and etched silver a real surface of 5 times, the apparent surface owing to the presence of minute irregularities and cracks; in the case of corrodible metals these defects generally behave as the seats of corrosion.—A. R. P.

From Empirical to Basic Principles in Particular Cases of Corrosion. G. Masing (*Korrosion. Bericht über die I. Korrosionstagung, Berlin*, 1931, 16–18).—The behaviour of copper, nickel, and iron under corrosive conditions in alkaline and acid media is compared from the point of view of the formation of protective films and potential differences.—A. R. P.

Corrosion in Its Technological Relations. E. H. Schulz (*Korrosion. Bericht über die I. Korrosionstagung, Berlin*, 1931, 6–15).—A discussion of corrosion and protection problems with especial reference to iron and steel. —A. R. P.

Electrochemical Corrosion of Metallic Structures. O. Scarpa (*Atti Soc. per il Progresso Scienze XX Riunione*, 1932, 1, (1), 595–632).—Corrosion of underground tubes, lines, and structures by stray currents and by chemical reactions is discussed.—G. G.

Remarks on the Problem of Corrosion Testing from the Point of View of the Constructor. P. Brenner (*Korrosion. Bericht über die I. Korrosionstagung, Berlin*, 1931, 61–71; discussion, 71–72).—The value of a light metal alloy to the constructional engineer depends on the effect of corrosion on the various mechanical properties. Curves are given showing the reproducibility of laboratory tests designed to ascertain the effect of accelerated corrosion on the tensile strength, elongation, and bending strength of aluminium alloys. The effect of the construction of various joints on their resistance to sea-water corrosion is briefly discussed.—A. R. P.

Progress in the Methods of Preventing Corrosion. Ulick R. Evans (*Met. Ind.* (*Lond.*), 1933, 42, 77–79).—A review of recent research on the prevention of the corrosion of copper–nickel alloys, aluminium–bronze, light alloys, the fogging of nickel, nickel plating, tin plating, and aluminium and selenium coatings.—J. H. W.

Increasing the Resistance [of Metals] to Corrosion by Alloying. A. Fry (*Korrosion. Bericht über die I. Korrosionstagung, Berlin*, 1931, 110–124).—A review of the development and properties of corrosion-resistant alloys with especial reference to non-rusting and non-scaling alloys. A bibliography of 24 references is appended.—A. R. P.

How Soil Corrosiveness can be Measured. William Thompson Smith (*Gas Age-Record*, 1932, 70, 131–134, 143).—Methods, including ground moisture determinations, hydrogen evolution method, total acidity measurements, loss of weight determinations, the geological method, chemical analysis, and various electrical methods of investigating the corrosiveness of soils are briefly reviewed.—J. S. G. T.

Methods of Corrosion Testing. Erich K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1932, 495–504).—An abbreviated account appears in *Z. Metallkunde*, 1930, 22, 328–333, 334–336. Cf. this *J.*, 1931, 47, 21.—B. Bl.

New Corrosion-Testing Device being Developed. Anon. (*Gas Age-Record*, 1932, 70, 143).—Apparatus in which the sample of corrodible material is alternately immersed for a definite time in corroding liquid and then exposed to air, is briefly described.—J. S. G. T.

Alloys for Chemical Plant Construction. Anon. (*Mech. World*, 1932, 92, 312–314).—Silicon–iron and chromium–nickel–iron alloys are suitable for plant-handling corrosive liquors. The varying resistance to corrosion of these alloys with varying composition is discussed.—F. J.

The Corrosion of Metals. P. F. Thompson (*Proc. Australian Inst. Min. Met.*, 1932, (87), 175–191).—A short review of the electrochemical theory of corrosion with especial reference to the mechanism of the corrosion of iron. —A. R. P.

V.—PROTECTION

(Other than Electrodeposition.)

(Continued from pp. 84–86.)

Study of Corrosion. Recent Progress in the Protection of Metals and Alloys. J. Cournot (*Usine*, 1931, **40**, (53), 29–31).—A brief review of factors operating to produce corrosion and rapid tests for investigating them, is followed by notes on the various methods adopted to resist corrosion. The use of such materials as stainless steel, electrolytic protection, and various coatings, metallic and non-metallic, is discussed.—H. W. G. H.

Modern Processes for Protection of Metals. Anon. (*Technique moderne*, 1931, **23**, 319–320).—Reviews the latest development in paints, varnishes, and enamels, sprayed metallic coatings, and chemically and electrolytically produced protective deposits.—H. W. G. H.

Comparison of the Protective Effect of Various Methods of Pickling Elektron Sheets. E. K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, **1931**, 25*).—The English pickling method is superior to the German one.—B. Bl.

Electrolytic Oxidation of Aluminium and Its Applications. Shoji Setoh (*J. Soc. Mech. Eng. Japan* (*Foreign Edn.*), 1931, **34**, 12–13).—[In English.] Abridged from the Home Edition, 1931, **34**, 973–985. The conditions of electrolysis to obtain thick films, taking into account the tendency of the film to dissolve in the electrolyte when the temperature of the bath is high, are discussed. An aluminium plate of not less than 0·5 mm. thickness was entirely oxidized using as an electrolyte a dilute aqueous solution of oxalic acid and keeping the temperature below 30° C. The chemical composition of the film is given as Al_2O_3,H_2O, and among the physical properties cited are sp. gr. (20° C.) 2·76; hardness (Marten's scratch hardness scale) 10; high resistance to abrasion; high dielectric strength; high resistance to thermal decomposition or deterioration, and high resistance to the corroding action of acids and salts. Practical applications of the film are made in heat-resisting electric insulators and windings of electric machines; in the protection of household utensils and parts of machines and apparatus in chemical factories against corrosion; and the protection of aluminium articles against abrasion. It is also stated that various permanent colours can be given to the film by means of suitable dye-stuffs.—J. W. D.

The Protection of Iron and Steel from Corrosion. I.—The Principles of Protection. II.—Practical Methods of Protection. Ernest S. Hedges (*Metallurgia*, 1932, **6**, 87–89; 1933, **7**, 89–92).—(I.—) The direct action of oxygen on iron in producing surface films over the surface of the metal and the protective qualities and other properties of such films, as well as the indirect action of oxygen on iron, are discussed in detail. Consideration is also given to the action of oxidizing solutions such as concentrated nitric acid, potassium chromate, hydrogen peroxide, &c., in producing passivity, and to the behaviour of iron anodes in producing the peculiar anodic state known as electro-chemical passivity. It is also stated that no fundamental difference can be found between film formation and passivity. (II.—) Practical methods of protection described and discussed are protection by oxide and other films, protection by metal coatings, hot-dipping, electroplating, metal spraying, and cementation. Methods of applying zinc, tin, lead, nickel, copper, chromium, and aluminium coatings are considered in detail, and special reference is made to the chemical and physical properties of the various coatings and to their resistance to various forms of corroding media, and also to their application in various industrial processes.—J. W. D.

Metallic Coatings as a Protection against Corrosion. W. H. Creutzfeldt (*Korrosion. Bericht über die I. Korrosionstagung, Berlin*, **1931**, 125–136).—Methods of coating iron and steel with zinc, tin, lead, aluminium, cadmium, nickel, and chromium are described and the protective values of the coatings so obtained are compared.—A. R. P.

Lead-Coated Wires. Herbert Kurrein (*Draht-Welt*, 1932, **25**, 691–693).—Lead has a number of advantages as a protective coating against atmospheric attack, but it has not as yet been widely applied. This is probably partly due to the coatings not realizing all expectations in the electrical and cable industries. K. advocates a phenol sulphonic acid bath as the best for electrodeposition of lead coatings.—A. B. W.

Ancient Lock Preserved with Lead. Anon. (*Dutch Boy Quarterly*, 1930, **8**, (4), 29).—A lock (composition not given), dipped in acid and coated with a thin film of lead in 1750, shows no corrosion at the present day.—E. S. H.

Investigations on the Mechanism of the Process of Galvanizing Iron. Heribert Grubitsch (*Monatsh.*, 1932, **60**, 165–180).—The rate of dissolution of steels with 0·011–0·87% carbon in molten zinc at various temperatures has been investigated. Solubility curves of pearlitic steels with not more than 0·6% carbon are similar to one another and all pass through a maximum within the range 480°–520° C. The magnitude of this maximum varies with the steel, but is not a function of the carbon content. The structure of the deposits varies considerably with the temperature of dipping, and in some cases is very characteristic. A relation between the solubility of the iron in zinc at the various temperatures and the structure of the zinc layer has been established.—A. R. P.

On the Use of the Preece Test Especially for Electrolytic Galvanizing. Jürgen Feiser (*Chem.-Zeit.*, 1932, **56**, 831–832).—The Preece test for evaluating zinc coatings on iron and steel consists in immersing the specimen repeatedly for periods of 1 minute in 20% copper sulphate solution until the original loose black coating is replaced by an adherent red film of copper showing that all the zinc has been removed. The test is shown to be of value only for examining the homogeneity of the coatings, and gives no indication of the thickness of the coatings, as the loss in weight during each immersion is greater the higher the iron content of the coating. Wide variations in the results are obtained in the test with homogeneous electrolytic deposits. As thin films of electrolytic zinc are more protective than much thicker films produced by hot-dipping, the test is of little value in comparing the value of films produced by the two processes.
—A. R. P.

Metal Sprayer. Anon. (*Chem. and Met. Eng.*, 1932, **39**, 625–626).—A new metal spraying gun capable of applying coatings of any metal that can be drawn into wire or rod, is illustrated.—F. J.

Spotting of Lacquered Metal Articles. —— Freitag (*Oberflächentechnik*, 1931, **8**, 217).—Addition of 15–20% of "Stabilisol A," a yellow viscous oil, to nitrocellulose lacquers prevents the metal attacking the lacquer with the formation of brown spots. The best solvents or diluents for these lacquers are butyl alcohol, butyl acetate, and cyclohexanone.—A. R. P.

Investigation of Paint Films for the Surface Protection of Duralumin Sheets. E. K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1932, 17).—Red lead paint is unsuitable as a priming coat for protection against sea-water and ferric oxide paint is little better. Aluminium paint will protect Duralumin against atmospheric corrosion, but not against corrosion by sea-water. Of the 64 paints tested, only 5 were found suitable for the protection of the under-water parts of seaplanes, and only 15 for the parts above the water-line and for land aeroplanes.—B. Bl.

Examination of Two Paints for the Surface Protection of Elektron. E. K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1932, 17).—B. Bl.

Metallic Zinc Paint Finds Great Favour Abroad. Anon. (*Daily Metal Reporter*, 1932, **32**, (223), 5).—A brief account of the continental use of metallic zinc paint, which is now also being made in the U.S.A. in increasing amounts.
—P. M. C. R.

Particular Purpose Paints. Edwin Gunn (*Architect*, 1932, **130**, 255–256).—A dull grey paint for metal protection is claimed to be applicable after merely wire-brushing the metallic surface, with which the pigment interlocks. One coat is said to give effective protection. It is stated that the paint can be applied to hot or wet surfaces, and that it possesses good covering power and high resistance to corrosion and vibration.—P. M. C. R.

A Useful Colour-Changing Paint. James Scott (*Eng. Rev.*, 1933, **46**, 493–494).—A bright red enamel or paint is described, which undergoes a sharp change in colour at or near 140° F. (60° C.), becoming a deep brown. The change is reversed on cooling, and the paint is recommended as an indicator of overheating in bearings.—P. M. C. R.

The Art of Painting. James M. Jardine (*Indian Engineering*, 1932, **92**, 154–156).—Practical instructions for the selection, application, and drying of paint, enamel, and varnish products for a variety of purposes.—P. M. C. R.

VI.—ELECTRODEPOSITION

(Continued from pp. 87–92.)

Anodic Phenomena in Cadmium Plating Solutions. Gustaf Soderberg (*Monthly Rev. Amer. Electroplaters' Soc.*, 1932, **19**, (2), 9–15).—Cadmium anodes polarize in cadmium cyanide baths at 20–30 amp./ft.^{2} with increase in the free cyanide content from 2 to 10 oz./gall.; at these current densities the time required for the attainment of potential equilibrium decreases with increase in current density. With a steel anode potential equilibrium is rapidly attained, and is independent of the cyanide content. There is no formation of carbonate at a cadmium anode, but some is formed when a steel anode alone is used. To plate the inside and outside of long hollow articles simultaneously, an external soluble cadmium anode and an internal insoluble steel anode give the best results.—A. R. P.

Modern Plants for Chromium Plating. W. Birett (*Z. Metallkunde*, 1932, **24**, 289–295).—A review of the general features and modern practice of chromium plating is given, particularly with regard to the construction of baths (tanks, heating), the influence of the composition of the electrolyte, bath control, and working conditions.—M. H.

Cold Baths for the Electrodeposition of Chromium. Anon. (*Industrie chimique*, 1932, **19**, 891–892).—A review of recently published work, showing that the most brilliant deposits and the highest current efficiencies are obtained by the use of cold baths.—E. S. H.

Factors Affecting the Bright Chromium-Plating Range. R. J. Piersol (*Metal Cleaning and Finishing*, 1932, **4**, 547–550, 562; *C. Abs.*, 1933, **27**, 28).—Cf. this *J.*, 1932, **50**, 371. A discussion of the effects of temperature, CrO_3 concentration, sulphate ratio, trivalent chromium, and the iron content on the bright plating range of chromium-plating baths.—S. G.

Characteristics of a Bath for Hard Chromium Plating. Edmond de Winiwarter and Jean Orban (*Technique moderne*, 1930, **22**, 731).—Abstract of a paper read before the 6e. Congrés International des Mines, de la Métallurgie et de la Géologie Appliquée, June, 1930. Increasing the acidity of the bath by sulphuric acid makes it possible to use higher current densities with the consequent production of harder and denser deposits.—H. W. G. H.

The Influence of the Acidity of the Electrolyte on the Structure and Hardness of Electrodeposited Nickel. D. J. Macnaughtan and R. A. F. Hammond (*J. Electrodepositors' Tech. Soc.*, 1931–1932, **7**, 1–19; discussion, 170–171).—Reprinted from *Trans. Faraday Soc.*, 1931, **27**, 633–648. See this *J.*, 1931, **47**, 590.—S. G.

Cadmium Plating Instead of Galvanizing. Anon. (*Apparatebau*, 1932, **44**, 177).—Describes the properties and advantages of cadmium coatings.—M. H.

Electrochemistry. Chromium Plating. H. T. S. Britton (*Times Trade and Eng. Suppt.* (*Electrical Section*), 1932, **31**, (750), 32).—A general review of recent advances in the electrochemical industry. In particular, extended reference is made to chromium plating and its importance, not only because of its corrosion resistance, but also because of extreme hardness.—S. V. W.

Ultra-Rapid Nickel Plating in France. Marcel Ballay (*Met. Ind.* (*Lond.*), 1932, **41**, 499–500).—Abstract of a paper read before the Electrochemical Society. See this *J.*, 1932, **50**, 493.—J. H. W.

A Year's Progress in Electrodeposition. H. Sutton (*Met. Ind.* (*Lond.*), 1933, **42**, 74–76, 82).—A review of the progress effected in the electrodeposition of metals during the past year, including improved cleaning, throwing into deeply recessed parts, the deposition of cadmium, nickel, and chromium, and standardization. A short bibliography is appended.—J. H. W.

Throwing Power in Electroplating. L. C. Pan (*Metal Cleaning and Finishing*, 1932, **4**, 441–444, 497–500, 559–560; *C. Abs.*, 1933, **27**, 29).—The use of the circular and tubular cavity scales to determine the throwing power in electroplating and the advantages of these determinations are discussed. The effects of electrode spacing, hydrogen evolution, and current density on the throwing power are outlined. A bibliography is given.—S. G.

Electroplating Solution Control. Lawrence E. Stout (*Metal Cleaning and Finishing*, 1932, **4**, 269–272, 343–344, 354, 411–414, 463–466, 511–514; *C. Abs.*, 1933, **27**, 29).—The operating characteristics of acid copper, cyanide copper, and sulphate nickel-plating baths are described. Methods of analysis for determining copper, iron, and free sulphuric acid in acid copper baths, and nickel, chlorine, and acidity in nickel baths are outlined.—S. G.

Micro-Organisms in Plating Solutions. E. A. Ollard (*Met. Ind.* (*Lond.*), 1933, **42**, 17–18).—A description is given of fibrous " weeds " that sometimes grow in both acid copper and nickel-plating solutions. Sodium fluorite and phenol are said to check the growth, but hydrogen peroxide and formaldehyde do not seem to have much effect.—J. H. W.

Electroplating Wire. A. Wogrinz (*Draht-Welt*, 1932, **25**, 259–260).—The relationships between wire velocity, immersed length, and current, in the continuous plating of wire are derived. If G is weight of wire plated per hour in kg.; d the diameter in m.m.; s the density; L the length immersed in metres; v the velocity in metres per second; N the weight of metal plated per kg. of wire; M the electrochemical equivalent of the metal deposited; f the current efficiency (fractional); i the current in ampères; c the current density in amp./dm.^{2}; then $v = G/0{\cdot}9d^2 . \pi . s$; $L = N . G/0{\cdot}1d . \pi . f . M . c$; and $i = N . G/f . M$.—A. B. W.

Metal Surface Finishes for Electrodeposition of Protective Metallic Coatings. W. J. Merten (*Metal Cleaning and Finishing*, 1932, **4**, 537–540, 546; *C. Abs.*, 1933, **27**, 29).—Experiments which demonstrate the improved cohesive bond obtained between electrodeposits and base metal through the use of the more perfect surface finishes are described and illustrated.—S. G.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-Refining.)

(Continued from p. 92.)

Aqueous Electrolysis in Metallurgy. Georg Eger (*Z. Elektrochem.*, 1932, **38**, 942–964).—The commercial and industrial electrolysis of copper, zinc, cadmium, the noble metals, silver, bismuth, tin, antimony, iron, nickel, cobalt, and chromium is described and that of various other metals is mentioned. More than 100 references to current literature are made.—J. H. W.

An Electric Furnace Method for Separating Manganese from Manganese Sulphate. A. L. Ducournau (*Proc. Louisiana Acad. Sci.*, 1932, **1**, 18–21

C. Abs., 1933, 27, 27).—The furnace was charged with a mixture of manganese sulphate and $\frac{1}{16}$-in.-mesh carbon. The quantity of carbon used was equal to twice the theoretical weight needed to reduce the Mn_3O_4 equivalent to the manganese sulphate. The charge was allowed to fuse at 1800°–2000° C. Manganese was separated. Analysis of 15 samples gave the following averages: manganese, 90·01; sulphur, 5·02; residue, 2·00%. The presence of manganese carbide in some of the samples is due to the reaction between manganese and carbon at high temperatures. The presence of sulphur in the samples is attributed to the reduction of the sulphates by carbon. The amount of carbon used did not affect the purity of the manganese obtained. If manganese is to be used in the manufacture of steel, a low percentage of sulphur is necessary.—S. G.

The Production of Ferro-Alloys. S. S. Steinberg and P. S. Kusakin (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1930**, 1471–1480; *C. Abs.*, 1933, **27**, 484).—[In Russian.] Molybdenite, containing 87·51% MoS_2, was smelted together with iron filings, coke, and lime in an experimental arc furnace. Iron alloys containing molybdenum 80, carbon 5–6, and sulphur $>$ 0·10% were easily obtained. The recovery of molybdenum from the ore reached 80–90%. In the preparation of pure iron–chromium alloy, crude iron–chromium, containing chromium 64·37–65 and carbon 4·5–6%, was mixed with magnetite in one case and with chromite ore in other cases and refined in the same furnace at temperatures up to 2050° C. In this way iron–chromium alloys containing as low as 0·5% or less carbon can easily be produced. Iron–vanadium alloys were prepared from iron–vanadium ore containing V_2O_5 48·44, and Fe_2O_3 26·38%, and $(NH_4)_3VO_4$ in an arc and a kryptol furnace. Charcoal, soot, and iron–silicon alloy were used as reducing agents. First, iron was melted in a magnesite crucible. To this were added vanadium ore, iron–silicon alloys, or other reducing agents, and lime. The temperature was kept as low as possible. In this way an iron alloy containing vanadium 36·93–44, silicon 1·18–1·23, and carbon 0·48–1·80% was obtained.—S. G.

Cadmium–Nickel and Iron–Nickel Accumulators. W. Dinser (*Bull. Assoc. Suisse Elect.*, **1932**, 234–235).—Among the advantages of the "alkaline" accumulator is its freedom from any reaction between electrodes and electrolyte, the latter serving simply as conductor. The batteries may therefore safely be left, either charged or not, without deterioration, and no changes analogous with the "sulphating" of a lead accumulator can take place. The construction, working, and applications of the cadmium–nickel and nickel–iron cells are described; considerable economies in time and cost of upkeep compensate for the initial outlay.—P. M. C. R.

On the Use of Antimony and Manganese Electrodes for Determining Hydrogen-Ion Concentration. I. I. Zhukov and J. A. Boltunov (*Zhurnal Obschtchey Khimii* (*Journal of General Chemistry*), 1932, 2(64), (4/5), 407–414).—[In Russian.] The influence of various substances on the efficiency of antimony and manganese electrodes in buffer solutions has been investigated to determine their suitability for practical applications. The antimony electrode is affected by a considerable number of substances, notably organic acids, so that in this respect it offers no advantages over the hydrogen electrode. On the other hand, it enables continuous observations of p_H values to be made without disturbing gas equilibrium, bubbling of hydrogen through the solution, or adding such substances as quinhydrone; it can also be used for the direct determination of the p_H of gels. The manganese electrode has no practical value, since it is strongly affected by a wide variety of substances and does not give constant readings over a period. In certain cases, *e.g.* when the ions S'', SO_3'', NO_2', and CN' are present, the only possible method appears to be the use of a glass electrode.—M. Z.

VIII.—REFINING

(Including Electro-Refining.)

(Continued from pp. 92–94.)

[Abstract of Papers Read at] the Pan-Union Conference on Electrochemistry and Chlorine [October 26, November 1, 1931]. B. I. Rimer (*Zhurnal Prikladnoi Khimii* (*Journal of Applied Chemistry*), 1932, [B], 5, (3/4), 485–494).—[In Russian.] —— *Billiter* reviewed the world progress in the electrolytic refining of copper, nickel, tin, zinc, lead, sodium, aluminium, and magnesium. *A. F. Alabyshev* described the production of metallic sodium and its use in industry. Electrolysis of fused sodium chloride containing 18% sodium fluoride, 10% potassium chloride and fluoride, is recommended. *N. A. Tzelikov* dealt with the same method, and —— *Rudnitzky* with the electrolysis of fused caustic soda. —— *Pletnev* described the production of metallic lithium by electrolysis of a mixture of lithium and potassium chlorides at 400° C. and the special precautions necessary for casting and packing the metal. *M. S. Maximenko* reviewed the prospective developments of the electrothermal industry in U.S.S.R. *M. W. Borodulin* discussed the resistance of materials suitable for chemical plant. Nickel, chromium-plated iron, and lead are considered suitable. Chlorine attacks nickel above 500° C. and the others at 400° C. *W. Skortcheletti* described the work of the (Russian) Institute of Metals on the chemical resistance of alloys. *W. J. Kurbatov* discussed the influence of non-ferrous metals on the corrosion of steel.—M. Z.

Resistance Limits [in the] Parting of [Silver–]Gold [Alloys]. Heinz Borchers (*Metall u. Erz*, 1932, 29, 392–398).—The effect of thermal and mechanical treatment, the rate of dissolution, and the presence of impurities in the acid on the parting of gold–silver alloys in sulphuric and nitric acids has been determined, and the results are discussed from theoretical considerations based on Tammann's rule of resistance limits. Alloys with a gold–silver ratio of 1 : 1·42–1 : 300 can be parted in sulphuric acid (*d* 1·84) in 15 minutes and alloys with a ratio of 1 : 1·75–1·3 in nitric acid (*d* 1·3) in 15 minutes, leaving a compact residue of gold.—A. R. P.

Removal of Copper from Ridder Crude Lead. M. P. Verkhovtzev (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1930**, 90–101; *C. Abs.*, 1933, 27, 481).—[In Russian.] The lead was heated with sulphur or metal sulphides, such as PbS and pyrites, in pots of a capacity of 280 kg. of lead. The amount of copper in the lead was thus reduced from 3·11–6·52 to 0·054–0·070%, whilst 92% of the gold and 90% of the silver were retained in the lead. The best results were obtained with lead sulphide ore as reagent.—S. G.

A Study of Electrolytes for Zinc. I.—Purification from Nickel. L. Cambi and V. Toja (*Giorn. chim. ind. appl.*, 1932, 14, 125–129).—The removal of nickel and cobalt from zinc sulphate solutions obtained in the production of electrolytic zinc from its ores by hydrometallurgical methods is discussed.—G. G.

Experiments on Smelting Precipitated Fine Tin Dust. V. A. Vanyukov, N. N. Murach, and A. N. Genvarskii (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1931**, 204–210; *C. Abs.*, 1933, 27, 483).—[In Russian.] The ordinary method of compressing zinc dust into briquets and smelting the briquets under a layer of powdered coal in closed crucibles is wasteful, since a good deal of the powder oxidizes and escapes in the form of a white smoke. The method used in these experiments was as follows. Cause the tin dust to react with chlorine to get $SnCl_4$, reduce this to $SnCl_2$ with tin scrap, and precipitate the tin with zinc. Press the precipitate into briquets which have the composition: tin 79·38, $SnCl_2$ 6·7, $FeCl_2$ 2·3, $ZnCl_2$ 2·04, H_2O 5·95, other impurities 4·63%. Place these briquets in crucibles under a protecting cover of various salts such as KCN, $ZnCl_2$, $CaCl_2$, Na_2CO_3, $CaCl_2 + Na_2CO_3$, $ZnCl_2 + CaCl_2$, $Na_2CO_3 + K_2CO_3 + NaCl$, and $Na_2SO_4 + NaCl$. This method gave good results.—S. G.

IX.—ANALYSIS

(Continued from pp. 91–96.)

The Service of Analytical Chemistry to Research. B. L. Clarke (*Bell Laboratories Record*, 1932, 10, 327–333).—Cf. this *J.*, 1932, 50, 364. The organization of the analytical chemistry division of the Bell Telephone Laboratories is outlined. Examples of standard forms and analytical procedures are illustrated.—J. C. C.

The Case for the Standardization of Analytical Methods. A. R. Williams (*Chem. Eng. Min. Rev.*, 1932, 24, 431–433).—Abstract of a paper read before the Analytical Group of the Victorian Branch of the Australian Chemical Institute. The advantages of standardization are pointed out and the necessity for periodic revision and improvement of methods is emphasized. —J. H. W.

Development and Position of Quantitative Spectrum Analysis. I.—Physical Principles and Methods. F. Waibel (*Z. Metallkunde*, 1933, 25, 6–12). —A review under the following headings: (1) physical principles: spectra of the elements; excitation of spectra by temperature, electrons, and light; (2) methods of quantitative spectrum analysis: observation of the spectra; flame analysis; spark analysis with solutions and solid electrodes; valuation of the spectrum photographs; (3) sensitiveness and accuracy of measurement. —M. H.

Authorized Tentative Methods of Sampling and Analysis for Copper. R. H. Walton, C. Blazey, V. S. Rawson, and V. Barker (*Chem. Eng. Min. Rev.*, 1932, 25, 18–30).—Recommended methods of sampling molten and ingot copper are given. Cu is determined by electrolysis. As, Sb, and Sn are separated, As being then determined either by titration with standard I solution or with standard KCNS (by NH_4CNS) using $Fe(NH_4)_2(SO_4)_2$ solution as an indicator, or by precipitation as $Mg_2As_2O_7$; Sb, in the absence of Sn by titration with $KMnO_4$ or by weighing as Sb_2O_4, and in the presence of Sn, similarly after removing the tin with $(NH_4CO_2)_2$; Sn by weighing as SnO_2 or by electrolysis. Pb is separated and weighed as $PbSO_4$; Fe is weighed as Fe_2O_3 or titrated; Zn is weighed as $ZnSO_4$ or as ZnO; Co is weighed as Co_3O_4, and Ni is determined by dimethylglyoxime. Se and Te are precipitated and weighed as such. Bi is determined colorimetrically or by precipitation as BiOCl. O_2 is determined by loss in weight after heating the Cu in a current of H_2; S by weighing as $BaSO_4$. Au and Ag are determined by fire assay or by the mercury–sulphuric acid method; Ag can also be determined independently by precipitation with NaCl or HCl.—J. H. W.

A Distillation Method for the Rapid Determination of the Volatile Constituents in Small Samples of Copper–Zinc Alloys. Lily I. Weinstein and A. A. Benedetti-Pichler (*Mikrochemie*, 1932, 11, 301–310).—By heating Cu–Zn alloys in H_2 at 1150° C. all the Zn, Pb, and Bi volatilize, and hence the sum of these constituents present may be determined by weighing the alloy before and after heating for 10 minutes in a current of H_2 if 1–3 mg. are taken for analysis. The results are about 0·5% too high. Errors are introduced by the reduction of any oxides or sulphides that may be present, by incomplete removal of Zn if Ag or Mg is present, and by partial loss of As if the alloy contains this element.—A. R. P.

On Methods of Testing the Purity of High-Grade Lead. R. S. Russell (*Proc. Australian Inst. Min. Met.*, 1932, (87), 167–174).—Spectrographic analysis is satisfactory when the lead contains less than about 0·01% of impurities. Bi may be determined colorimetrically with KI and Sb turbidimetrically as Sb_2S_3. There do not appear to be satisfactory methods for estimating Fe and Zn in amounts less than 0·001%.—A. R. P.

Microchemistry in the Science of Metals. M. Niessner (*Forschungen u. Fortschritte,* 1932, **8**, (31), 396).—Cf. this *J.*, 1932, **50**, 365. In many cases the nature and distribution of small quantities of impurities in metals and alloys can be determined by the use of modern sensitive methods of detection, *e.g.* impression prints of various kinds.—J. W.

On a New Micro-Analytical, Gravimetric Procedure. Julius Donau (*Monatsh.*, 1932, **60**, 129–140).—An improved type of filtering cup for microchemical analysis is described and some examples are given of its utility.—A. R. P.

Potassium Iodide as a Spot Reagent for Some Heavy Metals. E. Grünsteidl (*Mikrochemie,* 1932, **12**, 169–173).—Details are given of the application of the colour reactions of Cu, Pt, Pd, and Au with KI for the detection of these metals.—A. R. P.

Macro-Electrolytic Analysis and Rapid Separation of Copper and Nickel. J. Guzmán (*Anal. Soc. españ. Fis. Quím.*, 1932, **30**, 433–440).—The method described is suitable for separating large quantities of Ni and Cu. The cathode consists of 400 cm.^{2} of Cu wire mesh mounted on a rectangular frame and the anode of Fe or Cr–steel wire passivated by immersion in HNO_3. Current is obtained from an 18-v. accumulator, and is regulated by the use of a graphite powder resistance; with 4–5 amp. 1–2 grm. of the metals can be separated in 30–40 minutes. Both metals can be rapidly deposited from an ammoniacal solution of their nitrates to which $(NH_4)_2SO_4$ has been added; if both metals are present together, the Cu is first deposited from HNO_3 solution containing $(NH_4)_2SO_4$ by the use of a Pt anode, NH_4OH is added to the electrolyte, and the Ni deposited with the aid of a Pt or passive Fe anode. Other metals can be determined in a similar way.—A. R. P.

Improved Method for the Analysis of Gaseous Elements in Metals. N. A. Ziegler (*Met. Ind.* (*Lond.*), 1932, **41**, 637–638).—Read before the Electrochemical Society. Cf. this *J.*, 1932, **50**, 674.—J. H. W.

Electrolytic Determination of Bismuth in Alloys with Lead. L. Lucchi and A. Bartocci (*Annali chim. appl.*, 1932, **22**, 509–511; *Chem. Zentr.*, 1932, **103**, II, 3126).—A sample containing less than 0·1–0·2 grm. of Bi is dissolved in HNO_3, the solution evaporated to 2–3 c.c., and diluted to 30 c.c., and the Pb precipitated with 3 c.c. of H_2SO_4. The filtrate is evaporated to dryness, the residue treated with 20 c.c. of H_2O, and $Ba(OH)_2$ added until the liquid is alkaline. After addition of 1–2 c.c. of HNO_3, the solution is electrolyzed without previous filtration, using 0·1 amp. at 1·8–1·9 v. Deposition of Bi compounds on the anode is avoided by adding $H_2C_2O_4$ after some hours. The deposited Bi is washed with C_2H_5OH and dried at 100° C. for weighing. —A. R. P.

Contribution to the Quantitative Determination of Calcium by the Filtration Method. H. Th. Bucherer and F. W. Meier (*Z. anal. Chem.*, 1932, **89**, 171–173).—Instead of $H_2C_2O_4$ for the precipitation of Ca, a $0{\cdot}1N$-$Na_2C_2O_4$ solution may be used and C_2H_5OH added to increase the sensitivity of the nephelometric determination of the end-point.—A. R. P.

On the Determination of Cobalt with Permanganate. J. Ledrut and L. Hauss (*Bull. Soc. chim. Belg.*, 1932, **43**, 104–113).—The method depends on the precipitation of CoC_2O_4 from a solution containing 25% HCOOH. Nitrates and NH_4 salts interfere. The error is less than 0·5% of the Co. —A. R. P.

The Spot Method of Approximately Estimating Gold. N. A. Tananaev and E. W. Vassilieva (*Ukrainskii Khemichnii Zhurnal* (*J. Chim. Ukraine, Scientific Part*), 1932, **7**, (1), 50–57).—[In Ukrainian, with German summary.] A method of estimating Au by comparing the intensity of colour developed when a drop of the solution is placed on a filter-paper saturated with benzidine solution, with the colour produced by a standard Au solution. It is stated that as little as 0·00002 grm. Au can be estimated in 15–20 minutes with an accuracy of 2–20%.—M. Z.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

(See also "Testing" and "Pyrometry.")

(Continued from p. 96.)

For Metallographers. Anon. (*Eng. and Min. J.*, 1933, 134, (1), 39).—Announces the new (Eastman Kodak) Wratten metallographic plate. Its characteristics are high resolving power; availability of a very high photographic contrast; availability of lower contrasts; high green and blue sensitivity; and absence of sensitivity to red light—R. Gr.

Dark Field Illumination Adds Contrast and Resolving Power. W. Zieler (*Metal Progress*, 1933, 33, (1), 19–23).—The factors influencing the resolving power of a lens system are considered. Modification of the wave-length of the light used requires high technical skill, and is expensive and somewhat cumbrous; the angle of the cone of light entering the objective cannot be increased beyond a certain limit. Where reflected light is used, as in the examination of metallic samples, both prismatic and plane reflectors have certain disadvantages. A system is described in which the illuminating rays enter past a central stop, are reflected from a plane glass illuminator, to two spherical reflecting surfaces, so arranged that light reaching the sample does not previously pass through the objective. The latter has not, as in most microscopes, to serve both as condensing and as observing system; this renders more definite focussing possible, whilst the increased aperture of the illumination greatly enhances resolving power. The image appears bright on a dark ground, and a comparison of bright and dark-field images may reveal characteristics not easily observed by either method singly. The definition of particles in slight relief is performed with considerable success by the dark-field method. Illustrative photomicrographs and diagrams of the condenser systems reviewed are given.—P. M. C. R.

The Spectroscope in the Works. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, 8, 184–185).—A description of spectroscopes which are now available for works' use in the identification of alloys. Little skill is required in the use of the instruments, which are of the visual type, and offer considerable advantages for such purposes as the sorting of alloys and the control of scrap.—R. G.

A Self-Rectifying Demountable X-Ray Tube of High Power. C. E. Eddy (*J. Sci. Instruments*, 1932, 9, 354–358).—The requirements of a demountable X-ray tube for spectroscopy and crystal analysis are discussed. Full details are given of the construction of a tube of the thermionic type with detachable electrodes mounted on metal ground joints. The tube can pass 40 m.amp. at 50 kv. for long periods, and has taken 10 m.amp. at 95 kv. for a few minutes.
—W. H.-R.

An Automatic Safety Device for Water-Cooled X-Ray Tubes. Graham W. Marks and J. Grebmeier (*Rev. Sci. Instruments*, 1932, 3, 294–296).—There is inserted in the electric circuit an automatic switch comprising contacts made between two conducting rods and mercury contained in two narrow tubes dipping into a pool of mercury, the mercury level in the tubes being determined by the pressure of the water supply.—J. S. G. T.

Apparatus for the Control of Drying Chambers. Anon. (*Tonind. Zeit.*, 1932, 56, 156–157).—The apparatus comprises a balance to one arm of which is attached by means of a wire the test-piece which is suspended in the drying oven. The loss in weight is continuously recorded by the balance.—B. Bl.

Construction of an Air-Cooled Electromagnet. I. Walerstein and A. I. May (*Rev. Sci. Instruments*, 1932, 3, 136–144).—Describes an air-cooled electromagnet of the Boas type, in which the current is carried by 2000 turns of flat bare copper ribbon wound in 24 pancake coils cooled by a forced air draught. Using ferro-cobalt pole caps, a field of 48,500 gauss is attainable.—J. S. G. T.

A Small Experimental Electromagnet. S. R. Williams, W. W. Stifler, and T. Soller (*Rev. Sci. Instruments*, 1932, 3, 423–426).—Describes a simple and cheap form of electromagnet, giving field strengths up to about 18,000 gauss. —J. S. G. T.

XI.—PHYSICAL AND MECHANICAL TESTING, INSPECTION, AND RADIOLOGY

(Continued from p. 97.)

Etching Aluminium Alloy Airscrew Blades. H. E. F. (*Aircraft Eng., Workshop and Production Section*, 1932, 4, (46), 4).—Etching of aluminium alloy airscrew blades after about every 300–350 hrs. of flying is recommended in order to show up any cracks which may have developed. The treatment consists in swabbing the airscrews with 10–20% solution of caustic soda in water, rinsing, and then swabbing with a 20% aqueous solution of nitric acid. These operations are repeated until the desired depth of etch is obtained.—H. S.

Static and Dynamic Testing of Some Light Metals. Kurt Matthaes (*Jahrb. deut. Versuchsanst. Luftfahrt*, **1931**, 439–484).—A fuller report of *Z. Metallkunde*, 1932, 24, 176–180; cf. this *J.*, 1932, **50**, 600. The paper gives numerous results of the mechanical testing of light metals. The original should be consulted for detailed data.—B. Bl.

Metals at High Temperature—Test Procedure and Analysis of Test Data. Ernest L. Robinson (*Amer. Soc. Mech. Eng. Preprint*, **1932**, Dec., 1–4).—A definite relation between short and long-life tests at elevated temperatures has not yet been established. The flow of metals under low stresses, such that the resulting distortion is less than 0·1%, show, after a long lapse of time, a continued decrease in the rate of extension. In presenting data on the results of creep tests at high temperatures, it is important to include a record of the distortion—*i.e.*, extensions—and preferably a complete extension–time diagram of the test.—W. P. R.

Accelerated Method for Determining Creep Limit. A. Pomp and Walter Enders (*Instruments*, 1932, 5, 166–168).—A description is given of a creep-testing machine equipped to provide, by the action of a beam of light on sensitized paper, a continuous record of elongation. Automatic recording enables transitory elongations (due to temperature fluctuations, &c.) to be recognized, and thus avoids errors which may occur in a series of spaced instantaneous readings. The importance of precise temperature control is emphasized. With this equipment, elongation-time curves were determined over periods of up to 2400 hrs. on carbon steels, and indicated that values of elongation higher than 0·001% per hr. (as previously proposed by Pomp and Dahmen, see this *J.*, 1931, **47**, 71) can take place between the fourth and eighth hours with loads which are yet not high enough to cause continuous creep. It is now proposed that the greatest load which does not cause more elongation than 0·003% per hr. between the fifth and tenth hours shall be taken as the creep limit.—J. C. C.

New Portable Sheet Metal Tester. Anon. (*Instruments*, 1932, 5, 179).—A cupping test is carried out by using a vice to force the plunger of this machine into a sample of sheet. The pressure at rupture is shown on a hydraulic gauge, and the depth of the cup measured subsequently.—J. C. C.

Impact Values of Some Metals as Determined on the New Tentative Standard Test-Piece Proposed at the Zürich Congress. A. Bertella (*Ricerca scientifica*, 1932, 2, (5/6), 157–185).—The results of 1340 impact tests made on Mesnager bars of steels, cast irons, brasses, and copper with notches of 2 mm. or 3 mm. indicate that the 3-mm. notch gives more uniform values than the 2-mm. notch. The values obtained with the 3-mm. notch are 0·875 times those obtained with the 2-mm. notch. The fractures obtained in the tests are discussed, and the numerical results are shown diagrammatically.—G. G.

On the Bending and Torsion Vibrations of a Thin Cylindrical Crystal Rod of any Desired Crystallographic Orientation. E. Goens (*Ann. Physik,* 1932, [v], **15,** 455–484; errata, *ibid.*, 902).—The theory of bending and torsion vibration, which is of importance for the determination of the moduli of elasticity and torsion by dynamic methods, is discussed.—v. G.

The Scratch Extensometer. Anon. (*Instruments,* 1932, **5,** 253).—Cf. *J.*, this volume, p. 97. Extension is recorded by the scratch of a diamond on a steel target, and measurements are made by means of a microscope.—J. C. C.

Stress–Strain Recorder. Anon. (*Instruments,* 1932, **5,** 225).—A brief notice of the Southark–Emery stress–strain recorder. All moving parts are operated from a small motor. Extension of the specimen breaks an electric circuit, and the retreating contact is followed up automatically by a contact on the recorder.—J. C. C.

Portable Brinell Hardness Tester. Anon. (*Instruments,* 1932, **5,** 26).—Cf. this *J.*, 1932, **50,** 312. A 5-mm. ball is mounted on one side of a heavy two-pronged spring, so that when the instrument is forced by means of a vice against the specimen under test, a load of 750 kg. is applied.—J. C. C.

"Superior" Brinell Hardness Testing Machine. Anon. (*Instruments,* 1932, **5,** 269).—A brief notice.—J. C. C.

New Self-Indicating Unit for Screw-Power Universal Testing Machines. Anon. (*Instruments,* 1932, **5,** 252).—A large dial indicator can be fitted to beam-type testing machines.—J. C. C.

New Gigantic Testing Machine. Richard Rimbach (*Instruments,* 1932, **5,** 44–46).—An illustrated description of a testing machine at the University of California accommodating columns up to 33½ ft. long and capable of exerting up to 4,000,000 lb. in compression and up to 3,000,000 lb. in tension.—J. C. C.

RADIOLOGY.

On the Development of the X-Ray Method for Testing Materials. P. Wiest (*V.D.I.-Nachrichten,* 1932, **12,** (52), 2).—A short review.—J. W.

The Use of X-Rays for Testing Locomotive Details: German State Railways. Anon. (*Locomotive,* 1932, **38,** 398–400).—The portable X-ray plant and van used by the German State Railways for the inspection of rolling-stock, permanent-way material, constructional work, &c., is described and illustrated. It provides for careful inspection at points most liable to stress, and has been found especially useful in connection with the construction of the inner fire-box. Specimen skiagraphs are appended.—P. M. C. R.

X-Ray Testing Steel Structures. —— Kantner (*Elektroschweissung,* 1932, **3,** 21–25).—Describes the "shockless" apparatus and illustrates some applications.—H. W. G. H.

Recent Radiological Methods with Special Reference to Boilers and Built-In Apparatus. A. Herr (*Schmelzschweissung,* 1931, **10,** 258–262).—The accuracy, economy, and reliability of the X-ray method of examining the macrostructure of materials are illustrated by examples.—B. Bl.

X-Ray Inspection Outfit. Anon. (*Power Plant Eng.*, 1932, **36,** 354).—A travelling generator and inspection apparatus for the workshop examination of joints, seams, and welds is described and illustrated.—P. M. C. R.

Detecting Faulty Welds. —— (*Electrician,* 1932, **108,** 451; and *Elect. Rev.*, 1932, **110,** 557).—Cf. this *J.*, 1932, **50,** 560. Brief description of the portable "Metalix" self-protected X-ray outfit used by Messrs. Babcock and Wilcox for examining steel welds.—S. V. W.

Some Factors in the Design of Hot Cathode X-Ray Tubes for Steady Running. W. R. Harper (*Proc. Cambridge Phil. Soc.*, 1932, **28,** 497–508).—General considerations regarding the design of hot cathode X-ray tubes are discussed and a description is given of a tube constructed on these lines. If the electrical input of the tube is controlled satisfactorily, the quality of the vacuum in the tube has little influence on the steadiness of the beam.—E. S. H.

XII.—PYROMETRY

(Continued from p. 98.)

Measuring the Temperature of Zinc Baths. Gustaf Borlinghause (*Draht-Welt Export-Ausgabe*, 1932, (7), 67–70).—[In English, French, and Spanish.] A survey of available pyrometric devices leads to the choice of the thermo-electric pyrometer as providing the best combination of sensitivity, reliability, and durability for this type of service. To be really useful the pyrometer must give a close indication of the bath temperature, and is therefore best immersed directly in the bath or in a pocket filled with lead at the corner of the bath. The thermocouple outer sheaths are best made of steel, which is cheap, but must of course be frequently replaced.—A. B. W.

Pyrometry in the Brass Foundry. Chas. E. Foster. J. Arnott (*Met. Ind.* (*Lond.*), 1932, 41, 495).—Two letters disputing the advantages of using a Nichrome sheath for pyrometers in brass melting, as claimed by F. A. Livermore, and recommending the use of a bare thermo-couple.—J. H. W.

Infra-Red Pyrometer with Photo-Electric Cell. Anon. (*Technique moderne*, 1931, 23, 508).—The instrument is claimed to give accurate readings of temperatures between 400° and 3500° C. The infra-red radiation, of about 1 micron wave-length, emitted by the hot body, is compared with that from a filament lamp by means of the photo-electric cell. The voltage applied to the filament is then a measure of the temperature.—H. W. G. H.

Instruments as an Aid to the Production Engineer. A. Eric Smith (*J. Inst. Production Eng.*, 1932, 11, 258–271).—Includes brief descriptions of various types of indicating and recording pyrometers.—J. C. C.

On New Precious Metal Thermocouples for High Temperatures. Alfred Schulze (*Helios*, 1932, 38, 329–330).—An abstract of the work of W. Goedecke in the *Festschrift zum 50-jährigen Bestehen der Platinumschmelze G. Siebert G.m.b.H., Hanau*, 1931, 72–99. See this *J.*, 1932, 50, 94.—v. G.

Investigations of the Cooling Down of White-Hot Silit Rods by Means of Photographic Pyrometry. R. Hase (*Z. tech. Physik*, 1932, 13, 410–415).—In temperature measurements by the photographic method without using prismatic resolution of the light it is necessary to determine by the colour sensitivity and smoked glass absorption method the "effective wave-length" for the range of temperature investigated. By interpolation with different degrees of blackness and the use of the photo-electric photometer, it is possible even with rapid changing radiation to obtain an accuracy of ± 3° C. at 1400° C., but for intervals of more than 100° C. monochromatic light must be used. The calculations have been confirmed by observations on Silit rods, the heat constants of which have been determined by separate methods.—J. W.

On Micropyrometry, Especially on an Objective Micropyrometer. G. Lewin, W.-W. Loebe, and C. Samson (*Z. tech. Physik*, 1932, 13, 415–420).—A micropyrometer is described in which comparison of light intensities is replaced by comparison of light currents by means of photo-electric cells. In this way the temperature of individual portions of the hot surface having a diameter of less than 1 μ can be measured accurately. Examples of the use of the instrument for measuring the temperature of electric lamp filaments and complete technical details are given.—J. W.

Temperature Controller Uses Photo-Electric Cell. R. H. Newton and C. C. Furnas (*Chem. and Met. Eng.*, 1932, 39, 455).—A sensitive form of temperature controller as constructed and used by the Department of Chemical

Engineering at Yale University, U.S.A., is illustrated and described. A light reflected from the mirror of a galvanometer which is used in a potentiometer circuit connected to the detecting device is caused to play over the surface of a Weston Photronic cell. The cell, in turn, actuates relays, which control the heat supply—either fuel or electricity. The detecting device may be a single- or multiple-junction thermometer or a resistance thermometer, and it is probable that the circuit can be adapted to the use of a radiation pyrometer or other apparatus which employs a potentiometer. The controller is inexpensive, and simple to set up and keep in adjustment.—F. J.

Temperature Regulators in Metallurgy. Anon. (*J. Four élect.*, 1932, **41**, 420–423).—A description is given of several types of temperature regulators for use in metallurgical operations and their methods of use.—J. H. W.

Self-Acting Temperature Regulator. Anon. (*Chem. and Met. Eng.*, 1932, **39**, 460).—A new "Tycos" self-acting temperature regulator, suitable for use in plating tanks, &c., is illustrated.—F. J.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from p. 98.)

Some Special Alloys for Non-Ferrous Metal Mixers. Wesley Lambert (*Met. Ind.* (*Lond.*), 1933, **42**, 47).—A description of the preparation and use of various types of "hardeners," such as phosphorus, manganese, manganese–copper, silicon, aluminium, nickel, boron, beryllium and magnesium, sodium, barium, lithium and ferrous alloys, and sulphur and galena.—J. H. W.

Economical Melting in the Foundry. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, **53**, 499–500).—Precautions to be taken to prevent waste in the foundry are given, and an economical form of coke furnace is described.
—J. H. W.

Heat-Cracks and Casting Strains as Causes of Waste. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, **53**, 351–352).—The effects of defective moulding and casting are discussed.—J. H. W.

The Aluminium Foundry ; Methods and Results. C. Panseri (*Atti Sindacato Ingegneri Milano*, 1932, **10**, (1), 17–26).—A review of modern practice in the light metal foundry.—G. G.

Treatment of Aluminium Turnings with Salt Fluxes. (Some [Information] on the Systems KCl–NaF, KCl–NaCl–NaF, $KCl–CaF_2$, and $NaCl–CaF_2$). W. Leitgebel (*Metallwirtschaft*, 1932, **11**, 699–700).—Melting tests with aluminium turnings under various salt fluxes have afforded information on the system sodium chloride–potassium chloride–sodium fluoride. The two last-named constituents form a eutectic at 19% sodium fluoride and 653° C. In the ternary system the lowest melting point (607° C.) occurs with 12% sodium fluoride and 35–45% sodium chloride.—v. G.

Casting Temperature and Mechanical Properties of Aluminium Alloys. —— Thews (*Metallbörse*, 1932, **22**, 834–835, 866–867).—Over-heating of aluminium and its alloys, especially if the melt is held at a high temperature for a long time, causes porosity due to gas absorption, introduces oxide inclusions into the bath, and produces a coarse-grained structure; a low casting temperature does not ameliorate these faults.—A. R. P.

The Melting and Casting of Aluminium Alloys. W. Fröhlich (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, **53**, 206–207, 224–225).—Cf. this *J.*, 1932, **50**, 124. The melting and casting of aluminium alloys containing aluminium 81–100, copper 0–12·0, zinc 0·2–13·5, iron 0–1·7, and silicon 0–10%, and the properties of the resulting castings are described.—J. H. W.

Moulding Practice with Heat-Treated Aluminium Alloys. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, **53**, 459–460).—Copper-containing aluminium alloys exhibit as a rule severe piping and brittleness. These troubles can be reduced by the use of silicon and by suitable heat-treatment. Excessive temperatures must be avoided during melting, and pouring should be at about 705° C. In England heat-treatment is carried out in a carefully-regulated electric furnace, and consists of annealing for 18–24 hrs. at 515° C. and quickly quenching in water.—J. H. W.

A New Aluminium Alloy for Casting [M.V.C.]. Anon. (*Engineering J.*, 1931, 52, 432).—A note of the principal properties, and method of "modification" of "M.V.C." alloy.—H. F. G.

Investigation of a Cracked [Aluminium] Motor Piston. K. Matthaes (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1932, 18).—The fracture was attributed to the pressure at the high working temperature exceeding the tensile strength of the aluminium piston alloy at that temperature.—B. Bl.

Bearing Cover of Aluminium in Chill-Casting. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, 53, 479–480).—For casting aluminium and Silumin bearing covers, the mould is made of nickel–steel or nickel–cast iron, the effect of the nickel (added as a nickel alloy containing 6% of silicon) being to prolong the life of the mould. The mould is preheated to 120°–160° C. An example is given of the melting of an alloy of 85% of aluminium and 15% of 50 : 50 copper–aluminium in a crucible furnace, the casting temperature being 720°–760° C. (760°–800° C. for Silumin). Zinc chloride is used for deoxidizing. —J. H. W.

On the Preparation of "Aluminium–Bronze." Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, 53, 480).—Composition alone is not a sufficient criterion for "aluminium–bronzes," and the other factors which determine its quality and applicability are discussed.—J. H. W.

Froth Formation of "Aluminium–Bronze" and Special Brasses, Its Causes and Remedy. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, 53, 331–333).—The strong froth-formation that occurs in many alloys, especially in "aluminium–bronzes," is due to the oxidation of certain constituents and, in the case of aluminium alloys, to atmospheric oxidation. The manner in which these causes result in froth-formation and the precautions required to obviate it are described.—J. H. W.

Experiments on the Use of Calcium Carbide as a Deoxidizer for Bronze. I. I. Mokienko (*Metallurg* (*The Metallurgist*), 1932, 7, (2), 71–79).—[In Russian.] Owing to the lack of phosphorus at the Marty works at Nikolaev, attempts were made to use calcium carbide for deoxidizing bronze. Satisfactory results were obtained, the carbide acting as a deoxidizer without contaminating the alloy or causing any marked difference in its microstructure. The mechanical properties are improved : tensile strength increases by 4·5%, and elongation by 13·2%. It is concluded, however, that a small addition of phosphorus is still desirable (about $\frac{1}{5}$ of that formerly added) to improve the fluidity of the molten alloy.—M. Z.

The Bronze Founding Industry in 1932. Francis W. Rowe (*Met. Ind.* (*Lond.*), 1933, 42, 43–46).—An account of the progress in bronze founding that has taken place during the past year.—J. H. W.

Cause and Effect in Bronze Founding. Francis W. Rowe (*Met. Ind.* (*Lond.*), 1932, 41, 413–416; and *Found. Trade J.*, 1932, 47, 282–283, 292).—Abstracts of a paper read before the East Midlands Branch of the Institute of British Foundrymen on the subject of the melting and founding of bronze castings. —J. H. W.

Sound Non-Ferrous Castings. C. W. Bigg. — Peace. P. A. Russell. — Lucas. — Hillman. — Blandy. — Speirs. — Blades. F. W. Rowe (*Found. Trade J.*, 1932, 47, 330).—Abstract of a discussion of a paper by F. W. Rowe. See preceding abstract.—J. H. W.

The Manufacture of a Drum in Acid-Resisting Bronze. A. Führer (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, 53, 517–518).—A description is given of the casting of a drum in acid-resisting bronze of the following composition: copper 75, lead 9, nickel 5, antimony 5, tin 4, and phosphor–copper 2%. The copper and nickel are first melted, under a suitable cover, in a crucible furnace, and the antimony, lead, and tin are then added in that order. Finally, the phosphor–copper is added and the whole poured at 1120° C.—J. H. W.

The Casting of a Bronze Cupola in Green-Sand. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, 53, 518–519).—The mould preparation and coring and the casting of a cupola in 90 : 10 bronze in a green-sand mould are described.—J. H. W.

Roll-Bearings and Their Manufacture. Erich Becker (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, 53, 439–440, 458–459).—The manufacture of non-ferrous roll-bearings is described, and the composition and applications of a number of alloys containing copper 73–88, tin 5–13, zinc 0–8, lead 0·5–12, nickel 0–4·8, manganese 0–1, phosphorus 0–0·3, and antimony 0–3% are tabulated. According to Weinlig, the average life of a red brass bearing is 14,645 days, but this can be increased to 33,273 days with an alloy consisting of copper 85·5, tin 9·5, lead 0·5, nickel 3·5, and manganese 1%. Segregation in the lead-containing alloys can be minimized by small additions of zinc, nickel, sulphur, or sodium.—J. H. W.

Protection and Refining Slags for the Preparation of Brass Alloys. Edmund Richard Thews (*Metallbörse*, 1932, 22, 1166–1167).—The value of various fluxes in melting brass is discussed at some length with special reference to patented mixtures.—A. R. P.

On the Deoxidation of Red Brass with Phosphorus. Edmund Richard Thews (*Metallbörse*, 1932, 22, 1037–1038).—Cf. this *J.*, 1932, 50, 773. The effect of phosphorus in red brass is discussed and a brief account given of recent work on the deoxidation with phosphorus of an alloy of 81·5% copper, 3% tin, 7% lead, and 8·5% zinc. The beneficial action of phosphorus on this alloy is more likely to be due to the formation of a fusible phosphate slag with the zinc and tin oxides rather than to reduction of these oxides to the metals.—A. R. P.

The Casting of Slide Valves and Oblique Valves in Red Brass. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, 53, 417–419).—Until recently the casting of red brass slide and oblique valves was considered a difficult operation requiring special precautions. A general method of making these valves has now been developed and is here described, together with the methods of mould and core preparation. If scrap metal is used, it must be of known composition. Scrap containing aluminium, iron, or manganese must not be used. The casting temperature should not exceed 1150° C.—J. H. W.

Phosphorus in Red Brass. James Brinn (*Met. Ind.* (*Lond.*), 1933, 42, 10).—A letter commenting on an article with the above title by R. Thews (cf. this *J.*, 1932, 50, 773); and on letters by others, and claiming that the action of the phosphorus is to take the place of a flux and to oxidize in preference to copper, &c. The oxide combines with the solid oxide film on the metal surface forming a liquid slag and permitting metal to metal contact.—J. H. W.

The Casting of Red Brass and Brass Receptacles. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, 53, 436–438).—The system of moulding, gating, and casting brass receptacles is described.—J. H. W.

Manganese–Bronzes. Edmund Richard Thews (*Metallurgist* (Suppt. to *Engineer*), 1932, 8, 139–141).—Compositions are given of commercial "manganese–bronzes," and of proprietory alloys of similar type. The separate effects of manganese, iron, aluminium, lead, and tin are described. Various methods of melting are discussed. The addition of phosphorus and preliminary casting and remelting are advocated.—R. G.

Art Moulding in Nickel–Brass. —— Dubercet (*Rev. Fonderie moderne*, 1932, **26**, 424–425).—Nickel–brass is manufactured under a large variety of names, but consists essentially of nickel 15–25, copper 60–65%, and the remainder zinc. For art moulding, the following composition is recommended: copper 62, nickel 15, zinc 25·5, cupro-manganese 0·4 parts, and 0·1 part of a 20 : 80 lead–tin alloy. The mixing, melting, and casting of this alloy and the precautions to diminish segregation and pin-holes are discussed.—J. H. W.

Casting Table Legs in Brass and Nickel–Brass. A. Heinz (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, **53**, 477–479).—The correct and incorrect gating procedure for casting columns in copper and nickel–brass are illustrated, and details of moulding and pouring are described.—J. H. W.

Whitemetalling Bearing Bushes. Anon. (*Machinery* (*Lond.*), 1932, **40**, 270; *correspondence*, 528, and **41**, 253).—A fixture for casting sound bearing shells, free from blowholes, is described and illustrated. The metal is poured into a hollow mandrel, whence it flows through a number of $\frac{3}{16}$-in. holes into the space between the mandrel and the outer walls of the mould. The mandrel is forced out later in a small screw press.—J. C. C.

Forming and Pouring Hard Lead Castings. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, **53**, 419).—Hard lead castings contain copper and, more especially, antimony, the latter up to 28%. A typical alloy is lead 85, antimony 14, copper 1%. The copper is first melted, then the antimony is added in small pieces, and finally the lead is added with vigorous stirring. 5% lead–tin is used as a deoxidizing agent. The pouring temperature is about 550° C.—J. H. W.

Magnesium : Melting, Casting, and Uses. R. de Fleury (*Rev. Mét.*, 1932, **29**, 341–347; and (short abstract) *Met. Ind.* (*Lond.*), 1932, **41**, 245).—It is imperative to use fluxes in melting magnesium for founding. There are two methods of using the fluxes; in the one method the amount of flux is large in relation to that of metal which it virtually envelops and isolates from the atmosphere. This method involves some risk of inclusions of flux in the castings. The second method employs a minimum amount of flux and provides measures for its removal from the metal; a deep, narrow crucible is used. Fluxes for use in melting magnesium should have low melting-point (below 680° C.), low density (below 1·70), fluidity at the working temperature sufficient to protect the melt completely, but viscosity sufficient to prevent the flux from passing with the metal into the mould. They should be chemically inert towards magnesium and stable at the temperatures of use (up to about 800° C.). No single substance possesses all these properties, hence attention is paid to mixtures containing minimum amounts of chlorides, and particularly of magnesium chloride, which should be present in amounts only sufficient to form oxy-chloride with any MgO present and thereby permit easy removal. The selection of suitable fluxes is discussed and formulæ are given, but de F. remarks that these are suitable only for 20 kg. crucibles as used in the experiments, and would require modification to suit other conditions. The preparation of sand moulds, the features of the various additions made to the sands used for magnesium alloy castings, and the general technique of casting magnesium alloys in sand moulds are discussed. A note by M. Messier on the advantages gained by the use of cast magnesium alloy wheels on aircraft is appended.—H. S.

Melting Magnesium : Casting in Green Sand. A. Caillon and R. de Fleury (*Compt. rend.*, 1932, **195**, 549–551).—Hitherto the affinity of magnesium for water vapour has rendered it necessary for magnesium castings to be made in dried sand. By the use of suitable additions, however, green sand can be used. The following is an example of such a mixture: clay sand (8% Al_2O_3 + 90% SiO_2) 10 kg., white sand (99% SiO_2) 30 kg., flowers of sulphur 400 grm., ammonium fluoride 400 grm. The sulphur remains as such, owing to the decomposition by the excess magnesium of any sulphur dioxide formed, and acts as a protection against the action of moisture. The ammonium fluoride acts in the same way, by the formation of hydrofluoric acid. Other substances can be used instead of the ammonium fluoride; the best and most economical is a mixture of ammonium sulphate and calcium fluoride.—J. H. W.

Fluidity and Castability of Ultra-Light Alloys. L. Losana (*Alluminio*, 1932, 1, 237–243).—The fluidities (fluidity of tin at 300° C. = 1) of various alloys of magnesium with aluminium, zinc, &c., have been determined by casting the alloys from a bottom-pouring crucible, into a spiral mould. The "castability,"[1] expressed as the number of cm. of the mould filled by the alloy, is plotted against the casting temperature, mould temperature, and composition of the alloy. An "index of castability," and a "coefficient of equal castability"[1] are also proposed and defined.—G. G.

Melting and Pouring White Bearing Metals. Edmund R. Thews (*Metallurgist* (Suppt. to *Engineer*), 1932, 8, 170–173).—The relative advantages of tin- and lead-base bearing metals are discussed. In melting, it is important that oxidation of tin and antimony be avoided, and suitable methods of melting are described in detail. The various considerations which govern the choice of pouring temperatures are dealt with. Tin-base alloys permit a wider range of pouring temperature than lead-base alloys. The Brinell hardness (10 mm. ball; 500 kg. load) should be 28–32 for tin-base and 20–24 for lead-base alloys. In casting, porosity due to shrinkage is avoided by locally heating the mould or by application of heat to the feeding head.—R. G.

Arrangements for Casting Bearings in White Metal. A. Schüle (*Z. ges. Giesserei-Praxis: Der Modellbau*, 1931, 52, 29–30; and *Rev. Fonderie moderne*, 1932, 26, 383–384).—The construction and setting up of a special mould for casting white metal bearings are described.—J. H. W.

Prevention of Liquation in White Anti-Friction Alloys by Addition of Nickel. A. M. Botchvar, F. P. Borin, and M. Yoselevich (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1931**, (7), 850–854; *C. Abs.*, 1932, 26, 5893).—[In Russian.] Nickel was found to prevent liquation and to ensure uniform distribution of hard crystals in tin–antimony alloys. Experiments showed that 1–2·5% of nickel entirely prevents liquation and creates a uniform distribution of hard crystals of β solid solution of tin and antimony. Nickel, which forms a compound Sn_3Ni_2 with tin, forms needles uniformly distributed throughout the alloy. Nickel also increases the hardness of the alloy. The mechanical properties of this alloy and the effect of other elements, such as cobalt, manganese, cadmium, chromium, magnesium, and aluminium on tin–antimony, lead–antimony, and tin–lead–antimony alloys are now being investigated and will be reported later.—S. G.

Report of Committee B-6 [of A.S.T.M.] on Die-Cast Metals and Alloys. H. A. Anderson and P. V. Faragher (*Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 264–284).—See this *J.*, 1932, 50, 581.—S. G.

Widening the Field of Die-Castings. William J. During (*Amer. Machinist* (*Eur. Edn.*), 1932, 76, 532–534E).—Of the three methods of producing die-castings, mechanical, pneumatic, and hydraulic, the last has the advantages of pressure build-up, less risk, and positive smooth and dependable action. The application of this method to all kinds of die-castings, particularly of zinc, is described. This process has largely overcome previous limitations of zinc-base die-castings, and several illustrations of its application to such castings are given.—J. H. W.

Metal Pressure Castings. Joh. Mehrtens (*Z. ges. Giesserei-Praxis: Das Metall*, 1932, 53, 382–384).—The mechanism of metal flow in pressure castings and the advantages of this method of casting over sand-casting is discussed, and the machinery used in pressure-casting are briefly described.
—J. H. W.

Pressure Die-Casting. Anon. (*Fonderie moderne*, 1931, **25**, 273–274).—Abstract from *Z. ges. Giesserei-Praxis : Das Metall*, 1931, **52**, 26–26; see this *J.*, 1931, **47**, 305.—J. H. W.

Production of Gravity and Pressure Die-Castings in Aluminium.—I–II. C. Vaughan (*Amer. Machinist* (*Eur. Edn.*), 1932, **76**, 564–566E, 594–596E; also *Machinery* (*Lond.*), 1932, **41**, 337–343, 373–376; and *Met. Ind.* (*Lond.*), 1932, **42**, 125–126, 150–153, 179–180).—A paper read and discussed before the London Section of the Institution of Production Engineers. The design of moulds and details of pouring for gravity castings of aluminium alloys are considered having particular regard to the high shrinkage of the alloys and the sluggishness and slow freezing of the alloys relatively rich in zinc or iron. Illustrations of such castings are given. The moulds are usually made of close-grained cast-iron or semi-steel castings containing a little chromium. Cores, &c., are made of ordinary tool steel or higher-grade alloy steels. The mould faces are protected from erosion by spraying them while warm with a solution containing, for example, sodium silicate and chalk. The process of pressure die-casting is described in some detail.—J. H. W.

Mould for Die-Casting Aluminium Pistons. Anon. (*Machinery* (*Lond.*), 1932, **41**, 253).—The production of cracked pistons during die-casting is attributed to an excessive difference between the temperatures of the molten metal and the die. The metal should be poured at as near 700° C. as possible and the mould kept within 50° of 400° C. Methods of maintaining the mould temperature are discussed.—J. C. C.

Modern Plastic Shaping of Copper Alloys by the Die-Casting Process. Anon. (*Metallbörse*, 1932, **22**, 737–738).—The use of the two types of die-casting machine for the preparation of castings of brass and other copper alloys is described and the tensile properties of some die-cast copper alloys are given. Bronzes with up to 15% tin have recently been successfully cast by this method.—A. R. P.

Pressure Casting Brass. Anon. (*Aciers spéciaux*, 1932, **7**, 347–354).—Examples of the machinery and accessories used for making pressure castings in brass and a description of the method and examples of such castings are given.—J. H. W.

The Casting of Brass Under Pressure. M. Belin (*Usine*, 1931, **40**, (53), 35–37).—The advantages of die-castings and the difficulties encountered in producing them in brass are explained. The short life of the moulds, due to the rapid attack by the molten brass, has been overcome to a large extent by using very high pressures and low casting temperature. Detailed cost figures are given to show that, by this means, die-castings can be produced at an economic figure in many cases. It is emphasized that discretion must be used in choosing suitable cases, in many of which slight modifications in design are necessary.—H. W. G. H.

Zinc Alloys for Die-Casting Recently Improved. J. B. Nealey (*Metal Progress*, 1932, **22**, (6), 43–46).—A discussion of the scope of the die-casting process is followed by a consideration of dies as regards design, life, material, and operating conditions. Comparative figures for ultimate tensile stress, elongation, and impact strength (0·25 in. square bar) are given for die-castings of aluminium and of zinc, as against malleable iron, sand-cast brass, and grey iron. The properties of certain zinc-base die-casting alloys made with zinc of special purity, are tabulated, together with their percentage compositions. The use of a high grade of zinc largely eliminates warping, although dimensional changes occur in two stages during some weeks after casting: the earlier is probably the result of the relief of casting strain, the second and slower stage being ascribed to phase changes in the alloys. Details of stabilizing treatments are given, with tabulated effects on tensile and impact strength. The results of steam exposure tests are discussed. Machining, where necessary, is easy; soldering and welding are possible but difficult, although nickel-plating provides a satisfactory base for solder. A wide range of decorative finishes may be applied to the castings.—P. M. C. R.

Die-Casting. A. H. Mundey (*Met. Ind.* (*Lond.*), 1933, **42**, 51–56).—A description of die-casting methods, and of the properties, testing, and applications of lead-base alloys (type metals), bearing metals, zinc-base alloys, and aluminium alloys for die-casting.—J. H. W.

Alloys for Pressure Die-Casting. P. Mabb (*Machinery* (*Lond.*), 1932, **39**, 781).—The composition and properties of the principal aluminium-, zinc-, tin-, and lead-base die-casting alloys are tabulated. The characteristics of the alloys and the effects of impurities are briefly discussed.—J. C. C.

Improved Methods and Alloys Aid Die-Casting Industry to Expand. Anon. (*Machinery* (*N.Y.*), 1932, **39**, 266–269).—An illustrated review.—J. C. C.

The Production of Centrifugal Castings from Non-Ferrous Metals. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1932, **8**, 10).—The process is briefly described; it is shown that its nature tends to eliminate blow-holes and inclusions, and to produce a closer structure than other methods of casting. Results of mechanical testing illustrate the improvement in tensile strength and in elongation obtained in the case of certain bronzes; the improved wearing qualities of centrifugally-cast material render it especially suitable for marine propellers.—P. M. C. R.

Largest Centrifugally-Cast Bronze Wheel Ever Made. Anon. (*Found. Trade J.*, 1932, **47**, 362).—A short note, giving the physical properties of a centrifugally-cast wheel, 57·5 in. outside diameter and 6·25 × 7 in. section, made of a bronze containing copper 86·8, tin 12·4, phosphorus 0·3, and nickel 0·35%.—J. H. W.

The Removal of Sand from Castings. E. Tourneur (*Rev. Fonderie moderne*, 1932, **26**, 149–159, 173–181).—Read before the Association Amicale et Mutuelle de Fonderie. The removal of sand is always desirable and frequently indispensable, in view of the finish of the pieces and of possible enamelling, plating, or painting. Castings are classified according to size and method of treatment, and their preparation for cleaning is described. Several grades of sand are considered, and their properties compared; suitable grain-sizes for aluminium, brass, bronze, cast iron, and steel are indicated, and the relative advantages of sand and steel grit are discussed. Compressed-air plant, gravity, aspiration, and pressure systems of projection, and the adaptation of existing methods to various classes of work are considered. Emphasis is laid on the necessity for removing dust from the atmosphere and for adequate protection for operators, and T. describes several types of dust-collecting and air-conditioning plant. Methods of cleaning by water-jet and by combined water and sand-blast are described and illustrated. A review of chemical methods of cleaning states that hydrochloric and sulphuric acids are now the most favoured media; their advantages and limitations are discussed and compared, and details as to concentration, temperature, and the use of "modifying" materials are given.—P. M. C. R.

Trimming, Fettling, and Sand-Blast Equipment. Fred Gentles (*Iron and Steel Ind.*, 1932, **6**, 105–109).—A description of trimming, fettling, and sand-blast equipment considers in detail tumbling barrels, various types of sand-blast apparatus, pneumatic-chipping hammers, portable grinders, and the latest developments which consist in washing castings under hydraulic pressure. —J. W. D.

Foundry Core Binders. E. Perry (*Paint Varnish Production Manager*, 1931, **6**, (5), 8–10, 35–38; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1931, (**24**), 301). —The use, among other substances, of linseed oil and rosin as foundry core binders is discussed.—S. G.

Core and Mould Drying. W. Russell (*Iron and Steel Ind.*, 1932, **6**, 99–104). —Essential features such as proper drying, time of drying, control of temperature, and fuel and labour costs which must be considered in modern drying equipment are discussed. The various types of drying stoves available classed under headings such as bogie type for moulds, rack and transveyor type for cores, rack and bogie type for cores, drawer plate type for cores, continuous type for cores, and dryer unit for drying moulds in position are described and considered in detail.—J. W. D.

Hand-Moulding and Core-Making Equipment. Frank Whitehouse (*Iron and Steel Ind.*, 1932, **6**, 89–92).—A description of the equipment used in modern hand-moulding foundries deals in detail with sand preparation plant, the handling of materials, mould drying plant, and core-making equipment. —J. W. D.

Electric Heat Solves a Foundry Problem. Wm. B. Ferguson (*Maintenance Eng.*, 1932, **90**, 12–13; *Ceram. Abs.*, 1932, **11**, 229).—Electric heating coils are used to heat patterns in a moulding machine to prevent the moulding sand from sticking to the patterns.—S. G.

The Preparation of Moulding Sand. J. North (*Iron and Steel Ind.*, 1932, **6**, 85–87, 109).—The best results in connection with the use of natural bonded moulding sands are obtained when tests such as (1) an elutriation test to obtain the percentage of fines and the amount of silt; (2) tests for strength, *i.e.*, bond by ramming, and breaking tests at definite moisture content and ramming density; (3) permeability tests; (4) a test for actual moisture by evaporation; and (5) occasional sieve tests for checking grain sizes are regularly made on both new supplies of sand and all mixtures used in the foundry as facing sands together with their backing sands. Suitable equipment for the preparation of sand is described.—J. W. D.

Study of Moulding Sands. L. Gasquard (*Rev. Fonderie moderne*, 1932, **26**, 436–443; discussion, 443–445).—Read before the Association Amicale et Mutuelle de Fonderie. Cf. this *J.*, 1932, **50**, 509. Gives the composition of a large number of sands for various purposes and also the composition arrived at by calculation from the qualities required; describes the properties and constitution of the sands and methods of testing them.—J. H. W.

Machine Moulding Equipment. W. J. Cooper (*Iron and Steel Ind.*, 1932, **6**, 93–97).—Descriptions of various types of moulding machines which are divided into, and dealt with, under the five main sections, hand-operated machines, power-driven jarring machines, power-driven squeezing machines, machines combining jarring and squeezing operations, and the sand-slinger moulding machine.—J. W. D.

Mould-Handling Methods in Foundries. William L. Hartley (*Trans. Amer. Soc. Mech. Eng.*, 1931, **53**, MH 5, 59–63).—Mould handling in a foundry comprises between 20% and 40% of the total materials handled, and methods of cutting down the handling costs are discussed.—W. P. R.

Rubber and Its Applications in the Foundry. Pierre Wolff (*Usine*, 1931, **40**, (49), 37).—Conveyor bands, belts, piping, and sand-blast tubes are discussed and the necessary properties of rubber used for each are explained. —H. W. G. H.

XIV.—SECONDARY METALS: SCRAP, RESIDUES, &c.

(Continued from p. 99.)

Plumbers' Ashes and Drosses. Anon. (*Plumbing Trade J.*, 1932, **12**, 172). —An account of the recovery of pure lead from scrap.—E. S. H.

Standard Classification for Old Metals. Anon. (*Met. Ind.* (*N.Y.*), 1932, **30**, 239–240).—An account of a meeting of the National Association of Waste Material Dealers. This was also reported in the *Daily Metal Reporter*, 1932, **32**, (52), 9. See *J.*, this volume, p. 42.—I. M.

XV.—FURNACES AND FUELS

(Continued from p. 99.)

FURNACES

Fluctuating Flow of Heat in Furnaces. R. J. Sarjant (*Trans. Ceram. Soc.*, 1932, **31**, 83–128).—The flow of heat in industrial furnaces under fluctuating or discontinuous conditions of heating has been studied. An attempt is made to correlate experimental results with the mathematical treatment of the subject.—S. V. W.

Annealing and Hardening Furnaces. Anon. (*Maschinenkonstrukteur*, 1932, **65**, 132–136; 1933, **66**, 9).—A review of current furnace construction dealing with gas-fired, oil-fired, and electrically-heated furnaces. Many illustrations and diagrams of burner and heater construction are given, and approximate temperature ranges are usually indicated, as are the probable running costs. —P. M. C. R.

Redesigned Pot Improves Monotype Casting Efficiency. R. L. Davis (*Gas Age-Record*, 1932, **69**, 47–48, 50).—Improvements in a monotype casting-pot, including improved insulation with Sil–O–Cel and asbestos fibre, and improvement of the burner, has resulted in reducing the gas consumption for the same output by about 50%.—J. S. G. T.

Towns' Gas in the Tinplate Industry. Anon. (*Mech. World*, 1932, **92**, 239–240).—Cf. Jackson, this *J.*, 1932, **50**, 512. Interesting experimental work by Baldwins, Ltd., in conjunction with the Neath Gas Department on the use of towns' gas in the tinplate industry is described and illustrated. Tin-pot firing requires quick heating from cold, correct and uniform temperature in the tin-pot, and in the grease hopper. Quick heating obviates waste of time and fuel; maintenance of correct temperature minimizes scruff formation (oxidation of tin) and loss of grease; uniformity of temperature throughout the pot ensures an even coating of tin and minimizes the amount of tin necessary for an effective coating. Cost saved on these counts can be set against fuel costs. The experimental data given show that these economies are achieved by using towns' gas.—F. J.

Gas in the Wire-Drawing Industry. J. Bradbury (*Gas J.*, 1933, **201**, 199–201).—Applications of towns' gas as a fuel in the operations of the wire trade, *e.g.*, annealing, hardening, tempering, galvanizing, enamelling, are briefly discussed.—J. S. G. T.

New Principle Applied in Bright-Annealing Copper Wire. J. B. Nealey (*Wire and Wire Products*, 1932, **7**, 252–254, 270–272).—Describes the furnace construction and the method used in bright-annealing copper wire in a gas-fired unit in an atmosphere of steam which removes the difficulties of discoloration and objectionable oxidation. (Cf. this *J.*, 1932, **50**, 582, and this volume, p. 48.)—J. H. W.

Research on Noise Abatement in Industrial Gas Burners. Harry W. Smith, Jr. (*Gas Age-Record*, 1932, **70**, 643–648).—A study of the origins and possible reduction of noisiness in industrial gas burners is presented.—J. T.

Further Developments with the Luminous Flame Burner. Thomas E. Wood (*Gas Age-Record*, 1932, **69**, 573–574, 582).—Industrial applications of gas to normalizing, billet heating and metal melting (copper) using luminous flame burners are referred to.—J. S. G. T.

Combustible Losses in Flue Gases. J. D. Keller (*Blast Fur. and Steel Plant*, 1932, **20**, 723–726, 781–783, 786).—(I.) Discusses the basis and the value of the earlier graphical methods of representing the loss of heat in flue gases. Improved Ostwald charts are shown for certain fuels and examples given of the method of using them. (II.) Calculations of the chart for complete and incomplete combustion are dealt with. The estimation is also outlined of heat losses caused by the escape of unconsumed gases.—R. Gr.

Temperature Control by Oil Fuel. H. W. Ritchie (*Met. Ind.* (*Lond.*), 1932, **41**, 571–572).—Abstract of a paper read before the Glasgow University Engineering Society. Oil-firing for non-ferrous metal furnaces enables a high degree of temperature control to be attained, and this is further facilitated by the ease with which the air supply and preheating temperature can be regulated. Crucibles can frequently be dispensed with, thus saving a large item of expenditure. Oil-fired furnaces also have particular application for the casting of steel and cast iron.—J. H. W.

Electricity in Heating and Melting of Metals. A. G. Robiette (*Metallurgia*, 1933, **7**, 79–81).—Developments in metallurgical processes have shown the need for accuracy and control of heating and melting operations, and although electricity is a relatively costly fuel, furnaces of the Ajax–Wyatt type and the coreless induction furnace have a very high efficiency. It is stated that the Ajax–Wyatt furnace is now used to melt approximately 90% of the world's wrought brass requirements, and it is also being used for nickel–brass, zinc, cupro-nickel, and copper. Electric melting in resistance furnaces has done much to produce sounder aluminium ingots and castings. For heat-treatment furnaces an even distribution of temperature and accurate control are more readily obtained with electric heating, and there is a saving on the direct cost of fuel and electricity basis due to the very high efficiency obtained by the liberal use of heat-insulating material. Other advantages of electric heating are the question of furnace atmosphere and the life of refractory linings.
—J. W. D.

Contribution to the Knowledge of the Induction Crucible Furnace and Its Metallurgy. M. H. Kraemer (*Z. Metallkunde*, 1932, **24**, 281–284).—Cf. this *J.*, 1932, **50**, 776. Deals with the production of heat and its effect, the vortex motion and its variation by various factors, and the behaviour of slag in the high-frequency induction furnace. The experiments were carried out with 60 kg. steel melts.—M. H.

What Is to Be Considered in the Electrical Melting of Aluminium? E. Fr. Russ (*Metallwirtschaft*, 1932, **11**, 593–594).—The Russ furnace is described. The small crucible type holds 10 kg. of aluminium and operates with 4 kw. using 0·5 kw.-hr./kg. The hearth types hold 500 kg. (output 3500 kg./day) or 2000 kg. (output 14,000 kg./day) and the energy consumption is 0·4–0·45 kw.-hr./kg. Rules for operating the furnace are given.—v. G.

The Melting of Aluminium by Electricity. George Turner (*Met. Ind.* (*Lond.*), 1932, **41**, 583–584).—The Russ type of stationary and tilting crucible furnaces and hearth resistance furnaces are described. The furnace should never be completely emptied after pouring, and the melting temperature should not exceed 800° C. The proper use of these furnaces prevents undue oxidation, over-heating, and heavy loss of metal.—J. H. W.

Special Electric Furnaces for Annealing Copper Strip in Brass Works. Albert Reymond (*J. Four élect.*, 1932, **41**, 380–386).—Describes in detail a continuous strip-annealing furnace and its accessories for copper or brass.
—J. H. W.

Electrically-Heated Universal Furnaces for Continuous Heating Operations. C. Frick (*Chem.-Zeit.*, 1932, **56**, 215–217).—Illustrations and wiring diagrams are given of several types of electrically-heated tunnel furnaces suitable for annealing and heat-treating operations. Nickel–chromium alloy coils or spirals are used as resistors for temperatures up to 950° C. and Silit rods for higher temperatures.—A. R. P.

The Brown-Boveri–Grünewald Bright-Annealing Apparatus. H. Nathusius (*Z.V.d.I.*, 1932, **76**, 1221–1224).—For temperatures up to 550° C. iron annealing boxes can be used, but heat-resisting alloys must be used for higher temperatures. The temperature distribution in the boxes is discussed; circulation of the annealing atmosphere in the boxes by means of a pump does not provide a better equalization of the temperature. Suitable layering of the material in the boxes, *e.g.* by the interposition of rings, gives better results. If the material is oily, *e.g.* from the lubricant used in drawing or rolling, the oil provides a sufficiently protective atmosphere against oxidation when it is sufficiently volatile and has a low flash-point; hence tarry oils or rapeseed oil is unsuitable. In annealing copper, wood charcoal or water (to provide a steam atmosphere) can be mixed with the charge in the boxes.—v. G.

Fundamental Principles in Designing the Electric Furnace for Heat-Treatment. Mikio Mukoyama (*J. Electrochem. Soc.* (*Japan*), 1932, 66–73; *C. Abs.* 1933, **27**, 27–28).—[In Japanese.] There is a limiting temperature of electric resistance wire furnaces. By determining this temperature with various furnaces an equation was derived for the minimum electric power, the required temperature, T, and inner capacity of the furnace. The fundamental formula for the design of a resistor wire furnace was found to be: $Y = ax^{0 \cdot 41}$, $a = 0 \cdot 0017 \,.\, S \,.\, K_x \,.\, T^{1 \cdot 55}$, where Y is the input in watts; x the inner capacity of the furnace in c.c.; S a constant dependent on the shape of the furnace; K_x the ratio of heat loss of used materials.—S. G.

Electric Induction Furnace for Heat-Treating and Reheating. —— Boyer (*Arts et Métiers*, 1932, **85**, 437–443).—Based on a paper by *R. Perrin* and *V. Sorrell* presented to the Académie des Sciences and published in *Rev. Mét.*, 1931, **28**, 448–452. See this *J.*, 1932, **50**, 270. A full description of an electric induction furnace for heat-treating iron, nickel, and cobalt is given. The furnace consists of a primary circuit of copper wire, a magnetic core represented by the muffle containing the specimen, and a secondary circuit represented by a metallic envelope surrounding the muffle, and forming a short-circuited coil. A single-phase alternating current passes through the primary, and induces a variation of magnetic flux in the muffle which produces in the secondary a current of the same frequency as the original current, but of lower voltage and very high intensity. The various accessories to the furnace are also described. —J. H. W.

Annealing Furnace for Aluminium Articles. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1932, **53**, 500).—A brief description is given of an electric furnace with pyrometric control and the method of operating it.—J. H. W.

Developments in the Electrical Industry During 1932. —— (*Gen. Elect. Rev.*, 1933, **36**, (1), 7–71).—Reference is made to batch-type furnaces for bright-annealing copper wire and strip, and also to a continuous-type furnace for bright-annealing miscellaneous steel and non-ferrous parts. For producing protective atmospheres for use in furnaces, an ammonia dissociator has been developed. Another method is to use controlled mixtures of air and gas (towns' gas or natural gas).—S. V. W.

Furnaces and Kilns. E. P. Barfield (*Electrician*, 1933, **110**, 103).—A brief survey of progress during 1932.—S. V. W.

FUELS

Fuel Oil in Metallurgical Melting and Heating Practice. T. F. Unwin (*Metallurgia*, 1932, **7**, 49–51).—Factors which have led to the use of fuel oil are discussed, and the general advantages of fuel oil for furnace heating, such as high controllability of the fuel, flame control, residue from combustion, consistent calorific value, convenience of storage, continuous operation, and operating, labour, and maintenance costs, are discussed. The use of proper oil furnaces, specially designed to obtain the advantages from fuel oil, are stressed, and consumption figures are given as a guide to its economy in use for a wide range of metallurgical operations which include tube welding and annealing, melting of aluminium and copper alloys either in crucible or reverberatory furnaces, annealing of copper tubes and brass strip, and lead melting and refining.—J. W. D.

The Use of Fuel Oil in Furnaces. T. F. Unwin (*Met Ind.* (*Lond.*), 1932, **41**, 539–540, 568–570).—Cf. preceding abstract. Part of a paper read before the Institute of British Foundrymen. (For the remainder see *Iron and Steel Ind.*, 1932, **6**, —.) A similar paper by U. was also read before the Co-ordinated Societies, in Birmingham.—J. H. W.

Discussion on Oil-Fired Furnaces. — Sutton. — Molinaux. — Jude. — Hemms. — Crow. — Lavender. — Twigger. — Fallon. — Palmer. — Brazener. T. F. Unwin (*Met. Ind.* (*Lond.*), 1932, **41**, 586–587, 610).—Discussion of a paper read by T. F. Unwin before the Co-ordinated Societies and U.'s reply. (See preceding abstract.)—J. H. W.

The Use of Towns' Gas in the Melting and Heating of Metals. J. C. Walker (*Metallurgia*, 1932, **6**, 189–190).—Factors which have facilitated the use of towns' gas as an industrial fuel are (1) it requires no storage facilities; (2) the production of gas from coal is not only a thermally efficient operation, but the production of heat from gas is also thermally very efficient; and (3) it is always available. These factors enable heating operations to be effected with great precision, and accurate control can be maintained without the aid of specialized labour. The application of towns' gas for industrial purposes has also been developed with the gradual improvement in the design of furnaces and with progress in burner construction. Gas consumption figures are given for reheating furnaces for annealing brass and copper; and for melting furnaces for aluminium, brass, nickel, and type-metal.—J. W. D.

Using Gas in the Brass Industry. W. W. Young, Jr. (*Gas Age-Record*, 1932, **69**, 601–602 and 617).—Cf. this *J.*, 1932, **50**, 764, and this volume, p. 45. Results obtained in the bright-annealing of brass and copper, wire and strip, using various types of gas-fired furnaces are discussed. Equipment for forging, and preheating furnace linings are also discussed very briefly.—J. S. G. T.

The Use of Modern Gas-Heated Equipment for Various Industrial Drying Processes. W. Hind (*Gas World* (*Indust. Gas Suppt.*), 1932, **4**, (12), 12–18).—The use of towns' gas for various drying operations, including core, enamel, and cellulose drying is briefly referred to.—J. S. G. T.

Burning Gas with Preheated Air. Anon. (*American Gas J.*, 1932, **137**, (5), 30–31).—Formulæ are given for the possible percentage economy of gas used and probable increase of production associated with the use of preheated air in furnace heating. An economy exceeding 40% has been affected with preheated air at 1600° F. (871° C.), which is probably the economic limit of preheating attainable.—J. S. G. T.

Coke in Metallurgical Melting and Heating Practice. R. J. Sarjant (*Metallurgia*, 1932, **7**, 19–21).—The general characteristics of metallurgical cokes are considered and their chemical, physical, and combustible properties discussed. Reference is made to their metallurgical uses, and specifications are given for their application in various types of melting and for general heating.—J. W. D.

Disperse Fuel: Its Technical and Commercial Possibilities. John L. Stevens (*Fuel Economist*, 1932, **8**, (85), 70–72).—The method of preparation of colloidal fuel (coal-oil fuel), the use of coking and non-coking coals, and results obtained are briefly discussed.—J. S. G. T.

Tentative Method of Sampling Coke for Analysis (D 346–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 705–709; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 789–793).—S. G.

Tentative Method of Sampling Coal by Ball-Mill Method (D 271–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 710–712; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 794–796).—S. G.

XVI.—REFRACTORIES AND FURNACE MATERIALS

(Continued from p. 47).

Preparation and Shaping of Refractory Materials in Germany. Otto Philipp (*Feuerfest*, 1932, 8, 81–89, 101–104, 113–119).—Various machines, crushers, sieving machines, mixers and presses, used in Germany for manufacturing refractory bricks and shapes are described and illustrated.—v. G.

Refractories Produced by Melting. Friedrich Reinhart (*Tonind. Zeit.*, 1932, 56, 32–34).—A description of the different methods used in the production of refractories by fusion.—B. Bl.

Some Notes on Refractory Cements. Donald Andrews (*Indust. Chemist*, 1932, 8, 403).—Desirable properties of refractory cements are summarized. —E. S. H.

Modern Furnace Setting Cements [Quick-pach; Sairset]. Anon. (*Eng. Rev.*, 1932, 46, 326).—An account of two high-alumina furnace cements, Quick-pach and Sairset.—P. M. C. R.

Chrome Brick. Anon. (*Brit. Clayworker*, 1931, 40, 246–247; *Ceram. Abs.*, 1932, 11, 112).—Chrome bricks probably have fluctuated in popularity more than any other refractory; the reasons being cost, inability to resist load at working temperatures, variation in quality of the raw ore from different localities, &c. The most valuable deposits are in Greece. The raw ore must be carefully sorted prior to exportation. The concentrate is ground to a fixed fineness and mixed with the bond. The bond may be clay, fire-clay, bauxite, magnesia, water, a mixture of calcium and aluminium sulphates, or some combination of any of the materials. The ore should contain not less than 6% silica. The physical conduct of the chrome bricks and bricks prepared from other refractory materials and coated with chromite is discussed. A table of typical compositions of chrome ore is included, and the use of either the ore or bricks in such typical applications as nickel and nickel–copper blast furnaces, smelting of antimony, lead, bismuth, and steel, buffer linings for furnaces, gas-fired furnaces, tap holes, spouts, &c., is described.—S. G.

Physico-Chemical Properties of Natural and Artificial Graphites. J. A. Chapiro and —— Vessolovski (*Mineral Suir'e*, 1931, 6, (3), 265–274; *Ceram. Abs.*, 1932, 11, 183).—The electrical conductivity and resistance to high temperatures of graphite have been studied. The electrical conductivity depends on the structure of the sample, and to compare the results obtained powdered graphite was used and made homogeneous by sifting. The resistance of the powders of the different kinds of graphite previously compressed was determined. It was found that for each kind, the electrical resistance is the same for the grain-sizes from 0·10 to 0·27 mm. if the pressure of compression is 90 kg./cm.^{2}, but increases with finer powders. The resistance of different graphites diminishes progressively according to their crystallization. The more crystalline they are, the less is their resistance. The minimum is reached in the artificial graphite (Siemens electrode). Measurements of the resistance to temperature were made on graphite powders in the presence of excess air. A slight decrease in weight can be observed at low temperatures; this decrease depends on the length of time of heating. The temperature at which a sample of powdered graphite loses 3% of its weight during 10 minutes of heating was called "the temperature of attack." It was found that for a crystalline graphite like that of Ceylon or Madagascar, the temperature of attack is about 730° C., whilst less crystalline graphite has a slightly lower temperature of attack, and finally, for amorphous graphite, this temperature decreases to 535° C. The losses increase with the temperature almost exponentially for the same graphites.—S. G.

Refractory Agglomerates and Fused Cement. Anon. (*Rev. mat. constr. trav. pub.*, 1931, (265), 423; *Ceram. Abs.*, 1932, **11**, 181).—Studies made by Kestner, Arnould, and Jaurrier in 1926 and by Giuseppe Ongars in 1923 have given knowledge of mixtures that can be used like ordinary cement but without disintegration at high temperatures. The application of this process is varied, and has been made with completely satisfactory results: (1) as refractory pieces of special kilns, pieces of high price, and slow delivery, (2) repair of parts of refractory facings exposed to continued changes of temperature, (3) as a mortar for joining ordinary refractories in all furnaces, (4) for stopping cracks and to act as a protection against the destructive action of gas, &c., and (5) for application between refractory and metal parts.—S. G.

Kestner Refractory Hydraulic Cements and Mortars.—I.–II. J. Arnould (*Rev. mat. constr. trav. pub.*, 1931, (264), 169–172B, (265), 419; *Ceram, Abs.*, 1932, **11**, 181).—(I.—) This product is a true hydraulic, basic, and aluminous cement used with water like ordinary Portland cement. It is slow setting and rapid hardening, gives practically no shrinkage on setting, and gives a maximum of 1% shrinkage on initial firing. (II.—) This cement combines the qualities of products of construction and refractories, and can be used in a manner analogous to that of refractory masonry in kilns, gas generators, chimneys, &c. There are two types, one for low temperatures (below 1200° C.), and the other for high temperatures (below 1400° C.). The thermal conductivity of Kestner cement is close to that of bauxite. The melting point is 1300° C. for the first type and 1400° C. for the second.—S. G.

Apparatus for Testing Resistance to Pressure of Refractories at High Temperatures. G. Chaudron, M. Garvin, and A. Villachon (*Chim. et Ind.*, 1930, 21, 2; and *Feuerfest*, 1931, 7, 148; *Ceram. Abs.*, 1932, **11**, 110–111).—A kiln for testing resistance to pressure of refractory materials at temperatures above 1600° C. is described. The lower part is made of graphite and the upper part of iron. A measuring instrument of high sensitivity shows the beginning of the decrease in resistance, whilst an optical pyrometer (Ribaud) shows the temperature. Magnesite materials prefired to 2000° C. with 1·6% silicic acid and more showed a decrease in resistance; pure magnesite showed only a viscous deformation. Other oxide additions, such as alumina, chromium oxide, and iron–lime oxide, seem to have no effect on the mechanical properties of magnesium oxide. Fe_2CaO_3 appears to affect viscosity slightly.—S. G.

A Rapid Method of Estimation of Alumina in Clays. R. W. Ellison (*J. Amer. Ceram. Soc.*, 1932, **15**, 188–190).—With the material analyzed in routine a definite relation was noted between the proportion of combined water and silica. The determination of combined water and of iron was all that was necessary to calculate the silica and alumina. The procedure is given, and also a curve showing the relation between combined water and silica in the particular material cited. This same "short cut" chemical analysis is applicable to other clays when the curve for the ratio of combined water to silica has been determined for each clay.—S. G.

Tentative Method of Test for Particle Size of Ground Refractory Materials (C 92–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 412–414; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 721–723).—This method of test is intended for determining particle size of ground refractory raw materials and finished products, such as fireclay mortars and high-temperature cements. The test data are of use in helping to maintain uniformity in manufacturing process and development work, and in the purchase or sale of certain finished products. The materials or aggregates to which water is added for their use, or those which are shipped in a plastic condition, are to be subjected to the wet method of sieve analysis. This group includes plastic clays, mixes containing plastic clays, fireclay mortars, and high-temperature cements.—S. G.

XVII.—HEAT-TREATMENT

(Continued from pp. 47–48.)

Heat-Treatment of Aluminium Alloys. Douglas B. Hobbs (*Machinery* (*N.Y.*), 1933, **39**, 319–320).—The effects produced by the operations of annealing, "solution heat-treatment," and "precipitation heat-treatment" (ageing) on aluminium alloys are described on conventional lines, and typical tensile properties of some common alloys tabulated.—J. C. C.

Annealing Box for Cold-Rolling Mills and Wire-Drawing Works. Georg Weiss (*Draht-Welt Export-Ausgabe*, **1932**, (10), 92–97).—[In English, French, and Spanish.] After surveying the various types of annealing box extant, *viz.*, cast iron, riveted steel, welded steel, cast steel, and those fabricated in special heat-resisting alloys, W. urges that particular attention should be paid to the design of the base to avoid bulging in use and rapid thinning just above the bulge. It is also suggested that makers and users would benefit from a standardization of types and sizes.—A. B. W.

Heat-Treatment Without Detrimental Finish. J. Fallon. — Cookson. A. G. Robiette. — Kronsbein. A. Pinkerton. — Benton. J. W. Jenkin. A. G. Lobley. — Emms. — Crome and — Jones (*Met. Ind.* (*Lond.*), 1932, **41**, 565–567).—An open discussion before the Co-ordinated Societies (Birmingham Local Section of the Institute of Metals, Birmingham Metallurgical Society, and the Staffordshire Iron and Steel Institute). J. F. stated that the main factors governing bright-annealing were the time, temperature, and atmosphere, the heating agent having little effect. No method of bright-annealing brass had yet been found, but copper could be so treated. A. G. R. stated that brass could be bright-annealed, but required pickling to remove the zinc oxide film; copper and nickel were easy, but chromium alloys were difficult. A. P. stated that in the Grünewald process an oil film on the metal forms the atmosphere. J. W. J. described the process wherein the furnace was lowered over the container. A. G. L. recommended the electric furnace for annealing and stressed the importance of the atmosphere. Jones raised the questions of gas mixtures and costs. B. described the zinc film on annealed brass and its prevention. The various points raised were replied to by J. F.—J. H. W.

Bright-Annealing. A. G. Robiette. A. Glynne Lobley. J. Fallon (*Met. Ind.* (*Lond.*), 1932, **41**, 567, 597–598, 641).—A series of letters extending the open discussion on "Heat-Treatment Without Detrimental Finish" initiated by J. Fallon before the Co-ordinated Societies (see preceding abstract). A. G. R. maintained that brass can be "perfectly bright-annealed" and defended the use of the bell type of furnace carried to the charge. A. G. L. amplified his previous remarks, criticized J. F.'s replies and defended the use of the electric furnace. J. F. maintained that brass cannot be bright-annealed, stating that A. G. R.'s specimens were not bright and, in a later letter, disputes A. G. L.'s assertions and interpretation of his (J. F.'s) remarks.—J. H. W.

Influence of Electro-Magnetic Waves on the Hardness and Resistivity of Metals. G. Mahoux (*Usine*, 1931, **40**, (34), 29).—Abstract of a note presented to the Académie des Sciences. See this *J.*, 1931, **47**, 228.—H. W. G. H.

The Use of Oil as a Quenching Medium in Heat-Treating. Anon. (*Lubrication*, 1932, **18**, (4), 37–42).—The merits of oil, water, soap-solutions, brine, and glycerine as quenching media are considered, and the special advantages and limitations of each are indicated. A discussion of the quenching properties of various animal, mineral, and vegetable oils follows. It is suggested that a faulty quenching system is often the cause of errors in hardening, and diagrams of recommended systems and details of cooling apparatus are given. The effect of temperature, viscosity and circulation on quenching speed is considered, and requirements for quenching oils are formulated. It is stated that mineral oils

make satisfactory quenching media with sufficient attention to selection, fractionation, refinement, and addition of make-up oil. Purification of quenching oils, and the harmful effects of carbonaceous residues, are considered.
—P. M. C. R.

XVIII.—WORKING

(Continued from pp. 48–52.)

Variations in the Microstructure Inherent in Processes of Manufacturing Extruded and Forged Brass. Ogden B. Malin (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, 99, (Inst. Metals Div.), 165–173; discussion, 173–174).—For abstract of the paper, see this *J.*, 1932, **50**, 503, 703. In the discussion, in which *D. K. Crampton, K. R. van Horn*, and *O. B. Malin* took part, it is stated that within the range 56–64% copper a considerable difference is made to the grain structure by increasing the copper content, but little change occurs in grain-size. For a given copper content the best forging properties are obtained with straight zinc–copper alloys without additions of tin or aluminium, although addition of aluminium seems to cause the metal to fill out the corners of the die more readily. A brief outline is given of the modern theory of extrusion.—A. R. P.

An Extrusion Problem. Rubber Trade Methods Applied to Non-Ferrous Metals. Anon. (*Met. Ind.* (*Lond.*), 1932, **41**, 487–488).—A description of a forcing press used in the rubber industry, and a discussion of the application of the method of forcing with a screw feed as opposed to extrusion to non-ferrous metals are given.—J. H. W.

Vertical Extrusion Presses. Anon. (*Met. Ind.* (*Lond.*), 1932, **41**, 589–590).—Abstract of a trade publication (Fried. Krupp Grusonwerk) describing vertical presses for the extrusion of tubes, billets, and sections in brass, copper, and other alloys, and giving details relative to equipment and practice in extrusion.
—J. H. W.

Sheathing Cables with Lead. John R. Shea (*Dutch Boy Quarterly*, 1932, **10**, (1), 4–5).—Describes a press for the extrusion of sheaths of lead–antimony alloy for coating cables.—E. S. H.

The Rolling-Mill of the Future. C. E. Davies (*Met. Ind.* (*Lond.*), 1933, **42**, 59–64, 83–84).—An indication is given of the trend of rolling-mill design and practice in the near future.—J. H. W.

The Rolling Problem. E. Siebel (*Maschinenbau*, 1932, **11**, 497–500).—A report on the results of theoretical calculations and laboratory researches on the process of rolling metals with the technical conclusions reached from the work. The influence of roll diameter and friction is especially discussed. The article is written in a readily understandable manner without mathematical formulæ.—v. G.

The Calculation of Rolling Work. E. Cotel and I. v. Pattantyus (*Mitt. berg- u. hutt. Abt., Kgl. ung. Hochschule Berg- u. Forstwesen, Sopron, Ungarn*, **1929**, (1), 17–48).—Methods of calculating in advance the work done in rolling are considered historically. C. and v. P. modify the formula of Henmann, preferring the form : $N = FkvC$, where N = required horsepower; F = reduction of sectional area (actual diminution in cm.^{2}); k = limit of compression, in kgm./cm.^{2}, for hot material; v = peripheral velocity of rolls in metres/second; C = a factor calculated from results obtained by Puffe, and varying with the forms of the rolled product. A series of graphs, of forms characteristic for each type of section, is appended, together with a table of values for C.—P. M. C. R.

Modern Methods for the Determination of the (True) Rolling-Work. O. Emicke, H. Allhausen, and W. Mauksch (*Siemens Z.*, 1932, **12**, 341–346).—Discusses the application of the Siemens torsion-dynamometer and the Siemens pressure-box for the determination of the real rolling-work. Experimental results will be published elsewhere.—M. H.

Cluster Mills, Four-High Mills, and the Trend of Rolling Mill Design. E. L. Williams (*Met. Ind.* (*Lond.*), 1932, 41, 489–490).—Abstract of a paper read before the Sheffield Local Section of the Institute of Metals. The production of sheet and strip was originally effected by stamp batteries which had the advantage that the properties of the sheet were the same in all directions. These were followed by continuous 2-high, 3-high, 4-high, and cluster mills. In these last, the work rolls are of small diameter, strictly parallel, and prevented from deflecting under load by stout rolls mounted above and below them. The factors affecting roll design, roll material (usually forged chromium steel), coiling devices, costs of production, running speeds (normally 60–100 ft./minute), and auto-control mills (such as the Steckel mill) are discussed. —J. H. W.

Modern Cold-Rolling Mills. Anon. (*Met. Ind.* (*Lond.*), 1932, 41, 365–368).—A description of modern cold-rolling mills and auxiliary equipment manufactured by Messrs. Brooks (Oldbury), Ltd., under licence from the Demag A.G., Duisburg, Germany.—J. H. W.

Aluminium Sheet Production. XIV.—Cold-Rolling Mills. R. J. Anderson (*Metallurgia*, 1932, 6, 163–164, 168, 185–187; 7, 11–13, 43–45).—The various types of mills which are, or may be, used for cold-rolling aluminium sheet and coil are described. Two-high sheet mills, 2-high coil (strip) mills, and 2-high continuous mills are considered as well as multiple-roll mills such as 3-high, 4-high, cluster, and Steckel mills. Various kinds of rolls are used, including plain chilled cast-iron, chilled alloy iron, cast steel (hardened), and forged and heat-treated alloy steel rolls. Rolling-mill bearings are of various types, and include leaded–bronze, phosphor–bronze, and nickel bearing-bronze for roll-neck bearings of the journal type. Brief reference is also made to various types of rolling-mill drive.—J. W. D.

Push Bench Process for Manufacture of Seamless Tubes. Wm. H. Engelbertz (*Rolling Mill J.*, 1932, 6, 91–96).—A description of the essential features of manufacture of seamless tubes by the push bench process, *viz.*, hydraulic punch piercing of the billet, hot-drawing on a mandrel in a ring bed (or push bench), cross-rolling (or reeling), and mandrel extraction, and finally reducing or sizing by means of grooved rolls. Reference is made to the recent installation of push bench plants in Canada and the United States following successful operations with such plants in Africa and Europe. E. also compares production costs by the push bench, butt weld mill, Moon continuous butt weld mill, and the electric butt-welding machine. He concludes that considering the relative prices of billets and skelp the push bench can produce tube more cheaply than any other process, save only the Moon continuous butt weld.—A. B. W.

The Tube Reducing or Sinking Mill. Wm. H. Engelbertz (*Rolling Mill J.*, 1932, 7, 81–84).—A discussion of multi-stand reducing mills having 2 or 4 rolls per pass. It is claimed that end-thickening and squaring of the bore are materially diminished in the 4-roll mill developed by Stueting; moreover, a greater reduction per pass is possible with the 4-roll mill.—A. B. W.

The Production of Brass Bars and Sections. P. Siebe (*Draht-Welt*, 1932, 25, (31), 483–486).—A brief description of the melting (Ajax–Wyatt), casting, extrusion, drawing, and annealing of brasses; together with specifications of mechanical properties obtainable and notes on faults and their avoidance. —A. B. W.

Copper Rod Rolling, Wire-Drawing, and Annealing. John R. McKean (*Wire and Wire Products*, 1932, 7, 328–337, 363).—Read before the Wire Association. A description is given of the manufacturing practice of a large, modern copper wire-drawing works. In particular, the lay-out of the factory, the plant, copper rod-rolling and cleaning, wire-drawing, the tungsten carbide dies, fine wire-drawing, annealing, and its effect on the tensile strength, elongation, and scleroscope hardness and the mechanical properties required for various gauges by the American Society for Testing Materials are considered. As a lubricant for drawing, an emulsion such as vegetable oil 2, soap 1, and water 75 parts, having a fat content of 3–4%, is used.—J. H. W.

Manufacture of Brass Wire. P. Siebe (*Draht-Welt*, 1932, 25, (32), 499–501).—The production of α- and of α + β-brass wires, D.I.N. specifications, and the mechanical properties obtainable with various degrees of drawing are given, together with a brief reference to faults associated with overheating in annealing.—A. B. W.

Studies of the Wire-Drawing Process. III.—Lubrication. Edgar L. Francis (*Carnegie Schol. Mem., Iron Steel Inst.*, 1932, 21, 1–30). **Appendix on Wire-Drawers' Dermatitis.** F. C. Thompson and E. L. Francis (*ibid.*, 31–34).—Experimental results show that the film of lubricant in wire-drawing must be of the order of 10^{-5} in. thick, and a good lubricant must be capable of molecular orientation and adsorption at the metallic surfaces. This condition is satisfied by animal, vegetable, and "Germ" oils, all of which contain free fatty acids, but not by mineral oils. Under these conditions, lubrication is uninfluenced by viscosity, pressure, or relative speed, but is affected appreciably by the amount of fatty acids present. The two forms of friction-testing machines described gave useful information as to the probable relative behaviour of an oil under wire-drawing conditions, but were of little value for quantitative tests. They can also be used for testing solid lubricants, providing that certain specified precautions are taken. The behaviour of soap depends as much on its physical as on its chemical properties; it should contain not less than 80% saponified acids. Practically all lubricants except commercial soap should be used at elevated temperatures from the point of view of low frictional loss. Dermatitis has so far been experienced only in the ferrous section of the wire industry, where certain kinds of soap are used. The cause of the trouble appears to be some constituent of the soap, such as coconut oil. Additional factors are the presence of sweat, undue scrubbing of the hands, normal irritation of the skin by soap and water, and the effects of grit. It is stated that the trouble can be eliminated by rubbing the hands well with a mixture of unsalted lard and 5% boric acid before work.—J. H. W.

The Cold-Working of Metals. J. W. Berry (*J. Inst. Production Eng.*, 1932, 10, 297–312).—A general account is given of the behaviour of metals under the operations of drawing, cold-rolling, hand-raising, spinning, stamping, and double-action press work.—J. C. C.

Modern Drop-Forging Equipment and Its Services to the Railway Engineer. B. Powell Brett (*J. Inst. Locomotive Eng.*, 1931, 21, 697–730).—Contains a brief account of the drop-forging of Duralumin.—J. C. C.

Free Cutting Brass: Machinability of the Various Alloys. D. K. Crampton and H. P. Croft (*Metal Progress*, 1933, 33, (1), 31–32, 62).—An abstract of published information on the machining properties of brass rod, and of some recent experimental results. Feeds for free-turning brass rod are tabulated for different types of tool, and some notes on practice are given. The mechanical properties and compositions of copper, leaded-copper, phosphor–bronze. Muntz metal, and several commercial bronzes and brasses are tabulated, together with relative machinability figures, and with brief notes on cold-heading and cold-bending properties. The influence of certain ingredients is separately considered.—P. M. C. R.

The Drilling of Deep Holes in Light Metals. H. J. Stoewer (*Maschinenbau*, 1932, 11, 469–472).—The most satisfactory shape of drill, cutting angle, and rate of rotation for drilling deep holes in aluminium, Silumin, and Elektron have been determined experimentally.—v. G.

Tungsten Carbide Used for Resisting Abrasion. Anon. (*Machinery* (*N.Y.*), 1932, 38, 909; and *Machinery* (*Lond.*), 1932, 41, 14).—The use of tungsten carbide inserts to prevent excessive wear on a guide block for spring steel stock is described and illustrated.—J. C. C.

XIX.—CLEANING AND FINISHING

(Continued from pp. 52–53.)

On the Degreasing of Metal Parts and Mass Production Articles. K. Altmannsberger (*Oberflächentechnik*, 1932, 9, 88–89).—For removing animal or vegetable fats the articles are treated cathodically in a solution containing (in 100 litres) 6 kg. of sodium hydroxide, 500 grm. of sodium cyanide, 300 grm. of ammonium chloride, and 3–4 kg. of commercial water-glass. For degreasing and at the same time coating the articles with a thin film of copper (prior to nickel-plating), the bath should contain (in 100 litres) 8 kg. of sodium hydroxide, 4 kg. of sodium carbonate, 1·5 kg. of sodium sulphate, 500–750 grm. of potassium cyanide, 1·5 kg. of copper cyanide, and 3–3·5 kg. of potassium copper cyanide; this bath is used cold or slightly warm, and the articles are treated in it for 1·5 minutes. When the articles are very greasy preliminary tumbling in milk of lime is recommended.—A. R. P.

Directions for Cleaning Architectural Anticorodal. —— Zurbrügg (*Aluminium Broadcast*, 1932, 3, (37), 17).—Periodic cleaning is advisable to retain a silver-white colour. Polished objects may be cleaned with metal polish, benzine, or petrol. Matt or score-brushed objects may be cleaned with soft-soap solution, benzine, or petrol, or dry-cleaned by rubbing with powdered pumice, pan cleaners, fine wire (not brass) or bristle brushes, or soft rubber. —J. C. C.

Metal Cleaning and Bake Finishing. Fred Mannhardt (*Indust. Finishing Mag.* (*U.S.A.*), 1932, 8, (3), 52–54).—An account of modern practice.—E. S. H.

The Cleaning of Small Metal Objects Coated with Varnish or Oil Paint. C. Duret (*Moniteur de la Peinture*, 1932, 20, 72; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (26), 111).—Where sand-blasting apparatus is not available, potassium hydroxide or sodium hydroxide may be used, or the article may be brushed over with turpentine or alcohol and immersed in C.O.V. which carbonizes the organic material. With the last two methods it is necessary to wash the articles very thoroughly after the treatment, and to remember that the materials handled are extremely corrosive.—S. G.

Preparing Metals for Finishing. Anon. (*Brit. Indust. Finishing*, 1931, 2, 99; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1931, (22), 215).—Methods of cleaning zinc, copper, and tin surfaces are recommended. The types of paints suitable for use on these metals and on Duralumin are indicated, and typical formulæ are given.—S. G.

On the Use of Sal-Ammoniac in the Metal Industry. Georg Buchner (*Oberflächentechnik*, 1931, 8, 21).—The hydrogen chloride in dry ammonium chloride is 100 times more active than pure dry hydrogen chloride on copper at 250°–350° C. and 40 times more active on silver and nickel. This is explained on the assumption that ammonium chloride at high temperatures behaves as an ammino-acid forming salts of the type $(NH_3M')Cl$; in aqueous solution it behaves as a hydroxonium acid.—A. R. P.

Finishes for Aluminium. T. D. Stay (*Metal Progress*, 1933, 33, (1), 24–27). —Architectural castings in aluminium and its alloys are finding increasing application; some finish is necessary to remove small surface blemishes and sand-cracks. Sand-blasting is used to give a uniform surface texture of somewhat diminished reflecting power, or to serve as a base for other finishes. The "de-plated" slate-grey finish is produced by anodic oxidation. A polished finish is obtained by using emery or some other abrasive after sand-blasting. Methods of producing polished, buffed, satin, or wire-brushed finish are described, as are certain combination methods. Painting and lacquering are easily applied after sand-blasting, whilst the "Alumilite" anodic oxidation process produces an oxide coating coloured by certain dyes or pigments.—P. M. C. R.

The Anodic Oxidation and Dyeing of Aluminium for Decorative Purposes. A. W. Weil (*Brit. Indust. Finishing*, 1932, **3**, 85).—The chromic acid process of anodic oxidation and the dyeing of the film produced are described.—E. S. H.

Clear and Colour Finishes on Aluminium. The Alumilite Process. Ralph E. Petit (*Indust. Finishing Mag.* (*U.S.A.*), 1932, **8**, (4), 12–14).—Describes a method of protection of aluminium and some of its alloys by anodic oxidation, with or without colouring the oxide film by means of dyes.—E. S. H.

Decorating Sheet Metal Ware. Anon. (*Brit. Indust. Finishing*, 1932, **2**, 245–247).—Describes methods for the chemical deposition of copper for decorative purposes and the colouring (especially "bronzing") of the films so produced.—E. S. H.

Black Finishes for Sheet Metals. Anon. (*Brit. Indust. Finishing*, 1932, **3**, 4).—A black finish on brass may be obtained by immersing the article in a solution containing potassium sulphide and ammonia. Aluminium may be blackened by immersing in a solution containing sodium hydroxide and sodium chloride, kept at 80° C. Tin or tinplate acquires a black finish, after degreasing in boiling sodium hydroxide solution, by placing in a bath containing solutions of antimony chloride and cupric chloride.—E. S. H.

Improved Continuity Test for Enamel Insulation on Wires. C. L. Erickson (*Bell Laboratories Record*, 1932, **10**, 287–289).—Enamelled copper wire is passed between 2 rollers pressed together by a system of levers and weights. Electrical contacts between the rollers and the copper core are counted by the operation of a message register operated through a grid-controlled discharge tube. The use of rollers instead of the usual mercury bath has the advantage of indicating the presence of slivers or irregularities that break through the enamel under pressure. Also, it does not make the wire unfit for further use.—J. C. C.

Tumbling Barrels for Finishing. Harold C. Booth (*Indust. Finishing Mag.* (*U.S.A.*), 1932, **8**, (5), 12–16).—A description of types of barrels and technique.—E. S. H.

Rubbing, Polishing, and Buffing Mechanically. P. C. Bardin (*Indust. Finishing Mag.* (*U.S.A.*), 1932, **8**, (5), 7–9, 17–20).—A description of types of machines, flexible shaft equipment, and types of wheels used.—E. S. H.

The Wet-Polishing of Small Metal Parts with Steel Shot. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1932, **8**, 35–36).—A 60–90% saving of time is claimed to be effected by this process. The polishing fluid should be free from corrosive acids or alkalis; the pieces to be polished must be free from superficial unevenness, as the process does not remove this. The placing of too many pieces together in the polishing drum vitiates the method. Suitable adaptations of drum and shot for various types of work are given.—P. M. C. R.

Decorative Lacquers for Metal Goods. —— Sawifrie (*Ind.-Lack-Betrieb.*, 1931, **7**, (5), 69; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1931, (20), 98).—Small gold, silver, bronze and other metal articles used for ornamental purposes may be coated with nitrocellulose lacquers after the surface has been cleaned thoroughly with benzine. Extreme care must be given to the method of applying the lacquer or irregularities will appear on the surface. The subsequent polishing must also be very painstakingly performed, otherwise the proportion of rejects will be large.—S. G.

Coloured Finishes on Zinc. Anon. (*Brass World*, 1932, **28**, 224–225).—Reproduced from a booklet issued by the New Jersey Zinc Co., U.S.A.
—J. H. W.

New Methods of Surface Improvement [by Chromium-Plating]. K. Altmannsberger (*Oberflächentechnik*, 1932, **9**, 14).—The brass is etched in a mixture of nitric and sulphuric acids containing zinc sulphate, then nickel-plated, and the design produced by polishing certain parts. On subsequently plating with chromium the design appears in a matt and bright finish.—A. P.

XX.—JOINING

(Continued from p. 100.)

The Possibilities of Repairing Aluminium [and Its Alloys] by Soldering and Welding. H. Reininger (*Schmelzschweissung*, 1931, **10**, 86–88, 117–120, 196). —After reviewing the ordinary methods of joining aluminium by soldering and welding and describing the composition of solders and fluxes used, R. gives numerous practical hints on carrying out this work, with especial reference to the filling of pipes and cavities and the repair of fractures.—B. Bl.

Welding in Aeroplane Construction. Anon. (*Schmelzschweissung*, 1931, **10**, 290–293; 1932, **11**, 29–32).—Deals chiefly with steel, but some hints are given on the welding of aluminium and aluminium alloy tanks.—B. Bl.

Welding of the Aluminium Crank-Case of a Bus. Werner K. Raabe (*Schmelzschweissung*, 1931, **10**, 126).—The repair of fatigue cracks in a crank-case by welding is described with especial reference to the precautions necessary to avoid distortion.—B. Bl.

The Welding of Copper in the Construction of Apparatus. —— Geiger (*Schmelzschweissung*, 1931, **10**, 37–38).—Owing to its high heat conductivity, larger burners must be used for welding copper than for iron, and the distance between the two parts to be joined must also be greater; they should never be fastened together before welding. The weld should be made simultaneously from both sides, then hammered, annealed at 500°–550° C. and again hammered. When finished, the weld should be 20% thicker than the rest of the article, and should have a tensile strength of 90% of that of hard-rolled copper, with an elongation of 20%. Examples of copper-welding are illustrated. —B. Bl.

The Application of the Oxy-Acetylene Burner in the Construction of Accumulators. Gustaw Jonscher (*Schmelzschweissung*, 1931, **10**, 189–190).—Examples of the practical welding of lead sheets are given.—B. Bl.

Fluxes for Welding and Brazing. E. Lüder (*Schmelzschweissung*, 1931, **10**, 197–201, 220–222).—The function of fluxes is to remove non-metallic impurities from the surface of the parts to be joined and from the liquid weld metal; this function can be fulfilled by (*a*) gases, *e.g.* the reduction of iron oxides by a reducing flame and the reduction of aluminium oxide by a chlorine–oxy-hydrogen flame, or (*b*) fused salts which dissolve the impurities either chemically or physically. The action of the latter is strongly dependent on the temperature, and hence their composition should be so chosen that their most intensive action occurs just below the welding temperature. The various welding fluxes are described systematically: (i) acid fluxes with a base of silica, boric acid, or borax, the last 2 types being especially suitable for iron, copper, and their alloys; (ii) basic fluxes with an alkali carbonate base; (iii) aluminium fluxes with a chloride or fluoride base.—B. Bl.

The Measurement of [the Thickness of] Weld Seams. E. Kalisch (*Schmelzschweissung*, 1931, **10**, 181–183).—Some instruments for measuring the thickness of welded seam are described.—B. Bl.

Shrinkage Stresses in Welded Seams. Karl Melcher (*Schmelzschweissung*, 1931, **10**, 128–129).—Shrinkage stresses are greater with butt-welds than with chamfer welds. The basic principles for calculating these stresses are given and the influence of transverse and longitudinal shrinkage, of the weight, size, and arrangement of the article, and of step-wise and jump-wise welding on the stresses in the seam, are discussed.—B. Bl.

Electric Arc-Welding with Alternating Current of Grid Frequency. H. Hafner (*Bull. Assoc. Suisse Elect.*, 1933, **24**, (1), 1–9).—Arc-welding is more cheaply performed with a.c. than with d.c., although some additional precautions are necessary. H. prefers the single-phase transformer with condenser to the tri-phase transformer with potentiometer; he describes a new transformer which may be introduced into comparatively weak circuits. Two modifying attachments for use in tri-phase systems are described, with circuit diagrams.—P. M. C. R.

The New German Welding Symbols. Otto Bondy (*Mech. World*, 1932, 92, 25–27).—Among the most important steps at present being taken in the development of welding practice is the standardization of the symbols used to specify the various kinds of welds. B., who collaborated in the preparation of the recently-completed German standards, explains their essential features and application. Wherever possible, the symbols should give a clear pictorial representation of the weld by the form of its cross-section, and suffixes are used to give additional information. The need for an international system of welding symbols is emphasized, and certain symbols which might form the nucleus of a uniform code are suggested. Various types of weld with suggested symbols are illustrated.—F. J.

Electric Arc-Welding of Non-Ferrous Metals. H. Martin (*Mech. World*, 1932, 92, 165–166).—Where it can be employed, the gas-torch is the most satisfactory, but its use is limited. The electric arc offers the advantages of intense local heat (double the temperature of the oxy-acetylene flame), speed of metal deposition, and absence of burnt gas by-products. In spite of the high temperature, however, some preheating arrangements are necessary when welding copper, owing to its high thermal conductivity. The technique of preheating is briefly discussed. Copper can be arc-welded only in a horizontal position at the present stage of development, but the welding of vertical seams should become possible. Coated electrodes are essential to prevent formation of oxide in the weld, the best results having been obtained by the use of bronze core wires suitably coated and used on d.c. Hard-drawn wires give a much steadier and more concentrated arc than annealed wires. The use of heavily-coated electrodes with a high arc voltage will probably solve many of the existing problems, in addition to obviating preheating. The atomic hydrogen process or the use of the oxy-hydrogen flame is unsuitable for copper welding, owing to the affinity which copper has for hydrogen. The technique of arc-welding bronze, brass, nickel, Monel metal, and aluminium is also briefly discussed. (Cf. following abstract.)—F. J.

Electric Arc-Welding of Non-Ferrous Metals. Anon. (*Mech. World*, 1932, 92, 222).—A letter. The suggestion made by H. Martin (cf. preceding and following abstracts) that oxy-acetylene welding of copper may be supplanted by arc-welding, is challenged.—F. J.

Electric Arc-Welding of Non-Ferrous Metals. H. Martin (*Mech. World*, 1932, 92, 246).—Reply to a correspondent (cf. preceding abstracts), maintaining the utility of arc-welding for certain purposes and its superiority over gas-welding as regards temperatures attainable.—F. J.

Measuring and Measurements in Electric Arc-Welding. P. Flamm (*Elektroschweissung*, 1932, 3, 50–51).—The arc performs 2 functions—heating and depositing metal. Two methods are described for determining the proportionate time taken by these. The first is qualitative, and employs a telephone-earpiece, in which the sound gives an indication of the deposition time. In the second, variations in the arc cause variations in the filament current of a thermionic valve, the plate current of which is recorded. The resulting graph shows the proportion of heating time. Examples are given to demonstrate the effect of electrode coatings, different materials, and faults in technique.
—H. W. G. H.

Practical Hints for the Welder. W. Kemsies (*Schmelzschweissung*, 1931, 10, 278–279).—Practical hints for the welding of cast-iron, brass, and aluminium are given and a number of common errors are described.—B. Bl.

From Welding Handicraft to Welding Technique. Otto Mies (*Schmelzschweissung*, 1931, **10**, 50–51).—Historical.—B. Bl.

Prevention of Accidents in Autogenous Welding. W. Kemsies (*Schmelzschweissung*, 1931, **10**, 124–126).—Most accidents with gas cylinders are due to careless or clumsy handling. Possible causes of explosions are discussed and means for their prevention described. An account of some accidents is given.—B. Bl.

Welding in the Technical Schools. W. Heimann (*Schmelzschweissung*, 1931, **10**, 110–111).—The inclusion of welding technique in the curriculum of technical schools for apprentices and workmen is recommended.—B. Bl.

Laboratory for Welding Studies. J. R. Townsend (*Bell Laboratories Record*, 1932, **10**, 306–310).—A brief illustrated account of the equipment in a new laboratory established by the Bell Telephone Laboratories to study welding problems.—J. C. C.

Autogenous Welding in Electrical and Mechanical Construction. Electric Welding. Anon. (*Technique moderne*, 1931, **23**, 313–316).—A review of apparatus and up-to-date practice, and some notes on probable developments and the trend of research.—H. W. G. H.

The Development of Atomic Hydrogen Welding in America and Germany. Anon. (*Technique moderne*, 1931, **23**, 234–236).—The atomic hydrogen process is described and particulars of the apparatus made by the General Electric Company (U.S.A.) and the Allgemeine Elektrizitäts Gesellschaft (Germany) are given.—H. W. G. H.

XXI.—INDUSTRIAL USES AND APPLICATIONS

(Continued from pp. 101–107.)

Bearings. Anon (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 177–178).—A brief discussion of present views on the properties required in bearings, the conditions of working, and features requiring explanation.—R. G.

Metals for Bearings. Anon. (*Technique moderne*, 1931, **23**, 803).—Without giving quantitative data, the author reviews the desirable properties of an ideal, and the actual properties of a typical bearing metal and emphasizes the necessity of knowing every possible factor before deciding on a suitable metal for a given purpose. The best choice made, it is essential to supervise the actual application of the metal in order to realize the properties which decided its adoption. The precautions which should be taken are outlined.—H. H.

Tentative Specifications for Aluminium–Copper–Magnesium–Manganese Alloy Bars, Rods, and Shapes (B 89–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 298–301; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 687–690).—No scrap shall be used in the manufacture of the material except such as may accumulate in the manufacturer's own plants from material of similar composition and of his own manufacture. The requirements as to composition as determined by chemical analysis are: aluminium, min., 92·0; copper 3·5–4·5, magnesium 0·2–0·75; manganese 0·4–1·0%. Tables set forth requirements as to physical properties, and dimensions and permissible variations of alloy bars, rods, and shapes.—S. G.

Aluminium. R. E. Baker (*Canning Age*, 1932, **15**, 550–551).—In the canning industry aluminium is used for steam kettles, pipes, pans, and vats.—E. S. H.

Aluminium in Central Heating. R. Touchard (*Rev. Aluminium*, 1932, **9**, 1867–1870).—An account of the application of aluminium to the construction of central heating appliances.—J. H. W.

Extra Light Metallic Constructions in Light Alloy. J. Bally (*Rev. Aluminium*, 1932, **9**, 1861–1866).—An account of the application of Duralumin to the construction of large light metal parts.—J. H. W.

Duralumin or Special Steels? A. Mazzini Beduschi (*Chimica*, 1932, 8, 267–269).—The relative merits of Duralumin and special steels for some modern constructional purposes, especially for aeronautics, are discussed.—G. G.

On the Problem of the Use of Aluminium Alloys. V. Magliocco (*Auto Italiana*, 1932, (31), 27–29).—The spheres of utility of light alloys are described.—G. G.

Cast Aluminium in the Electrotechnical Industry. O. Schaumann (*Elettrotecnica*, 1932, 370–372).—A descriptive article.—G. G.

Aluminium Paint. Ernest Scheller (*Official Digest, Federated Paint Clubs*, No. 119, 1932, 993–997; *C. Abs.*, 1933, 27, 197).—The manufacture of aluminium flake, its behaviour in various vehicles, and its place in paints are reviewed.
—S. G.

Aluminium Paint as a Primer for Woodwork. Charles Whelan (*Decorator*, 1932, 30, 50).—Advantages of aluminium paint for use on woodwork are summarized, especially in regard to moisture-proofing and protection from oxidation under the influence of light.—E. S. H.

Aluminium Powder and Coloured Bronzes in the Paint Industry. H. Rabate (*Peintures, Pigments, Vernis*, 1932, 9, 134–138, 154–159; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (27), 255).—Cf. *J.*, this volume, p. 102. Although aluminium itself is a good conductor of electricity, aluminium paints are poor conductors. They are non-poisonous, traces of aluminium being harmless in human organism. Surfaces painted with aluminium are easily preserved in good condition; an alkaline wash followed by water is recommended. American tentative specifications covering vehicles for outside paints and paints for wood are given. Aluminium paints are particularly suitable for the protection of aeroplanes and in naval construction. In the final instalment of this article, R. describes the use of aluminium paints as impermeabilizing agents for wood and as coatings for objects already covered with materials containing mineral oil. Aluminium powder itself has a variety of uses outside the paint industry; it may be used, together with mica powder, for making " satin " paper, and is also incorporated in special rubber preparations. The polished powder is used in lithography, and aluminium dust is used as a source of heat in the Thermit process. Aluminium in the form of leaf is used in decoration. A *bibliography* of 70 references, mostly American, gives a comprehensive view of what has been written on this subject.—S. G.

Tentative Specifications for Hard-Drawn Copper Transmission Cable (B 87–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 226–229; and *Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 666–669).—Cover bare concentric-lay cables of 19 strands or less composed of copper wires laid helically about an axis in one or more layers. The copper from which the wires are manufactured shall conform in quality and purity to the requirements for wire-bars in " Standard Specifications for Lake Copper Wire-Bars, Cakes, Slabs, Billets, Ingots and Ingot Bars " (B 4) or " Standard Specifications for Electrolytic Copper Wire-Bars, Cakes, Slabs, Billets, Ingots and Ingot Bars " (B 5). The wires shall be continuous throughout the length of the cable; no splices or brazes will be permitted in any wire after final drawing. Details of pitch and lay of the wires are set forth, and a table gives the requirements as to tensile properties. The variation in tensile strengths of the wires in any cable length (exclusive of the soft or annealed core) shall not exceed 5000 lb./in.^{2}. Unless otherwise specified, 19-strand cable shall be made with a soft or annealed copper core having the same diameter as the other wires in the cable. This soft or annealed wire must have a tensile strength of not more than 37,000 lb./in.^{2} nor less than 31,000 lb./in.^{2}, and a minimum elongation of 30% on 10 in. Details are given as to test samples and their preparation and the determination of tensile properties and electrical resistivity. Finally, the requirements in respect of dimensions and emissible variations, finish, packing and marking, and inspection, are set forth.—S. G.

Tentative Specifications for Copper Water Tube (B 88–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 242–246; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 682–686).—Cover seamless copper tubes especially designed for plumbing purposes, underground water services, &c., but also suitable for copper coil water heaters, fuel oil lines, gas lines, &c. There shall be 3 classes of copper water tube, depending on the principal uses: Class A.—Designed for underground services and general plumbing purposes; Class B.—For general plumbing purposes; Class C.—For use with soldered fittings only. The tubes must be made from copper free from cuprous oxide, as determined by microscopic examination at a magnification of 75. Class A and B tubes when furnished in coils must be annealed after coiling; when furnished in straight lengths they must normally be hard-drawn, but may be furnished with a light temper if so specified. Class C tubes must be furnished in straight lengths, hard-drawn. The purity of the copper shall be at least 99·90%, as determined by electrolytic assay, silver being counted as copper. The tensile strength and grain-size requirements are:

	Nominal Temper.		
	Annealed.	Light Temper.	Hard-Drawn.
Tensile strength, lb./in.^{2} min.	30,000	32,000	48,000
,, ,, ,, max.	...	40,000	...
Elongation on 4 in., % min.	25	...	...
Mean grain-size, mm.	0·025 to 0·075	...	...

Hammering, opening, bend, expansion, and hydraulic tests are specified. A table sets forth standard dimensions, weights, and wall thickness tolerances. —S. G.

Copper Pipe for Gas Distribution. Arthur F. Bridge and Frederic A. Hough (*Gas Age-Record*, 1932, **69**, 503–513).—The use of copper pipe for gas distribution in California is discussed in some detail. Among subjects treated are: corrosion tests, electrolysis and pipe-line currents, effects of gases on copper, mechanical properties and construction methods, making service connections, installing copper mains and services inside steel, economics of copper pipe installations, the life of gas mains.—J. S. G. T.

Tentative Specifications for Copper-Base Alloys in Ingot Form for Sand-Castings (B 30–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 234–238; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 674–678).—Cover copper-base alloys in ingot form for sand-castings in 20 different compositions, regularly sold by the trade and arbitrarily given numbers of 1–20 inclusive, to differentiate them from one another. Care is to be taken that each lot of ingot metal is as uniform in quality as possible; the metal may be manufactured by any refining process that will yield a satisfactory quality of product. The requirements as to chemical composition are set forth in a table, whilst tables in an appendix (which does not constitute a part of the specifications) indicate the approximate physical properties that may be expected of carefully manufactured alloys of the formulæ indicated.—S. G.

Alloy Cables at Dagenham. Anon. (*Met. Ind.* (*Lond.*), 1932, **41**, 513).—The cables over the River Thames at Dagenham in the South-East England Electricity Scheme consist of 7 cadmium–copper wires surrounded by 84 phosphor–bronze wires all of 0·0856 in. diameter. The breaking strength of the completed cable was more than 26 tons/in.^{2}.—J. H. W.

Tentative Specifications for Sand-Castings of the Alloy: Copper 80 per Cent.; Tin 10 per Cent.; Lead 10 per Cent. (B 74–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 230–233; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 670–673).—Cover alloy castings, the alloy being of copper, tin, and lead, and known commercially as 80 : 10 : 10, deoxidized with phosphorus. The castings are intended for use for bearings and bushings in the cast state. This alloy is also frequently used for castings which are required to resist some of the mild acids such as are found in mine waters. The alloy may be made by any approved method, and the castings shall be of uniform quality. The requirements as to chemical composition are:

	Minimum, %.	Desired, %.	Maximum, %.
Copper	77	79·25	...
Tin	9	10	11
Lead	9	10	11
Zinc	0·25	0·75	1
Phosphorus	...	...	0·01
Antimony	...	...	0·50
Iron	...	...	0·25
Nickel	...	...	0·50
Sulphur	...	...	0·08
Aluminium	...	...	none*
Silicon	...	...	0·03
Total constituents other than copper, lead, tin, zinc, nickel, and antimony	...	...	0·50

* The term "none" is defined as a maximum of 0·005%.

The requirements as to tensile properties are: tensile strength, 25,000 lb./in.^{2}; yield-point, 12,000 lb./in.^{2}; elongation, 6% on 2 in. The yield-point is to be determined as the stress producing an elongation under load of 0·5%, *i.e.*, 0·01 in. on a gauge length of 2 in. The requirements as to pressure tests shall be mutually agreed on by manufacturers and purchaser. Details are given of the test-specimens.—S. G.

A New British Standard for Gold Wares. Ernest A. Smith (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 143–144).—Cf. this *J.*, 1932, **50**, 662. A brief historical account of gold standards, referring particularly to the recent legalizing of 14 carat gold (58·5) as a standard for gold wares, and the abolishing of the two standards of 15 carat and 12 carat quality.—R. G.

Abrasion-Resistant Hard Lead for Chemical Use. Anon. (*Lead*, 1932, **2**, (1), 7).—"Plumbalun" consists of lead, containing in the surface layer a finely-grained abrasive, aloxite. The material is used in the chemical and process industries, particularly for the buckets and flights of conveyors handling wet, corrosive substances.—E. S. H.

Lead Fittings for the Modern House. Bernhardt E. Muller (*Dutch Boy Quarterly*, 1931, **9**, (2), 14–15).—Discusses the use of lead in mediæval and modern architecture.—E. S. H.

Lead Mould Used to Cure Rubber Hose. James L. Cutler (*Dutch Boy Quarterly*, 1931, **9**, (2), 10–11).—Lead is extruded from a lead press and the uncured rubber hose is admitted into the lead tube, being thus carried along by the extrusion of the lead sheath. The hose, inside the lead jacket, is filled with water, placed in a heater, and cured under steam pressure.—E. S. H.

The Return of Pewter. Anon. (*Dutch Boy Quarterly*, 1930, **8**, (2), 11–12).—A historical survey, discussing modern uses of pewter. Outstanding properties are the resistance to tarnish and the soft surface to the touch.—E. S. H.

Lead–Asbestos Anti-Vibration Pads for Rubber Mills. Anon. (*Lead*, 1932, 2, (2), 2).—Pads consisting of a lead envelope, enclosing ¼ in. asbestos, are used for absorbing vibration in rubber mills.—E. S. H.

Tentative Specifications for Magnesium-Base Alloy Sheet (B 90–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 305–306, and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 691–692).—Cover commercial magnesium-base alloy sheet having a sp. gr. of 1·9 or less. Annealed sheet is the only temper covered by these specifications, inasmuch as the metal should be in this form for subsequent forming operations. Two typical alloys are specified, and are designated as alloys Nos. 1 and 2. The alloys may be made from virgin metal or from purified scrap metal of known composition. The requirements as to chemical composition are: No. 1.—aluminium 3·5–6·5; manganese, min., 0·2; copper, max., 0·1; other impurities, max., 0·3%; magnesium, remainder. No. 2.—manganese, min., 1·2; copper, max., 0·05; other impurities, max., 0·2%; magnesium, remainder. The requirements as to physical properties are: No. 1.—tensile strength, min., 33,000 lb./in.; elongation on 2 in., min., 10%. No. 2.—tensile strength, min., 28,000 lb./in.^{2}; elongation on 2 in., min., 5%.—S. G.

Tentative Specifications for Magnesium-Base Alloy Wrought Shapes (Other than Sheet) (B 91–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 307–308; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 693–694).—Cover commercial magnesium-base alloy shapes, other than sheet, having a sp. gr. of 1·9 or less. Mechanical working operations develop the maximum properties without the need for subsequent heat-treatment. The alloys are designated as alloys No. 1 and 2, and the requirements as to chemical properties are the same as for the magnesium-base alloy sheet (see preceding abstract). The wrought sections shall conform to the following requirements as to tensile properties: No. 1.—tensile strength, min., 35,000 lb./in.^{2}; elongation on 2 in., min., 8%. No. 2.—tensile strength, min., 30,000 lb./in.^{2}; elongation on 2 in., min., 4%.—S. G.

Ten Years' Progress in Nickel–Copper Condenser Tubes. Anon. (*Nickel Bulletin*, 1932, **5**, 234–236).—Ten years ago, condenser tubes were usually made of 80 : 20 nickel–copper, but more recently the 70 : 30 alloy has been used. The behaviour of these tubes shows that these alloys are well suited to withstand the severe conditions imposed on them.—J. H. W.

Controlling Cinema Lighting. Anon. (*Nickel Bulletin*, 1932, **5**, 204).—A brief account of the application of nickel–copper alloys, particularly of "Ferry" wire, an alloy containing 44% of nickel, to the construction of lighting resistances.—J. H. W.

Utilitarian Uses of Monel Metal in Building Construction. Anon. (*Amer. Metal Market*, 1932, **39**, (152), 6; and (abstract) *Met. Ind.* (*Lond.*), 1932, **41**, 198).—Short note describing the application of Monel metal in building construction in the U.S.A.—J. H. W.

"Tungum" in the Motor Industry. Anon. (*Met. Ind.* (*Lond.*), 1932, **41**, 302).—"Tungum," an alloy of unspecified composition, is said to be a suitable material for replacing steel for industrial purposes, in that it can be annealed to the softness of copper and work-hardened to a strength comparable to that of mild steel. It can be welded, &c., and spun, and will take chromium plate without intermediate nickelling. It is a corrosion-resistant alloy, and has a 22-carat gold colour.—J. H. W.

Closed and Intermittent Contacts of Light, Heavy, and Difficultly-Fusible Materials. B. Duschnitz (*Helios* (*Fachzeit.*), 1932, **38**, 300–301).—A review of the metals and alloys used for electrical contacts and a discussion of the properties necessary for this purpose.—v. G.

XXIII.—BIBLIOGRAPHY

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(Continued from pp. 109–110.)

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[This specification covers the alloy generally known as Duralumin.]

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Deretschej, E. G. *Production of Non-Ferrous Metal Alloys.* [In Russian.] Pp. 319. 1932. Moscow and Leningrad: Zwetmetisdat. (Rbl. 4.40.)

***Deutsche Materialprüfungsanstalten.** *Mitteilungen der deutschen Materialprüfungsanstalten. Sonderheft XXI: Arbeiten aus dem Staatlichen Materialprüfungsamt und dem Kaiser-Wilhelm-Institut für Metallforschung zu Berlin-Dahlem.* 4to. Pp. 102, illustrated. 1932. Berlin: Julius Springer. (R.M. 16.50.)

[Contains the following papers: O. Bauer u. M. Hansen: "Der Einfluss von dritten Metallen auf die Konstitution der Messinglegierungen. IV.—Der Einfluss von Aluminium. Ein Beitrag zur Kenntnis des Dreistoff-Systems Kupfer–Zink–Aluminium" (see *J.*, 1932, **50**, 426); M. Hansen u. B. Blumenthal: "Zur Kenntnis der Zweistoffsysteme des Aluminiums mit Kadmium, Blei und Wismut" (see *J.*, 1932, **50**, 151); E. Schmid u. G. Siebel: "Röntgenographische Bestimmung der Löslichkeit von Mangan in Magnesium" (see *J.*, 1932, **50**, 155); M. Straumanis u. J. Weerts: "Über die β-Umwandlung in Kupfer–Zink– und Silber–Zink–Legierungen.—I." (see *J.*, 1932, **50**, 158); M. Straumanis u. J. Weerts: "Über die Ausscheidung der α-Phase im β-Messing" (see *J.*, this volume, p. 12); G. Wassermann: "Über die Umwandlung des Kobalts" (see *J.*, 1932, **50**, 338); W. Boas u. E. Schmid: "Über die Struktur der Oberfläche geschliffener Metallkristalle" (see *J.*, 1932, **50**, 552); V. Caglioti u. G. Sachs: "Die Walztextur von Zink und Magnesium" (see *J.*, 1932, **50**, 363); Erich Seidl: "Die Bedeutung der Struktur für die bleibende Formänderung von Kristallen" (see *J.*, this volume, p. 128); V. Caglioti u. G. Sachs: "Die Entwicklung von Eigenspannungen durch Dehnen" (see *J.*, 1932, **50**, 291); W. Fahrenhorst u. E. Schmid: "Über die plastische Dehnung von α-Eisenkristalle"; W. Fahrenhorst, K. Matthaes, u. E. Schmid: "Über die Abhängigkeit der Dauerfestigkeit von der Kristallorientierung" (see *J.*, this volume, p. 5); E. Schmid u. M. A. Valouch: "Über sprunghafte Translation von Zinkkristallen" (see *J.*, 1932, **50**, 342); M. A. Valouch: "Bemerkungen zur Walztextur von Zink" (see *J.*, 1932, **50**, 363); W. Boas u. E. Schmid: "Laue-Diagramme mit grossen Ablenkungswinkeln" (see *J.*, 1932, **50**, 165); G. Wassermann: "Über eine Heizvorrichtung für Röntgenpräparate" (see *J.*, 1932, **50**, 246); E. Schmid: "Über die Bedeutung der Röntgenstrahlinterferenzen für die Metallkunde" (see *J.*, this volume, p. 18); J. Weerts: "Präzisions-Röntgenverfahren in der Legierungsforschung" (see *J.*, 1932, **50**, 486); W. Boas u. E. Rupp: "Über Elektronenbeugung an reinem und an passiven Eisen"; E. Schmid u. G. Wassermann: "Röntgenographische Untersuchungen an elektrolytisch-oxydiertem Aluminium" (see *J.*, this volume, p. 84); B. Blumenthal u. M. Hansen: "Über die Einfluss von Kadmium und Blei auf die Eigenschaften des Aluminiums" (see *J.*, this volume, p. 120); O. Bauer u. P. Zunker: "Einfluss von Temperatur und Fremdmetallen auf die Walzbarkeit von Zink" (see *J.*, 1932, **50**, 701).]

***Eggert, J., und E. Schiebold.** Herausgegeben von, im Auftrage der Deutschen Gesellschaft für Technische Röntgenkunde beim Deutschen Verband für die Materialprüfungen der Technik. *Wechselwirkung Zwischen Röntgenstrahlen und Materie in Theorie und Praxis.* (Röntgentagung in Münster 1932.) (Ergebnisse der technischen Röntgenkunde. Herausgegeben von J. Eggert und E. Schiebold. Band III.) Med. 8vo. Pp. ix + 211, with 114 illustrations in the text. 1933. Leipzig: Akademische Verlagsgesellschaft m.b.H. (Brosch., M. 17; geb., M. 18.80.)

[Contains the following: M. v. Laue: "Die Röntgenstrahlen in ihrer Stellung zur allgemeinen physikalischen Theorie (Einführender Vortrage)"; P. Debye: "Streuung von Röntgen- und Kathodenstrahlen"; W. Heissenberg: "Über die Streuung von Röntgenstrahlen an Molekülen und Kristallen"; R. W. James: "Die absolute Bestimmung der Atomformfaktoren durch Versuche mit Kristallen"; H. Mark: "Die Dispersion der Röntgenstrahlen"; D. Coster: "Energieniveaus in Atomen und röntgenspektroskopische Forschung"; W. Noddack: "Die Anwendung der Röntgenspektroskopie in der chemischen Analyse"; J. Eggert und E. Schiebold: "Neuere Röntgentechnik (Einführender Vortrage)"; H. Seemann: "Erregung der Röntgenstrahlen"; H. Stintzing: "Die Vakuumtechnik offener Entladungsröhren"; O. Berg und W. Ernst: "Über einen Röntgenspektrographen und eine Spektraluntersuchungsröhre"; O. Fischer: "Neue Apparate für die Materialuntersuchung mit Röntgenstrahlen"; H. Behnken: "Die Anwendung extrem hoher Spannungen zur Erzeugung sehr schneller Kathodenstrahlen und sehr harter Röntgenstrahlen"; F. Luft: "Radiographie mit Gammastrahlen"; M. Widemann: "Moderne Röntgen-Prüfmethoden an Schwermetallerzeugnissen"; R. Berthold: "Neue Ergebnisse der Gemäldeprüfung mit Röntgenstrahlen"; F. Regler: "Quantitative Messungen elastischer Spannungen an technischen Werkstücken und Stahlbauten mit Hilfe von Röntgenstrahlen"; W. Schmidt: "Über thermische Ausdehnungsmessungen an Eisen mittels Röntgenstrahlen"; E. Schiebold: "Kristallstrukturforschung 1930–1932."]

***Frommer, Leopold.** *Handbuch der Spritzgusstechnik der Metallegierungen einschliesslich des Warmpressgussverfahrens. Grundlagen des Spritzgussvorganges. Konstruktionsprinzipien der Spritzgussmaschinen und Formen nebst Ausführungsbeispielen. Werkstoffkunde. Werkstattspraxis.* Med. 8vo. Pp. xvii + 686, with 244 illustrations. 1933. Berlin: Julius Springer. (Geb., R.M. 66.)

***Greaves, Richard Henry, and Harold Wrighton.** *Practical Microscopical Metallography.* Second edition, revised and enlarged. Med. 8vo. Pp. xi + 256, with 311 illustrations. 1933. London: Chapman and Hall, Ltd. (18*s.* net.)

***Gregg, J. L.** *The Alloys of Iron and Molybdenum.* (Alloys of Iron Research, Monograph Series.) Med. 8vo. Pp. xii + 507, with 154 illustrations. 1932. New York: McGraw-Hill Book Co., Inc. ($6.00); London: McGraw-Hill Publishing Co., Ltd. (36*s.* net.)

***Institution of Mining and Metallurgy.** *Transactions of the Institution of Mining and Metallurgy. General and Personal Index. Vols. XXXI to XL.* 1921–1931. Compiled and edited by Geo. Fredk. Bird. Demy 8vo. Pp. 143. [1933.] London: The Institution, 225 City Rd., E.C.1.

***Joint Council of Qualified Opticians.** *Enquiry into the Manufacture of Gold-Filled Spectacles.* 4to. Pp. 31, with 26 illustrations. 1932. London: Joint Council of Qualified Opticians, Clifford's Inn Hall, Fleet St., E.C.4.

Kieser, August Jean. Herausgegeben von. *Handbuch der chemisch-technischen Apparate, maschinellen Hilfsmittel und Werkstoffe. Ein lexikal. Nachschlagewerk für Chemiker und Ingenieure.* Lieferung 1. Pp. 96. 1932. Leipzig: Otto Spamer. (Lfg. M. 8.50.)

Koppel, J. Herausgegeben von. *Chemiker-Kalender. Ein Hilfsbuch für Chemiker, Physiker, Mineralogen, Industrielle, Pharmazeuten, Hüttenmänner usw.* Begrundet von Rudolf Biedermann. Fortgef. von **Walter Roth.** Jahrgang 54, 1933. In 3 Tln. 8vo. Teil 1: Taschenbuch. Pp. viii + 56 Bl. Schreibpap. + 105. Teil 2: Dichten, Löslichkeiten, Analyse. Pp. iv + 708. Teil 3.—Theoret. Teil. Pp. v + 650 + 22. 1933. Berlin: Julius Springer. (In 2 Bände, geb., Lw. nn. M. 20.)

La Motte, Frank L., and others. *Hydrogen-Ion Concentration.* 8vo. 1923. London: Baillière, Tindall, and Cox. (21*s.* 6*d.* net.)

Library Association. *The Subject Index to Periodicals,* 1931. Roy. 4to. Pp. x + 267. 1932. London: The Library Association. (70*s.*)

***Masing, G.** *Ternäre Systeme. Elementare Einführung in die Theorie der Dreistofflegierungen.* Med. 8vo. Pp. viii + 164, with 166 illustrations. 1933. Leipzig: Akademische Verlagsgesellschaft m.b.H. (Brosch., M. 8.30; Kart, M. 9.60.)

Nickel-Informationsbüro. Herausgegeben vom Leitung: **M. Wachlert.** *Nickel-Handbuch. Nickelstahl.* 1 Teil: *Baustähle. Nickel–Kupfer.* Pp. 46. 2 Teil: *Legierungen über* 50% *Nickel.* Pp. 32. 1932. Frankfurt a. M.: Nickel-Informationsbüro.

***Plant, C. Hubert.** *The Metallography of Iron and Steel.* Demy 8vo. Pp. ix + 211, with 71 illustrations. 1933. London: Sir Isaac Pitman and Sons, Ltd. (12*s.* 6*d.* net.)

Royal Society. *Year-Book of the Royal Society of London,* 1933. (No. 37.) Demy 8vo. Pp. vi + 218. 1933. London: Harrison and Sons, Ltd. (5*s.*)

***Schumacher, Earle E.**, and **Ellis, W. C.** *The Deoxidation of Copper with Various Metals.* (Bell Telephone System Technical Publications, Metallurgy, Monograph B 707.) Med. 8vo. Pp. 8, with 9 illustrations. 1932. New York: Bell Telephone Laboratories, Inc., 463 West St.

[A reprint of a paper entitled " The Deoxidation of Copper with Metallic Deoxidizers, Calcium, Zinc, Beryllium, Barium, Strontium, and Lithium," read before the Electrochemical Society. See this *J.*, 1932, **50**, 580.]

***Schweiz. Verband für die Materialprüfungen der Technik.** *Ergebnisse der an der Eidg. Materialprüfungsanstalt in den Jahren* 1930/31 *durchgeführten Versuche mit autogen und elektrisch geschweissten Stäben.* (Bericht Nr. 19. Diskussionsbericht Nr. 46 der Eidg. Materialprüfungsanstalt.) 8¼ in. × 11¾ in. Pp. 39, with 67 illustrations. 1932. Zürich: Schweiz. Verband für die Materialprüfungen der Technik.

***Schweiz. Verband für die Materialprüfungen der Technik.** *Härtekurs.* Veranstaltet vom Verein Schweiz. Maschinen-Industrieller und vom Schweiz. Verband für die Materialprüfungen der Technik in den Räumen der A.-G. Brown, Boveri & Cie., Baden (Aargau), 4 und 5 September, 1931. Kursleiter Hans Stäger. (Bericht Nr. 21. Diskussionsbericht Nr. 64. der Eidg. Materialprüfungsanstalt.) 8¼ in. × 11¾ in. Pp. 55, with numerous illustrations. Zürich: Schweiz. Verband für die Materialprüfungen der Technik.

***Society of Chemical Industry.** *Reports of the Progress of Applied Chemistry, Volume XVII*, 1932. Demy 8vo. Pp. 721. 1932. London: Society of Chemical Industry, Central House, 46–47 Finsbury Sq., E.C.2. (Members, 7*s.* 6*d.*; non-members, 12*s.* 6*d.*)

[Reports of non-ferrous metallurgical interest are: "Non-Ferrous Metals," by A. R. Powell; and "Electochemical and Electrometallurgical Industries," by J. H. West.]

XXIV.—BOOK REVIEWS

(Continued from pp. 111–112.)

[All books reviewed are contained in the Library of the Institute.]

Handbuch der technischen Elektrochemie. Herausgegeben von Victor Engelhardt. Erste Band. 2 Teil: **Die technische Elektrolyse wässriger Lösungen. A.—Die technische Elektrometallurgie wässriger Lösungen, Gold, Silber, Kupfer, verschiedene Metalle.** Bearbeitet von G. Eger, M. Hosenfeld u. W. Schopper. Med. 8vo. Pp. viii + 331, with 89 illustrations. 1932. Leipzig: Akademische Verlagsgesellschaft m.b.H. (Brosch., M. 30; geb., M. 32.)

The publication of this second part completes volume I of the "Handbook." It follows the same lines as Part I, of which a notice appeared in this *Journal*, 1931, **47**, 506, and completes the account of the production of the metals by electrolysis of their aqueous solutions. The electrolysis of gold and silver is dealt with in two short monographs, each occupying about 20 pages, whilst four-fifths of the book is devoted to copper. This section is very exhaustive, both from the practical and theoretical aspects, and it is well illustrated by line drawings and half-tone figures of actual plant.

The last nine pages deal with the production of gallium, indium, thallium, tellurium, tungsten, molybdenum, and vanadium. These metals are of very little industrial importance, and the last three, which have some special applications, cannot be produced by electrolysis of aqueous solutions. This part of volume I is considerably smaller than was originally intended, owing to the omission of the section on electroplating and the related processes, which had been contemplated. This section will now form an appendix to volume III, and volume II, dealing with the application of electrolysis of aqueous solutions to the chemical industry, is already in the press.

The enormous amount of work involved in compiling this handbook—volume I has taken 4 years—will, we feel sure, be accounted well worth while by electrometallurgists the world over.—C. J. SMITHELLS.

Travail de l'Aluminium et de ses Alliages. La Fonderie. Demy 8vo. Pp. 163, with 53 illustrations. Paris: L'Aluminium français, 23 bis rue de Balzac.

Gas, electric resistance, and hammer welding, and various methods of soldering are described from an impartial point of view. The possibility of arc welding is not mentioned. Calculations for riveted joints in aluminium and Duralumin are explained.—H. W. G. H.

Who's Who, 1933. An Annual Biographical Dictionary with which is incorporated "Men and Women of the Time." Eighty-fifth year of Issue. 8vo. Pp. xlviii + 3648. 1933. London: A. & C. Black, Ltd. (60*s.*)

Tens of thousands of biographies are included in this invaluable annual publication which must find a place on the desk of everyone who has to deal with men and affairs.—ED.

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

1933 APRIL Part 4

I.—PROPERTIES OF METALS

(Continued from pp. 113–120.)

On the Alleged Allotropy of Antimony. A. Schulze and L. Graf (*Metallwirtschaft*, 1933, **12**, 19–21).—Reversible electrical and dilatometric anomalies of antimony are apparently to be ascribed to internal mechanical deformations, *e.g.* elastic displacements of the crystallites against one another; they disappear on ageing at 600° C. and do not occur in single crystals. No transformation can be detected by X-ray examination at high temperatures.—v. G.

Absorption of Light in Cæsium Vapour. H. J. J. Braddick and R. W. Ditchburn (*Nature*, 1933, **131**, 132–133).—The absorption of light by cæsium vapour (at 270° C. and 0·15–0·6 mm. pressure) has been measured between 3184 A. and 1935 A. The absorption at a given wave-length is proportional to the pressure. Attention is directed to an increase in absorption in the far ultra-violet.—E. S. H.

Tensile Properties of Copper at Low Temperature. Masawo Kuroda (*Sci. Papers Inst. Phys. Chem. Res. Tokyo*, No. **393**, 1932, 163–167).—[In English.] Test-pieces were cut from copper plate 3 mm. thick and quenched after annealing at 800° C. Tensile tests were carried out at temperatures from + 16° to − 180° C. by means of an apparatus in which the specimen was immersed in petroleum ether cooled by the admission of liquid air. The stress-strain relations resemble those found by Pester (this *J.*, 1932, **50**, 431), and show no yield-point, in contrast to the results of Schoenmaker (this *J.*, 1931, **47**, 102). K. concludes that the well-defined yield-point in steels is due to the crystal boundary structure, and not to the resistance of slip within the crystal.—W. H.-R.

The Elastic Constants of Single Crystals of Copper. Ren'iti Kimura (*Kinzoku no Kenkyu* (*Journal for the Study of Metals*), 1933, **10**, (1), 35–45).—[In Japanese.] From the modulus of elasticity E and of torsion n in various directions, the Voight moduli were found for single-crystal copper at room temperature: $S_{11} \cdot 10^{12} = 1 \cdot 291$; $S_{12} \cdot 10^{12} = -0 \cdot 523$; $S_{44} \cdot 10^{12} = 1 \cdot 636$; $E_{[111]} : E_{[100]} = 2 \cdot 06$; $n_{[111]} : n_{[100]} = 1/1 \cdot 81$. These values are all given in c.g.s. units.—S. G.

Comparative Properties of Oxygen-Free High-Conductivity Phosphorized and Tough-Pitch Coppers. W. R. Webster, J. L. Christie, and R. S. Pratt (*Amer. Inst. Min. Met. Eng. Preprint*, **1933**, Feb., 1–4).—A comparison of so-called "oxygen-free high-conductivity copper" and the samples reported on in an earlier paper (*Proc. Amer. Inst. Metals Div., Amer. Inst. Min. Met. Eng.*, **1927**, 233; see this *J.*, 1927, **37**, 382; 1928, **40**, 461). It is found that the oxygen-free copper resembles phosphorized electrolytic, rather than the tough-pitch electrolytic in the annealing temperature at which softening starts. The oxygen-free copper shows high values for reduction in area lying on a very flat curve. Phosphorized copper is better suited to the manufacture of small seamless tubes than is tough-pitch copper. The oxygen-free variety can also withstand more severe drawing operations in greater consecutive numbers than even the phosphorized copper. Annealing scale flakes off the latter, but not off the former.—W. A. C. N.

The Recovery of the Electrical Resistance of Copper, Silver and Gold, and of Platinum and Palladium from the Effects of Cold-Work. G. Tammann and K. L. Dreyer (*Ann. Physik*, 1933, [v], **16**, 111–119).—The changes in the hardness and electrical resistance of copper, silver and gold, and of the thermo-electric power of platinum and palladium, has been determined during annealing of the cold-worked metals. In the case of the first three the decrease of hardness occurs within the same temperature range as the decrease in resistance; this range is lower for silver than for copper and gold. The resistance and thermo-electric properties of platinum and palladium decrease at temperatures much below those at which softening occurs. The softening temperatures of copper, silver, and gold are reduced by increased cold-work, whereas they remain constant for platinum and palladium with reductions between 15% and 40%. These differences are discussed with reference to the position of the metals in the Periodic Table.—v. G.

The Extraction of Germanium from Germanium-Bearing Spelter Retort Residues. Howard S. Gable (*Rec. trav. chim.*, 1933, **52**, 225–228).—[In English.] Germanium has been extracted from the retort residues from Missouri zinc ores. The residue is heated at about 1350° C. with a large excess of carbon; zinc distils off, whilst germanium is not markedly volatile at this temperature. The germanium in the residue is then treated with hot hydrochloric acid and separated by distillation as germanium tetrachloride. Spectroscopic examination showed that the germanium thus obtained was contaminated only by silicon and iron in appreciable quantities. Spelter retort residues are suggested as a commercial source of germanium. The germanium content varies from 0·1 to 0·5% of the original residue, the material is cheap, and the method of extraction simple.—E. S. H.

The Electrical Conductivity of Mercury at High Temperatures. Werner Braunbek (*Z. Physik*, 1933, **80**, 137–149).—The following relative values of the electrical conductivity of mercury under 300 atmospheres pressure have been determined at the respective temperatures (° C.) stated: 0°, 1·00; 100°, 0·91; 200°, 0·82; 300°, $0{\cdot}73_5$; 400°, 0·65; 500°, 0·57; 600°, 0·50; 700°, $0{\cdot}43_5$; 800°, 0·38; 900°, 0·33. The following values of the pressure coefficient $\times 10^5$ of change of resistance at pressures of between 300 and 600 atmospheres were also found at the respective temperatures: 0°, 3·2; 100°, 3·7; 200°, 4·3; 300°, 5·1; 400°, 5·9; 500°, 6·8; 600°, 7·9. The results are in good agreement with those of Birch [*Phys. Rev.*, 1932, **41**, 641].—J. S. G. T.

Deposits of Metallic Mercury by High-Frequency Discharge. D. Banerji and Radharaman Ganguli (*Phil. Mag.*, 1933, [vii], **15**, 676–681).—Coloured rings, due to deposition of mercury, are found to occur under certain conditions on the inside wall of a high-frequency electric discharge tube containing mercury vapour and fitted with external electrodes.—J. S. G. T.

The Effect of Mercury Vapour on Sliding Contacts. R. M. Baker (*Electric J.*, 1932, **29**, 64–65).—The voltage drop across a sliding contact between brass or copper rings and carbon brushes operating in a non-oxidizing atmosphere of hydrogen or nitrogen was reduced by as much as 90% when a small amount of mercury vapour (derived from a mercury seal) was present. The amount of mercury causing the effect is very small. No mercury was visible on the surface of the ring after running 2–3 weeks.—J. C. C.

The Electromotive Behaviour of Nickel and Cobalt. Erich Müller and J. Janitzki (*Z. physikal. Chem.*, 1932, [A], **162**, 385–397).—Nickel and cobalt resemble iron in their electromotive behaviour, which is exhibited only on damaged places, so that the compact metal shows only a limiting potential at which the rate of diffusion of the ions into solution is the same as the rate of diffusion of the discharged hydrogen atoms. It is doubtful whether in neutral salt solutions the reversible limiting potential of nickel is ever reached. For cobalt in normal cobalt chloride solution $\varepsilon_{\pi} = -0{\cdot}292$ v.—B. Bl.

X-Ray Studies on the Diffusion of Copper into Nickel. Chujiro Matano (*Mem. Coll. Sci. Kyōtō Imp. Univ.*, 1932, [A], **15**, 351–353).—[In English.] Cf. this *J.*, 1931, **47**, 71, 475; 1932, **50**, 291. From measurements of the changes in radii of the Debye rings, the coeffs. of diffusion of copper into nickel have been determined as 3·5 × 10^{-7} cm.^{2}/day at 650° C. and 1·9 × 10^{-5} cm.^{2}/day at 890° C.—E. S. H.

A New Determination of the Atomic Weight of Osmium. Raleigh Gilchrist (*U.S. Bur. Stand. J. Research*, 1932, **9**, 279–290; and *U.S. Bur. Stand. Research Paper* No. **471**; also (short note) *Met. Ind.* (*Lond.*), 1933, **42**, 154).—A method is described for the preparation of pure osmium. The value of the atomic weight of osmium is calculated from the average percentage of osmium found in carefully prepared samples of ammonium chloro-osmate and of ammonium bromo-osmate. The value obtained from the ratio $(NH_4)_2OsCl_6$: Os is 191·53, and from the ratio $(NH_4)_2OsBr_6$: Os is 191·57, based on the values for nitrogen, hydrogen, chlorine, and bromine given in the International Table of Atomic Weights for 1932. The weighted average value is 191·55. The densities of ammonium chloro-osmate and of ammonium bromo-osmate at 25° C. were found to be 2·93 and 4·09 grm./cm.^{3}, respectively.—S. G.

The Production of Polonium from Radioactive Lead Salts. S. Meyer (*Anz. Akad. Wiss. Wien*, 1931, **68**, 84).—Two methods are described: (1) the polonium was separated as an isomorphous polonium lead tellurate. By separating the lead as sulphate and the tellurium as metal, the polonium alone remained in solution. (2) The polonium was attached to a platinum colloid as carrier, and after exposure to the quartz mercury vapour lamp the platinum was separated and the polonium distilled in a stream of hydrogen.—W. A. C. N.

The Optical Constants of Transparent Silver. Hans Murmann (*Z. Physik*, 1933, **80**, 161–177).—A method for determining the optical constants *n*, *k* of thin absorbing layers of known thickness deposited on a transparent plate is described and applied to the case of a deposit of silver. The dependence of *n* and *k* on the thickness of deposit is discussed. The density of a layer of silver of thickness 15 mμ is the same as that of massive silver.—J. S. G. T.

The Diffusion of Thorium in Tungsten. Gorton R. Fonda, Andrew H. Young, and Amy Walker (*Physics*, 1933, **4**, (1), 1–6).—Thoriated tungsten wires have been heat-treated in gas so as to develop variations in grain-size ranging in length from 4 μ to 3 cm. These variations produced marked changes in the thermionic emissive characteristics, *e.g.*, rates of de-activation and duration of emissive life at normal operating temperature. The heat of diffusion was unaffected. The intergranular diffusion of thorium through tungsten is too rapid to be measured. The conception that the observed phenomena depend entirely on such diffusion is in accord with the existence of a critical grain-size for the realization of a maximum emissive life. Experiments demonstrating the spreading of thorium atoms over the surface of a tungsten single-crystal, and showing the effect of slight strains in the crystal lattice on activation, are described.—J. S. G. T.

Experiments on the Contact Potential of Zinc Crystals. W. A. Zisman and H. G. Yamins (*Physics*, 1933, **4**, (1), 7–9).—Experiments showing that it is possible to obtain a reproducible contact p.d. on zinc in air at ordinary pressures by using the cleaved surface of a single crystal, are described. It is suggested that the lack of reproducibility of the Volta effect of turned or scraped surfaces of zinc is due to anisotropy of the crystals, and not to condensation phenomena associated with roughness of the surface. Confirmatory evidence is found in the reproducibility of the contact p.d. of turned and scraped surfaces of copper. Ende's suggestion that emery embedded in the metals gives rise to false p.d. is shown to be correct. Emery increases the p.d. between zinc and gold by about 0·4 v.; rouge decreases it by about 0·5 v.—J. S. G. T.

The Exact Determination of Specific Heats at Elevated Temperatures. III.—Systematic Study of the Causes of Experimental Error in the Use of the Metallic Calorimeter and in the Measurement of the Specific Heats of Worked Metals. F. M. Jaeger, E. Rosenbohm, and J. A. Bottema (*Rec. trav. chim.*, 1933, **52**, 61–84).—Attention is directed to the discordance of published experimental data concerning the specific heats of metals and the variation of these values with temperature. The phenomena accompanying the exchange of heat between a metal calorimeter and its surroundings are considered, and it is shown that the apparent invalidity of Newton's law must be attributed to the properties of the Dewar flask employed. The necessary cooling corrections are discussed. The value obtained for the specific heat is influenced very strongly by the particular internal condition of polycrystalline metal, which is as a rule ill-defined, even when allotropic modifications are absent. This is regarded as the principal cause of lack of reproducibility. When the metals are subjected to a definite thermal treatment, the internal structure is stabilized, and reproducible results are obtained. These features are illustrated by measurements of the specific heats of platinum, silver, copper, and gold. —E. S. H.

The Change in Thermo-Electric Power on Recovery of Metals from Cold-Work. G. Tammann and G. Bandel (*Ann. Physik*, 1933, [v], **16**, 120–128).—The thermo-electric power of metal wires drawn to various degrees of hardness has been measured against fully-annealed wires of the same metal and the effect of temperature on the e.m.f. has been determined. For wires drawn down to 95–98% reduction, silver gives 0·5, copper 0·10, gold 0·05, magnesium 0·14, iron —0·4, nickel 0·95, platinum 0·07, palladium 0·8 v./° C., and aluminium zero against the corresponding annealed wire. The e.m.f. in the case of silver rises linearly with the degree of reduction. The temperature interval during which the thermo-electric power of silver decreases coincides approximately with that in which the recovery of the electrical resistance occurs. The e.m.f. of the hard/soft silver couple decreases by about 20–30% during 2 weeks' storage at room temperature.—v. G.

Exploring the Conductivities of Molten Metals. Anon. (*Electric J.*, 1932, **29**, 193).—A note, illustrated by resistivity-temperature curves for tin, copper, and two copper–tin alloys containing 4% and 2% tin, respectively. These were obtained from measurements of the voltage drop between contacts at the ends of a porcelain rod which was mounted in a fused quartz tube and immersed in the molten metal through which a constant current was passed.—J. C. C.

A Theory of the Change of Electrical Resistance in Metals Caused by Hydrostatic Pressure. Kôtarô Honda, Tamotu Nishina, and Tokutarô Hirone (*Sci. Rep. Tôhoku Imp. Univ.*, 1932, [i], **21**, 851–868).—[In English.] See abstract from another source, this *J.*, 1932, **50**, 422.—E. S. H.

Change of Electrical Resistance Due to Magnetization. Walther Gerlach (*Physikal. Z.*, 1932, **33**, 953–957).—Read before the VIII Deutsche Physikertag, September, 1932. The following matters are discussed: (1) the relation between the temperature coeff. of electrical resistance of a ferromagnetic metal, *e.g.*, nickel, and its magnetic energy; (2) change of electrical resistance associated with magnetization in the neighbourhood of the Curie point; and (3) change of electrical resistance in intense fields below the Curie point. —J. S. G. T.

Superconductivity in Metals. E. L. Hill (*Rev. Sci. Instruments*, 1933, [N.S.], **4**, (1), 3–6).—A very readable article, briefly summarizing knowledge of the phenomenon of superconductivity in metals, is presented.—J. S. G. T.

Theory of Superconduction.—II. R. de L. Kronig (*Z. Physik*, 1933, **80**, 203–216).—Cf. *J.*, this volume, p. 118. A theory of superconduction, explaining why only elements of small atomic volume and many outer electrons can function as superconductors, is developed.—J. S. G. T.

Transverse Magnetostriction Effect. Werner Fricke (*Z. Physik*, 1933, **80**, 324–341).—A method, employing high-frequency fields, for the investigation of the transverse magnetostriction effect in cylindrical rods is described and results obtained with iron, nickel, and cobalt are detailed.—J. S. G. T.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 120–128.)

Thermal Expansivity of Aluminium Alloys. L. W. Kempf (*Amer. Inst. Min. Met. Eng. Preprint,* **1933**, Feb., 1–15).—Data have been gathered during the examination of a great number of alloys used in the development of an aluminium piston having relatively low thermal expansion. The apparatus was essentially of the (U.S.) Bureau of Standards type. Pure metals were used in the alloys. Generally by adding metals of lower thermal expansivity to aluminium an alloy is produced with a lower coeff. of expansion than that of pure aluminium. The latter decreases with increasing quantities of the alloying element when the coeff. of expansion of the latter is lower than that of pure aluminium. Copper, silicon, nickel, and iron are increasingly efficacious in this order in reducing the coeff. of expansion of aluminium. Some variation arises in the results for copper as compared with those of some previous workers. It is pointed out that structural changes attendant on the reheating during the determination of thermal expansion may, if disregarded, bring about relatively large errors in the determination. Approximate coefficients of thermal expansions for a number of commercial aluminium alloys have been estimated. Basic data available on the effect of various alloying elements on the thermal expansion of pure aluminium have been used.—W. A. C. N.

The Equilibrium Diagram of the Binary System Antimony–Manganese. Takejiro Murakami and Atsuyoshi Hatta (*Kinzoku no Kenkyu* (*Journal for the Study of Metals*), 1932, **9**, (11), 465–475).—[In Japanese.] The equilibrium diagram of the antimony–manganese system has been determined by means of thermal analysis, electrical resistance measurements, and microscopic examination. In this system there exist 3 intermetallic phases, η(MnSb), ϵ(Mn_3Sb_2), and δ(Mn_2Sb). The η-phase has practically no solubility range and forms a eutectic with antimony at 570° C., 9·5% manganese. The ϵ-phase is formed by the peritectic reaction melt $+ \delta \rightleftarrows \epsilon$ at 872° C., the existing range being 32–41% manganese. The δ-phase exists in the range 45–50% manganese at high temperature, and 47–48% manganese at room temperature. The δ-phase forms a eutectic with the β-phase (Mn) at 922° C., 55% manganese. The β-phase is produced by the peritectic reaction melt $+ \gamma \rightleftarrows \beta$ at 1202° C. On further cooling, the β-phase is resolved into the α-(Mn) and δ-phases at 677° C., 94·5% manganese by the eutectoid reaction $\beta(Mn) \rightleftarrows \alpha(Mn) + \delta$.
—S. G.

Resistance to Fatigue of some Aluminium Casting Alloys. R. Cazaud (*Bull. Assoc. Tech. Fonderie,* 1932, **6**, 485–486).—Results are cited for the following alloys: (1) aluminium 92, copper 8%, sand-cast; (2) aluminium 88, copper 12%, chill-cast; (3) aluminium with silicon 5, 12, and 18%, chill-cast.—W. N.

Beryllium Alloys. R. Straumann (*Uhrmacherkunst,* 1932, **57**, 655–656; and (abstract) *Z. Instrument.*, 1933, **53**, 93).—The hardening effect of beryllium on copper is described. Alloys of copper–beryllium, nickel–beryllium, iron–nickel–beryllium, and chromium–nickel–beryllium are useful in the manufacture of watches and clocks. A copper–beryllium alloy (2·5% beryllium) is particularly useful for springs and driving parts; it is non-magnetic, is less liable to break than steel, and does not rust. The nickel–beryllium alloy is suitable for springs that have to withstand high temperatures. All the alloys should be melted in a vacuum in order to avoid the formation of beryllium oxide.—E. S. H.

An Electrochemical Investigation of Cadmium–Silver Alloys. Arne Ölander (*Z. physikal. Chem.*, 1933, [A], **163**, 107–121).—The electrode potential of the cell cadmium (liquid) | lithium, rubidium, cadmium chloride | cadmium-silver alloy (solid) and its temperature coeff. have been determined for 71 alloys between 330° and 555° C. The results agree, in the main, with the known equilibrium diagram, except that a δ-field has been separated from the γ-field. The δ-phase has a lattice structure which is identical with that of the γ-phase, and it is assumed that the γ-phase has an oriented and the δ-phase a random atomic distribution. The β′-phase bears a similar relation to the β-phase as the γ-phase to the δ. The heats of transformation of γ into δ and of β′ into β have been calculated and the deviation of the oriented atomic structure of the β′ and γ-phases from the perfect orientation has been estimated.—B. Bl.

Calcium Alloys [of Lead and Copper]. R. R. Syromiatnikov (*Metallurg* (*Metallurgist*), 1931, 6, 466–485; *Chem. Zentr.*, 1932, 103, II, 3615–3616).—[In Russian.] Calcium forms two compounds with lead, Pb_3Ca, melting point 670° C., and PbCa. Pb_3Ca forms a eutectic with lead (melting point 330° C.) and with PbCa (melting point 630° C.) containing 9·2% calcium. Alloys with more than 16% calcium cannot be prepared under a calcium chloride slag; on melting calcium with lead under slags containing chlorides of lithium, sodium, potassium, or barium, alloys are obtained which contain more or less of the metal in the slag. Iron crucibles are the only satisfactory containers for melting the alloys, the use of clay or porcelain crucibles resulting in contamination of the alloy with aluminium and silicon. Alloys with up to 10% calcium can be prepared by electrolysis of a mixture of calcium chloride and fluoride over molten lead which is kept stirred during the process; with current at 18 v. external heating of the crucible is unnecessary. Rapidly-cooled calcium–lead alloys are harder than slowly-cooled alloys, but lose their extra hardness after annealing at 175° C. Calcium–copper alloys with up to 16·8% calcium can be prepared by adding calcium to molten copper under a calcium chloride and fluoride flux using a copper rod; iron rods contaminate the alloys with iron. The 16% calcium alloy has a structure comprising copper crystals surrounded by the copper–Cu_3Ca eutectic and forms a suitable material for use in deoxidizing copper. With 0·5% calcium the conductivity of copper falls to 50% of that of pure copper, but the hardness and tensile strength are scarcely affected; addition of molybdenum does not overcome the effect of calcium on the conductivity of copper as stated by Regelsberger.—A. R. P.

Physical Properties and Structure of the Binary System Iron–Cobalt. A. Kussmann, B. Scharnow, and A. Schulze (*Z. tech. Physik*, 1932, 13, 449–460). —The abnormally high conductivity at low temperatures of body-centred cubic iron–cobalt alloys in the middle of the system corresponds with a high saturation magnetization; the density, thermal expansion, and hardness do not show any peculiarities, and the alloys probably consist of an ordered solid solution phase of the β′-brass type. The transformation from random to regular orientation cannot be suppressed by quenching, and shows no (or only a very small) hysteresis. At the upper limit of the transformation range of the alloy with 52% cobalt, which should lie at about 800° C., no sharp transformation point has so far been found by electrical measurements. This probably lies at still higher temperatures just below the γ–α change point, and either consists of a change in the state of the valency electron system without rearrangement of the atoms or of a close proportionality between the lattice changes and the atomic grouping.—J. W.

Notes on the Copper-Rich Alloys. H. C. Anstey (*Metallurgia*, 1933, 7, 117–118).—The development of copper alloys is briefly reviewed and the effect of small percentages of other elements such as zinc, tin, lead, silver, silicon, and phosphorus on the modulus of elasticity, coeff. of expansion, and electrical conductivity of copper is discussed. Special reference is made to the " aluminium–bronzes " and to their increasing application in engineering due to their high tensile strength, which is retained at elevated temperature, and which results from their modification with small percentages of nickel and iron. It is also suggested that in the future development of alloys it may be possible to determine mathematically the subsequent conditions which will result when two or more systems combine.—J. W. D.

Investigation on the Influence of the Thermal Treatment on the Magnetic Properties of Geissler Alloys. W. W. Sholobow (*Metallurg* (*Metallurgist*), 1931, **6**, 856–868; *Chem. Zentr.*, 1932, **103**, II, 3615).—[In Russian.] The residual magnetism of the alloys decreases with increase in temperature and reaches zero between 150° and 350° C. except in the case of the alloy containing copper 57·3, manganese 26·2, and aluminium 16·5%, the magnetism of which increases with increase in temperature. In alloys in which the residual magnetism decreases on heating it increases during cold-rolling; and in alloys in which it increases on heating it decreases during cold-rolling. Hard-rolled alloys lose their magnetism at lower temperatures (150°–250° C.) than similar annealed alloys (250°–350° C.). The change in the magnetic properties caused by temperature changes appears to have no connection with the transformations revealed by thermal and micrographic analysis.—A. R. P.

Rate of Precipitation of Nickel Silicide and Cobalt Silicide in the Hardenable Copper–Nickel–Silicon and Copper–Cobalt–Silicon Alloys. Curtis L. Wilson, Horace F. Silliman, and Eugene C. Little (*Amer. Inst. Min. Met. Eng. Preprint*, **1933**, Feb., 1–12).—The paper arises out of a paper by Corson (this *J.*, 1928, **40**, 505). It shows that although the rate of precipitation increases with the reheating temperature in a general way it does not do so continuously. The discontinuities are shown on curves which are supplementary to Corson's. Modifications in the solubility curves are suggested. The hardness of the heat-treated nickel silicide alloys was found to depend on the percentage of nickel silicide present, the quenching temperature, the temperature of reheating the quenched specimens, and the length of time the specimens were held at the reheating temperature.—W. A. C. N.

Investigations on the Equilibrium Relations of Heavily Alloyed Bronzes. I.—Studies on the Copper–Nickel–Tin System. II.—Studies on the Equilibrium Diagram of the Lead–Tin Bronzes. J. Veszelka (*Banyamérnöki es Erdömérnöki Föiskola bányászati es Kohászati osztályának Közleményeiböl*, 1932, **4**, 1–24, 25–42; and *Mitt. berg. hütt. Abt. Kgl. Hochschule Berg.- u. Forstwesen zu Sopron, Ungarn*, 1932, **4**).—[In German.] (I.—) The ternary system nickel–copper–tin contains 5 quasi-binary systems, *viz.*, copper–Ni_4Sn, copper–Ni_3Sn_2, Cu_4Sn–Ni_3Sn_2, Cu_3Sn–Ni_3Sn_2 and Cu_6Sn_5–Ni_3Sn_2, from which it appears that nickel has a greater affinity than copper for tin. The equilibria in the ternary system have been investigated by thermal and micrographic analysis of alloys with constant nickel contents of 2, 4, 7, 10, and 15%, and of alloys with a constant tin content of 25%, as well as by determination of the isothermals for 750°, 700°, and 500° C. The characteristic solidification and transformation reactions in copper–tin alloys are suppressed by the presence of more than 4% nickel, and the peritectic horizontal $\alpha +$ liquid $\longrightarrow \beta$ becomes a surface with 7% nickel corresponding with no definite reaction other than the end of the solidification process. With increasing nickel the β-field becomes smaller, and finally disappears at 5% nickel, the γ-phase solidifies over a spherical surface, and, with more than 7% nickel, the α- and γ-phases form a eutectic mixture. The transformation temperature of β is increased by addition of nickel, and with 4% nickel it begins immediately after the alloy solidifies. The γ-phase is stabilized by addition of nickel as the Ni_3Sn_2 thereby formed remains in solid solution down to room temperature; no decomposition into ($\alpha + \delta$) occurs, therefore, except when the nickel content is low or the tin content very high. In the quasi-binary system copper–Ni_3Sn_2 the solubility of the compound in copper increases rapidly with rise of temperature, hence these alloys, especially those with 3–15% nickel, can be hardened by quenching and ageing. The paper contains numerous sectional equilibrium diagrams and photomicrographs of characteristic structures. (II.—) Cf. *J.*, this volume, p. 12. Lead affects only slightly the solidification and transformation processes of tin–copper alloys; the only new reactions caused by lead are the formation of a lead-rich liquid by a monotectic reaction similar to that which occurs in lead–copper alloys, and the reaction α + liquid (copper) $\longrightarrow \beta$ + liquid (lead) which occurs over a wide concentration range at 772° C. The miscibility gap in the quasi-binary system Cu_3Sn–lead begins at 2% lead.—A. R. P.

Precipitation of Alpha from Beta Brass. Oscar T. Marzke (*Amer. Inst. Min. Met. Eng. Preprint*, **1933**, Feb., 1–10).—An attempt to determine the character of the needle-like α-phase precipitate in the copper–zinc system and also the orientation relationship between the matrix and the precipitate. A summary of recent work on this and cognate subjects is given. Alloys containing 62, 60, 58, and 56% copper, respectively, were used. They were prepared from very pure materials. Heat-treatment consisted in quenching at a controlled rate, rapid quenching followed by reheating, and rapid quenching after furnace cooling various amounts below the transformation temperatures. The quenching media were tap water, cold air blast, still air furnace, sand and oil at 200° C. Two types of precipitate were ultimately observed, depending on the temperature of precipitation. At high temperatures it occurred in needle form, and at low temperatures in plates. It was found that a (111) plane and [011] direction of the precipitate are parallel to a (011) plane and [111] direction of the matrix.—W. A. C. N.

Studies on Brasses. —— Moustacas and —— Merle (*Usine*, 1931, **40**, (23), 33).—Abstract of paper read before the 10e. Congrès de Fonderie. Many foundry troubles, especially with brass, are thought to be due to the metal, and would be avoided by closer co-operation between the refiner and the founder. Differences in properties of brasses having practically the same chemical composition are thought to be due to " brass disease," and a small amount of afflicted metal may contaminate a charge.—H. W. G. H.

The Precious Metal Alloys of Gold, Silver, and Nickel. F. Renaud (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 444–448).—The gold–nickel alloys are interesting metallurgically on account of their sensibility to heat-treatment at low temperatures which is accompanied by structural modifications. Silver–nickel alloys, on the other hand, offer problems with regard to the solubility of the metals in one another and to the homogeneity of the resulting materials. The equilibrium diagrams and physical properties of these alloys are discussed. —W. A. C. N.

Investigations on the Solid Solution System Gold–Silver and on Its Attackability by Nitric Acid. M. Le Blanc and W. Erler (*Ann. Physik*, 1933, [v], **16**, 321–336).—Tests on the solubility of gold–silver alloys in nitric acid of such a density that it will not dissolve pure gold show that there are no well-defined resistance limits at 49° C. Even alloys with less than 48 atomic-% silver lose some silver after prolonged exposure to the acid. The attackability rises at first slowly, then rapidly, and finally slowly again with increasing silver until a solubility equal to that of pure silver is reached. The steep rise in the solubility lies between 57 and 62 atomic-% silver, but depends to some extent on the time, density of the acid, and degree of working, cold-working increasing the rate of dissolution of the silver. Determinations of the lattice constants agreed well with those of Sachs and Weerts; the minimum of the constants, however, was found at about 50 atomic-% silver.—v. G.

White Metal Bearing Alloys: Mechanical Properties at Different Temperatures and Service Tests. Harry K. Herschman and John L. Basil (*U.S. Bur. Stand. J. Research*, 1933, **10**, 1–5; and *U.S. Bur. Stand. Research Paper* No. **512**).—A more complete discussion of the details and results of this investigation was presented in a paper read before the American Society for

Testing Materials (see this *J.*, 1932, 50, 429). Some additional work has since been completed; this included (1) a metallographic study of the alloys tested, and (2) the determination of the mechanical properties of hardened lead B (lead 98, sodium 0·65, potassium 0·3, calcium 0·75, lithium 0·4%).—S. G.

Thermal and Electrical Conductivities of a Number of Magnesium Alloys and Their Relation to the Wiedemann–Franz Law. Rimpei Kikuchi (*Sci. Rep. Tôhoku Imp. Univ.*, 1932, [i], 21, 585–593).—[In German.] Cf. this *J.*, 1932, **50**, 732. The thermal and electrical conductivities of pure magnesium and of binary alloys of magnesium containing up to about 6% of other metals have been determined. The alloying metals decrease both conductivities progressively, the magnitude of the effect produced increasing in the order copper, nickel, silver, zinc, tin, aluminium. The Wiedemann–Franz law holds only approximately.—E. S. H.

Tensile Properties of Cast Nickel–Chromium–Iron Alloys and of Some Alloy Steels at Elevated Temperatures. William Kahlbaum and Louis Jordan (*U.S. Bur. Stand. J. Research*, 1932, **9**, 327–332; and *U.S. Bur. Stand. Research Paper* No. 474).—The tensile properties as measured in "short-time" tests were determined for a medium-manganese steel at 900° F. (482° C.); for a series of cast nickel–chromium–iron alloys containing carbon 0·5, chromium 35, and nickel 10–45%, at a temperature of 1550° F. (843° C.); and for 3 tungsten–chromium–vanadium steels and 4 molybdenum–chromium–vanadium steels at temperatures of 850° and 1000° F. (454° and 538° C.). The nickel–chromium alloys showed no marked change in proportional limit at 1550° F. (843° C.) over the range of composition studied. With nickel contents above 30%, the tensile strengths of the alloys decreased noticeably and the ductility increased.—S. G.

Special Cupro–Nickel Alloys. M. Ballay (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 203–208).—Cf. this *J.*, 1932, **50**, 541. Initially the equilibrium diagram of the copper–nickel series and the physical properties of the most important commercial alloys in that series are discussed. The effect of impurities in modifying those physical properties is enlarged upon. Especial attention is given to Monel metal. Separate sections are devoted to the consideration of copper–nickel alloys containing varying amounts of silicon and tin, both separately and together. Alloys containing aluminium are employed in the cast state, and are said to have good mechanical resistance, and to be reasonably resistant to corrosion, particularly by sea-water. Manganese in small quantities increases the hot-working properties.—W. A. C. N.

Copper–Nickel Alloys Containing Silicon. M. Ballay and A. Le Thomas (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 598–611).—Cf. this *J.*, 1932, **50**, 541, 661. The resistance to oxidation, erosion, and shock, and the satisfactory physical properties of copper–nickel–tin alloys are first discussed and illustrated by curves and results. While the influence of manganese, antimony, zinc, and lead in these alloys is negligible, that of silicon is important. The effect of silicon on various standard copper–nickel–tin alloys, up to a content of 5% silicon, has been studied. Photomicrographs are given to indicate the various structural changes.—W. A. C. N.

On the Equilibrium Diagram of the Binary System Nickel–Zinc. Kanzi Tamaru (*Kinzoku no Kenkyu* (*Journal for the Study of Metals*), 1932, **9**, (12), 511–626).—[In Japanese.] See abstract from the English copy of this paper, *J.*, this volume, p. 15.—S. G.

Factors Determining the Properties of White Bearing Metals. J. Neill Greenwood and G. B. O'Malley (*Proc. Australian Inst. Min. Met.*, 1932, **(87)**, 207–215).—A brief resumé of the properties of tin- and lead-base bearing metals and the effect of casting conditions on the structure and behaviour during use.—A. R. P.

Magnolia Metal. Anon. (*Technique moderne*, 1931, **23**, 27).—An outline of the properties of this alloy.—H. W. G. H.

[Report on] Inorganic Chemistry. H. Bassett (*Ann. Rep. Prog. Chem.*, 1932, **29**, 74–95).—A review of recent work on the chemistry of non-ferrous metals. References are given to work on the following systems: silver–copper–manganese, iron–nickel–phosphorus, iron–zirconium, iron–cobalt–tungsten, iron–cobalt–molybdenum; silver–copper–zinc, aluminium–magnesium–silicon, aluminium–magnesium–copper, aluminium–copper–silicon, aluminium–copper–iron, iron–cobalt–carbon, and iron–cobalt–chromium. —E. S. H.

On the Existence of Resistance Limits in Solid Solutions with Random Atomic Distribution.—II. U. Dehlinger and R. Glocker (*Ann. Physik*, 1933, [v], **16**, 100–110).—In continuation of earlier work (see this *J.*, 1932, **50**, 607) it has been calculated that the frequency of chains consisting of two of the less noble atoms in a solid solution lattice decreases rapidly at 29 atomic-%, and those consisting of three such atoms at 21 atomic-%. However, all these calculations give a very close approximation to zero solubility, but not complete insolubility, as has been observed experimentally at Tammann's suggested "resistance limits". It is therefore assumed, and this is supported by the researches of Graf (see this *J.*, 1932, **50**, 355), that the atoms of the noble metal go into solution from the surface layer attacked by the solvent, and then are again precipitated in the voids in the second layer, and thus, if their concentration therein is sufficient, further attack is hindered.—v. G.

Contribution to the Investigation of the Cathodic Disintegration of Metallic Alloys.—III.–IV. L. Belladen (*Gazz. chim. ital.*, 1932, **62**, 493–496, and 497–502).—Cf. this *J.*, 1932, **50**, 354. (III.—) The cathodic disintegration of bismuth–antimony and copper–tin alloys is shown graphically as a function of the composition. (IV.—) The results obtained in the whole series are discussed with reference to the crystal symmetry and lattice structure of the various alloys investigated. The composition of the dusts obtained from solid solutions, intermetallic compounds and eutectics, and the influence of cold-working and annealing on the pulverization of copper are discussed, and a definite relation between pulverization and lattice parameters has been established. —G. G.

The Exact Determination of Specific Heats at Elevated Temperatures. IV.—The Law of Neumann–Joule–Kopp–Regnault Concerning the Additivity of Atomic Heats of the Elements in Their Chemical Compounds. F. M. Jaeger and J. A. Bottema (*Rec. trav. chim.*, 1933, **52**, 89–111).—See this *J.*, 1932, **50**, 478.—E. S. H.

The Magnetic Susceptibility of Several Systems of Binary Alloys [Au–Ag; Au–Cu; Sb–Bi; Pt–Pd; Sn–Bi; Bi–Pb; Cd–Sn; Sb–Pb; Bi–Te; Al–Sn]. Yosomatsu Shimizu (*Sci. Rep. Tôhoku Imp. Univ.*, 1932, [i], **21**, 826–850).—[In English.] The relation between magnetic susceptibility and concentration has been examined in the systems gold–silver, gold–copper, antimony–bismuth, and platinum–palladium (which form continuous solid solutions), and also in the systems tin–bismuth, bismuth–lead, cadmium–tin, antimony–lead, bismuth–tellurium, and aluminium–tin. All the specimens were prepared by melting and annealing in a vacuum. The great effect of absorbed gases is emphasized, and the curious results obtained by previous investigators of these systems are attributed to the neglect to melt and anneal in a vacuum. In the case of alloys which form continuous solid solutions the maximum deviation of susceptibility from the values calculated from the additive law is small, whilst the deviation of density is less than 1%. In the case of eutectic alloys with solubility on both sides, the susceptibility–concentration curve is linear in the range of eutectic composition and slightly curved in the range of solid solution. The apparent decrease of magnetic susceptibility of bismuth or antimony on adding small quantities of tin, tellurium, lead, &c., which has been attributed to the formation of a solid solution, is shown to be due to the presence of absorbed gases.—E. S. H.

Hall E.M.F. and Intensity of Magnetization. E. M. Pugh and T. W. Lippert (*Phys. Rev.*, 1932, [ii], **42**, 709–713).—Further experiments confirm P. and L.'s previous conclusion (*ibid.*, 1930, [ii], **36**, 1503), that the Hall e.m.f. is a linear, single-valued function of the intensity of magnetization $B-H$, but is neither a linear nor a single-valued function of either the induction B, or the applied field H alone. The materials investigated included electrolytic iron, various steels, an iron–cobalt alloy (50% cobalt), and an iron–nickel alloy (30% nickel). In each material the ratio $E/(B-H)$ remained constant, dependent on temperature and previous heat-treatment only, for all of the magnetic changes to which it was subjected.—W. H.-R.

Mono-Crystal Barkhausen Effects in Rotating Fields. Fred J. Beck, Jr., and L. W. McKeehan (*Phys. Rev.*, 1932, [ii], **42**, 714–720).—The experiments described refer to silicon–steel, but the results are of general interest. A single crystal disk of silicon–steel was held stationary in a magnetic field, which was rotated slowly in the plane of the disk. Two search coils mounted at right angles were used to measure the longitudinal and transverse components of the change in magnetization arising from the same Barkhausen discontinuity. For low values of magnetization ($I = 190$ and 100, respectively) the effects were mainly transversal with respect to the applied field H, and were more nearly transversal for the greater value of magnetization. The direction and frequency of the effects were unaffected by changing the direction of H in the plane of the disk so that no dependence on the crystallographic directions of I, H, or dH/dt has been established.—W. H.-R.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 128–130.)

A Micrographic Study of the Decomposition of the β-Phase in the Copper–Aluminium System. Cyril Stanley Smith and W. Earl Lindlief (*Amer. Inst. Min. Met. Eng. Tech. Publ.* No. **493**, 1933, 1–39).—Micrographic examination of specimens of an aluminium–copper alloy containing 11·87% aluminium after annealing at temperatures between 566° and 573° C. has shown that the eutectoid temperature is 570° ± 1° C.; electrical conductivity measurements have confirmed this. Numerous samples of the alloy were quenched from the homogeneous β-field in a salt bath maintained at constant temperatures between 375° and 565° C. and their microstructure was examined after varying periods in the bath. At 565° C. the transformation started after 1 hr. and was completed in 10 hrs., whereas at 535° C. it was complete after 7 minutes; at still lower temperatures the rate of transformation rapidly decreased, until at 400° C. it occupied 5 days. The high rate of transformation at 535° C. was accompanied by the appearance of a new transitional phase β′, from which the α-needles or plates grew very rapidly; the amount of α formed was greater the lower the temperature, and below 400° C. practically the whole of the alloy was converted into α, although the saturated α-phase normally contains only 9·8% aluminium. A theory is advanced to account for the formation of β′ and supersaturated α based on the assumption that β′ is more stable than β at temperatures below 535° C. and contains a higher aluminium content. The β′ phase appears as clusters of rosettes in specimens etched with ammoniacal hydrogen peroxide or with a solution of chromic acid in 1 : 1 nitric acid; ferric chloride, ammonium persulphate, and potassium dichromate etching reagents fail to reveal its presence. Addition of large amounts of tin to the alloy stabilizes the β′-phase, but small amounts tend to delay its formation on cooling.

The hardness of β′ is approximately the same as that of β, and it is suggested that the so-called β′ of Obinata (this *J.*, 1930, **43**, 456) was really a fine (α + δ) complex. The final hardness of eutectoidal specimens increases with decreasing temperature of formation from 565° to 525° C., then decreases at lower temperatures owing to the appearance of α before the eutectoid.—A. R. P.

The Distinction Between Rolled Gold and Electroplated Gold. E. Raub (*Mitt. Forschungsinst. Edelmetalle*, 1932, **6**, 57–63).—Edges of the articles which have been cut, sawn, or punched when examined under the microscope show the absence of gold on the cut side when the article is made of rolled gold, whereas in plated articles all portions have the same thickness of gold. Soldered places in rolled-gold articles are also free from gold on the surface, but are covered in plated articles. The thickness of gold in pressed parts is the same on the prominences and in the recesses in the case of rolled gold, but is thinner in the recesses in the case of plated gold. In the links of chains gold fails to plate at the places where 2 links touch, but in rolled gold chains there is an equal thickness of gold all round the link. To prepare the specimens for examination they should first be plated with copper from a cyanide bath, then from an acid bath until a heavy coating is obtained; the article is then sectioned, polished, and etched in concentrated nitric acid for 1–2 seconds. —A. R. P.

Segregate Structures of the Widmanstätten Type Developed from Solid Solutions of Copper in Zinc. M. L. Fuller and J. L. Rodda (*Amer. Inst. Min. Met. Eng. Preprint*, **1933**, Feb., 1–13).—Presents an analysis of the crystallographic relationship between the segregate and the solid solution matrix in the Widmanstätten structures observed when a secondary phase ε is precipitated from the η solid solution of copper in zinc. The plane of segregation in the matrix contains the direction of closest atomic packing of the lattice. Both segregate and matrix are hexagonal close-packed. It is suggested that a (10·4) plane of the segregate is parallel to a (10·4) plane of the solid solution matrix, that the closest-packed directions in the two planes, which are at the same time directions of closest possible atomic packing in this type of lattice, are coincident, and that the principal axes of the segregate crystals are at 4° to the principal axis of the parent mixed crystal. A theoretical explanation of the mechanism of the segregation phenomenon has been put forward.—W. N.

Preparation of Lead and Lead Alloy Cable Sheath for Microexamination. Earle E. Schumacher and G. M. Bouton (*Met. Ind.* (*Lond.*), 1933, **42**, 101–103).—Abstract of the discussion of a paper by W. H. Bassett, Jr., and C. J. Snyder, read before the American Society for Testing Materials (see this *J.*, 1932, **50**, 485).—J. H. W.

The Measurement of Grain-Size. R. G. Johnston (*Met. Ind.* (*Lond.*), 1933, **42**, 145–146).—Gulliver's theory of grain measurement (this *J.*, 1918, **19**, 145) depends on 2 assumptions, *viz.*, that the average or mean grain-size as usually obtained has a real meaning, and that the number of grains in a given field can be counted. It is claimed that neither of these postulates can be granted, and that the only possible method of measuring grain-size is by comparison with an arbitrarily accepted standard grain pattern.—J. H. W.

Grain-Size Measurement. J. D. Jevons (*Met. Ind.* (*Lond.*), 1933, **42**, 194).—A letter supporting the conclusions given in an article by R. G. Johnston (see preceding abstract).—J. H. W.

Recrystallization Power and Shear Hardening in Aluminium Single-Crystals. W. G. Burgers (*Nature*, 1933, **131**, 326–327).—Experiments on the recrystallization of stretched single-crystals of aluminium indicate that, for the same amount of shear, the number of crystallites formed under identical conditions of heat-treatment decreases as the number of slip planes involved in the distortion increases. An explanation, based on G. I. Taylor's view of curvature on slip planes, is given, and the possibility of the simultaneous occurrence of lower recrystallization power and greater hardening is considered.—E. S. H.

New Additions to the Theory of Recrystallization. U. Dehlinger (*Metallwirtschaft*, 1933, 12, 48–50).—D. assumes that the recrystallization of a deformed metal starts in the places of smallest stress. The greater stresses are so far relieved during the primary working recrystallization that the atoms can attach themselves by a kind of slip mechanism to the places of low stress which act as recrystallization nuclei. These small stresses remain almost constant, and provide a motive power for secondary recrystallization after prolonged annealing. The differences in the surface energies of different crystal surfaces, which have previously been assumed to be the cause of growth, are of too small an order of magnitude to effect this.—v. G.

On Recrystallization. A. E. van Arkel (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1931**, (2–3), 84–90).—See this *J.*, 1930, **44**, 556.—D. N. S.

On the Structure of the Surface of Cut Metal Crystals. W. Boas and E. Schmid (*Mitt. Material., Sonderheft* 21, 1933, 39–42).—See this *J.*, 1932, **50**, 552.—J. W.

The Crystal Structure of Borides of the Composition MeB_6. M. von Stackelberg and F. Neumann (*Z. physikal. Chem.*, 1932, [B], **19**, 314–320).—CaB_6 has a cubic cæsium chloride structure composed of calcium atoms and B_6 groups, the six boron atoms of the latter occupying the corners of an octahedron. SrB_6, BaB_6, LaB_6, CeB_6, PrB_6, NdB_6, ErB_6, and ThB_6 all have a similar structure, and all have a metallic character.—v. G.

Magnetochemical Researches. VII.—On the Magnetism of the Borides of the Rare Earths. W. Klemm, W. Schüth, and M. von Stackelberg (*Z. physikal. Chem.*, 1932, [B], **19**, 321–327).—Since the metallic character of borides of the formula MeB_6 has been established by their electrical conductivity, it follows from magnetic measurements that, in the borides LaB_6, CeB_6, PrB_6, NdB_6, and SmB_6, the rare-earth metals are embedded in the form of tervalent ions in the electronic gas which produces the metallic character of the compounds.—v. G.

X-Ray Study of Copper–Cadmium Alloys. E. A. Owen and Llewelyn Pickup (*Proc. Roy. Soc.*, 1933, [A], **139**, 526–541).—The whole range of the copper–cadmium system has been examined by X-ray powder methods. The phase regions of the diagram given by Jenkins and Hanson have been confirmed. The β-, γ-, and ε-phase structures were too complex to be solved from the photographs taken, but the δ-phase structure was confirmed to be similar to that of γ-brass. The close analogy, suggested by some workers, between the corresponding phases of the copper–cadmium system and the copper–zinc, silver–zinc, and silver–cadmium, is not supported by the present results. Special attention is given to annealing treatments. While lattice distortion in filings is completely eliminated by simple annealing, such annealing may not, and does not with these alloys, bring about true thermal equilibrium. Alloys were therefore annealed in lump form for long periods, which, when followed by comparatively short annealing of the filings, produced equilibrium. The solid solubility of cadmium in the copper lattice decreases with decreasing temperature. The limits of solubility are: 97·8% copper at 500° C., 99·0% at 400° C., and 99·5% at 300° C. A modification is therefore suggested in the $(\alpha) - (\alpha + \beta)$ boundary of the equilibrium diagram given by Jenkins and Hanson. This change is considered to be of importance in the working of the industrial alloys of the system.—J. S. G. T.

The Lattice Constants of the Copper–Palladium Solid Solutions. J. O. Linde (*Ann. Physik*, 1932, [v], **15**, 249–251).—The lattice constants of copper–palladium alloys have been determined in a Seemann–Bohlin camera with an accuracy of ± 0·05%. The values for the solid solution are consistently greater than corresponds with the mixture rule, the difference reaching a maximum of 0·35% at 50 atomic-% palladium. The regularly oriented phase Cu_3Pd has the same lattice constants as the solid solution of the same composition, but there is a volume contraction of 0·5% when the solid solution corresponding with CuPd is converted into the body-centred cubic lattice of this compound.—v. G.

Crystal Structure of Electrolytically-Deposited Iron–Nickel Alloys. Keizô Iwasé and Nobuyuki Nasu (*Kinzoku no Kenkyu* (*Journal for the Study of Metals*), 1933, **10**, (1), 26–34).—[In Japanese.] Iron and nickel were co-deposited in various proportions electrolytically from their mixed sulphate solutions, and X-ray diffraction patterns were photographed by the Debye–Scherrer and Seemann–Bohlin methods. The results obtained were as follow: Iron and nickel co-deposited from a solid solution. The homogeneity of the solid solution thus formed appears to be not so good as that of the alloy solidified from the melt. (2) The co-existence of α- and γ-solid solutions is also observed in deposits the nickel concentration of which ranged from 15 to 58%. In the melted alloys this range is between 25 and 33% nickel. (3) The lattice constant of the α- (or γ-)solid solution increases slightly at first, reaches a maximum and then decreases as the nickel (or iron) content increases. It is concluded, from these results, that when the total or local concentration of the one metal in the deposit is small, two cases may arise: either (i) the metal is forced to deposit among the crystals of the other metal without forming its proper crystal lattice, forming a pseudo-solid solution as a result, or (ii) the unit mass of the deposited crystals of that metal is small and consequently it easily diffuses into the other after deposition. When the concentration of the metal is fairly large, the unit mass of that crystal also becomes large, and its diffusion into the surrounding crystal of the other takes place less easily than before, leaving some of that crystal undiffused. This tendency becomes greater as the concentration of that metal in the deposit increases. The existence of the maximum on the above-mentioned curve and the co-existence of α- and γ-solid solutions in a wider range of the composition of the deposited melted alloy are sufficiently explained by the process of deposition suggested above.—S. G.

Changes in the Lattice Constants and the Conductivity of Palladium by Electrolytic Charging with Hydrogen. F. Krüger and G. Gehm (*Ann. Physik*, 1933, [v], **16**, 174–189).—Palladium rods were charged electrolytically with hydrogen for varying periods at 20° C. and the absorbed hydrogen was determined by measuring the quantity of gas evolved and deducting it from the theoretical amount based on the current used. X-ray photographs showed the presence of two face-centred cubic phases, one apparently corresponding with palladium containing only a small amount of hydrogen in solid solution as its parameter increased with the hydrogen content from 3·884 to 3·886 A. (± 0·001), and with 10% hydrogen the lines of the second phase appeared. The latter has a lattice parameter of 4·020 A. with less than 44 atomic-% hydrogen, and this increases linearly to 4·045 A. with 47·4 atomic-% hydrogen. The electrical resistance increases linearly from $11·6 \times 10^{-4}$ for pure palladium to $19·6 \times 10^{-4}$ for alloys containing the second phase. At 44 atomic-% hydrogen the curves of concentration/electrical resistance and concentration/lattice parameter show sharp deviations, indicating that this is the boundary of the homogeneous second phase. Its upper limit is not known, as no alloys could be prepared with more than about 47–48 atomic-% hydrogen.—v. G.

Lattice Constants and Electrical Conductivity of Electrolytically Charged Palladium–Silver Alloys as a Function of the Hydrogen Content. F. Krüger and G. Gehm (*Ann. Physik*, 1933, [v], **16**, 190–202).—The lattice parameter of the equiatomic silver–palladium solid solution is about 0·01 A. less than that required by the mixture rule. Alloys with 10, 30, and 40% silver were charged with hydrogen in the same way as pure palladium (cf. preceding abstract). In all cases a small expansion in the lattice parameter occurs corresponding with a solubility of hydrogen, which, however, in no case exceeds

10 atomic-%. With higher hydrogen content a second lattice appears. The field of homogeneity of this phase begins at 41 atomic-% hydrogen for the 10% silver alloy ($a = 3.999$ A.), at 44 atomic-% hydrogen for the 30% silver alloy ($a = 3.974$ A.), and at 32 atomic-% hydrogen for the 40% silver alloy ($a = 3.972$ A.). From these figures it is concluded that at about 45% silver the miscibility gap between the hydrogen-rich and the hydrogen-poor phase is closed. The rate at which equilibrium with hydrogen is reached decreases with increasing silver content, so that determinations must be made with thin wires. Maximum absorption of hydrogen occurs with the 30% silver alloy, which absorbs more hydrogen than pure palladium.—v. G.

On the Structure of Technical Zinc Dust. G. Wassermann (*Metallwirtschaft*, 1933, 12, 1–2).—X-ray examination of zinc dust reveals zinc crystallites of about the same size as the particles recognizable under the microscope, so that each particle consists of only one or a few crystals. Weak lines of zinc oxide can also be detected in the röntgenographs, and these lines are just as strong in the coarser part of the material as in the finer, hence it appears that the oxide forms a thin surface film on the zinc particles. The particles of zinc dust cannot be melted together even at 500° C. in a vacuum; on addition of zinc chloride and heating until the latter begins to volatilize, the dust can be melted into a button. If the zinc chloride cannot be distilled, the zinc particles will not fuse together, but remain suspended in the flux.—v. G.

On the Crystallographic Treatment of Wire- or Rod-Shaped Single Crystals. J. Leonhardt (*Metallwirtschaft*, 1932, 11, 659–662).—For the mathematical treatment of röntgenographic and crystallographic problems in rod- and wire-shaped single crystals the use of a projection net, obtained by central projection on a cylindrical surface and unrolling of this surface to produce a plane, is recommended.—v. G.

Does the Change in Lattice Constants in the Formation of Solid Solutions Depend on the Grain-Size? E. Schmid and G. Siebel (*Metallwirtschaft*, 1932, 11, 685).—Experiments on silver–copper, aluminium–magnesium, zinc–magnesium, magnesium–aluminium, and copper–aluminium alloys have failed to confirm Wiest's observation on silver–copper alloys (cf. this *J.*, 1932, **50**, 308) that the change in lattice constants produced by a metal entering into solid solution is dependent on the grain-size. The lattice constants were the same in single crystals as in polycrystalline aggregates having a grain-size down to 0·05 mm.—v. G.

Does the Change in Lattice Constants in the Formation of Solid Solutions Depend on the Grain-Size? U. Dehlinger and P. Wiest (*Metallwirtschaft*, 1933, 12, 2–3).—A reply to Schmid and Siebel (cf. preceding abstract). D. and W. have repeatedly confirmed their results with silver–copper alloys, and have found similar results with silver–gold alloys. In the latter case the cast and recrystallized alloys have different lattice constants.—v. G.

On a Relation between the Mechanism of Precipitation in Single Crystals and Polycrystalline Aggregates. P. Wiest (*Metallwirtschaft*, 1933, 12, 47–48).—Before complete precipitation of the silver the Debye lines of copper saturated with silver and of copper from which all the silver has been precipitated, but of no intermediate stage, can be seen in juxtaposition in X-ray photographs of rotating wires of the quenched and tempered alloy of copper with 10% silver. In photographs of stationary wires, however, single points can be detected in the lines of both constituents which can be attributed only to a gradual transition between the phases. These facts are explained as follows: owing to the relatively rapid rate of transformation, in a definite time-interval during the precipitation many grains have not changed at all, and others have completely decomposed, whereas only a relatively small number of grains can be observed in the process of precipitation.—v. G.

Heat of Disintegration (Auflockerungswärme) of the Lead [Crystal] Lattice. G. v. Hevesy, W. Seith, and A. Keil (*Z. Physik*, 1932, **79**, 197–202).—The heat of disintegration of the crystal lattice of lead is derived from data relating to the temperature coeff. of the velocity of diffusion of a radioactive lead isotope in lead, and found to be 27,830 cal. per mol.—J. S. G. T.

Sodium–Lead Alloys. The Structure of the Compound Known as Na$_4$Pb. Charles W. Stillwell and Walter K. Robinson (*J. Amer. Chem. Soc.*, 1933, **55**, 127–129; and (abstract) *Met. Ind.* (*Lond.*), 1933, **42**, 257).—The type structure of a compound appears to depend on the ratio between the number of atoms and the number of valence electrons in the molecule rather than on the empirical formula. X-ray analysis of the phase known as Na$_4$Pb showed it to possess a face-centred cubic structure, with $a_0 = 13{\cdot}27 \pm 0{\cdot}035$ A., and to be apparently analogous to the γ-phase of copper, silver, and gold alloys. Its more exact formula is Na$_{31}$Pb$_8$.—R. G.

New Phenomena Relating to the Change of [Electrical] Resistance of Bismuth Single-Crystals in Magnetic Fields. I.—An Electrical Method of Analysis of Crystal Structure. O. Stierstadt (*Z. Physik*, 1933, **80**, 636–669).—A method for the determination of the change of electrical resistance of a bismuth crystal, oriented as desired, in a magnetic field, is described. The change of resistance perpendicular to the principal axis for different orientations of the crystal exhibits features characteristic of the crystal structure, and effects associated with planes not related in any direct simple manner to the primary crystal structure, and with the presence of impurities are observed. The phenomena are suggested as an auxiliary means of crystal structure analysis.—J. S. G. T.

Precision Determinations of Lattice Constants by the Powder Method. G. Menzer (*Fortschritte Min., Krist., u. Pet.*, 1932, **16**, (2), 162–207).—The principles of the method, the calculations and corrections necessary, and the various old and new precision methods are described at length and critically discussed. —J. W.

The Effect of Lattice Distortion and Fine Grain on the X-Ray Spectra of Metals. W. A. Wood (*Phil. Mag.*, 1933, [vii], **15**, 553–562).—The effects of fine grain and of lattice distortion on the X-ray spectrum of a metal are differentiated by reference to results obtained with electrodeposited and cold-rolled nickel, and a method is suggested for calculating the proportionate contribution of each factor to the broadening of the X-ray diffraction lines. —J. S. G. T.

On the Corrections for Debye–Scherrer X-Ray Photographs. Zenji Nishiyama (*Kinzoku no Kenkyu* (*Journal for the Study of Metals*), 1932, **9**, (11), 476–489).—[In Japanese.] See abstract from the English copy of this paper, *J.*, this volume, p. 17.—S. G.

The Tropism of Crystals. F. Bitter (*Phys. Rev.*, 1932, [ii], **42**, 731–732).—A theoretical note. The anisotropy of a crystal is not confined to that of the crystallographic planes, in which the atoms are regarded as points or spherically symmetrical centres of force. Directional effects may also be caused by electronic spins, atoms which are not spherically symmetrical, &c. The effect of spin coupling on ferromagnetism is discussed. If the spins are coupled so that the energy is least when neighbouring spins are parallel, the crystal will exhibit spontaneous magnetization, but if the coupling is such that the energy is least when the spins cancel each other in pairs, the orientation will be unaffected by a magnetic field, although the "spintropism" may show other effects, and B. suggests that peculiarities such as elastic hysteresis, unexplained critical temperatures, &c., may be due to a "tropism" of this kind.—W. H.-R.

Industrial Applications of X-Ray Crystallography. Robert Schmidt (*Technique moderne*, 1932, **24**, 710–713).—The construction and handling of the

"Metalix" apparatus are explained. Full details of simple examples of lattice measurement are given and profitable uses in industry, such as quantitative analysis, detection of lattice distortion, and grain-size estimation, are suggested.—H. W. G. H.

IV.—CORROSION

(Continued from pp. 131–133.)

On the Velocity of Dissolution of Aluminium in Aqueous Solutions of Ferric Salts. Witali Heller (*J. Chim. physique*, 1932, 29, 488–506).—The velocity of dissolution of aluminium in ferric salt solutions has been followed by (*a*) gravimetric determination of the dissolved metal; (*b*) volumetric analysis of the solution; and (*c*) measurement of the volume of hydrogen evolved. It is shown that about 90% of the total hydrogen liberated in the reaction goes to reduce the ferric salt, the remainder being evolved in the free state. The velocity coeff. in ferric chloride solution is independent of concentration between 0·15 and 0·43 grm.-mol. per litre, but falls when the concentration is less than 0·15 grm.-mol. per litre. The low temperature coeff. (1·27 for an increase of 10° C.) and the considerable influence of stirring indicate that the velocity is controlled by a diffusion process. The velocity of dissolution of aluminium in ferric nitrate is about 9 times less than in ferric chloride. Aluminium scarcely dissolves in ferric sulphate, but the addition of chloride ions accelerates the reaction considerably. The velocity of dissolution of magnesium in aqueous solutions of weak acids, or salts of weak bases and strong acids, is proportional to the H-ion concentration.—E. S. H.

Corrosion and Protection against Corrosion of Aluminium Rolling Alloys in the Construction of Airplanes. Paul Brenner (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1931, 505–520).—See *Z. Metallkunde*, 1930, 22, 348–356; cf. this *J.*, 1931, 47, 19; and *Z. Metallkunde*, 1930, 22, 420–422; cf. this *J.*, 1931, 47, 83.—B. Bl.

Influence of Common Salt Solutions of Varying Concentrations on the Course of the Corrosive Attack in Alternating Immersion Tests [Lautal]. Erich K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1931, 521–524).—See *Korrosion u. Metallschutz*, 1930, 6, 250–255; cf. this *J.*, 1931, 47, 341.—B. Bl.

On the Question of Corrosion. III.—Aluminium, Lead, Copper. L. W. Haase (*Gas- u. Wasserfach*, 1932, 75, 372–374).—The behaviour of aluminium, copper, and lead under corrosive conditions is discussed and the utility of these metals under various conditions described.—B. Bl.

Corrosion Phenomena in Gas-Heated Geysers: Causes and Prevention. Prof. Junkers Forschungsanstalt, Abteilung Wärmetechnik, Dessau (*Gas- u. Wasserfach*, 1932, 75, 753–758).—Two cases of corrosion of the copper covers of hot-water geysers are described; in one case the cause of the trouble was traced to the high carbon dioxide content of the water and to stray electric currents, and in the other case no explanation could be found.—B. Bl.

On the Use of Lead and Copper Tubes for Drinking-Water Pipes. G. Nachtigall (*Gas- u. Wasserfach*, 1932, 75, 941–949).—Systematic tests on the rate of dissolution of lead and copper from new pipes of these metals filled with water show that after 9 hrs.' standing the first half-litre of water taken from the lead pipe in the first month contained 2·1 mg., in the fifth month 0·5 mg., and in the seventh month 0·3 mg./litre of lead, whereas under the same conditions water taken from the copper pipe contained 3 mg./litre of copper in all cases. No effect on the health of users of the water was observed in either case.
—B. Bl.

Contribution to the Knowledge of the Destruction of Lead Cables. W. Zwieg (*Elektrotech. Z.*, 1933, 54, 154–155).—The cause of a failure of an underground lead cable was traced to the mechanical vibrations set up by street cars running near it. Chemical and electrochemical corrosion took place only after the formation of fatigue cracks. The cable sheath consisted of very pure lead; alloyed lead has a greater resistance to fatigue and corrosion, and should therefore be used for cable sheaths.—B. Bl.

[Corrosion of Buried Cables.] Anon. (*Telephone Eng.*, 1931, 35, (1), 42).—The existence of a.c. power distribution systems is not likely to cause corrosion of buried sheathed cable. Certain soils, and moisture in ducts may give rise to corrosion.—H. F. G.

Modern Theories of Corrosion of Metals and Methods for Testing their Resistance to Chemicals. N. A. Isgarichev (*Zvetnye Metally* (*The Non-Ferrous Metals*), 1930, 328–347; *C. Abs.*, 1933, 27, 485).—[In Russian.] See this *J.*, 1932, 50, 231.—S. G.

V.—PROTECTION

(Other than Electrodeposition.)

(Continued from pp. 131–136.)

Researches on the Anodic Film of Aluminium. I.—Effect of the Concentration of the Electrolyte on the Formation of Anodic Film. Shoji Setoh and Akira Miyata (*Sci. Papers Inst. Phys. Chem. Res. Tokyo*, No. 396, 1932, 189–236).—[In English.] The effect of the concentration of the electrolyte on the formation of an anodic film on commercially pure aluminium in aqueous solutions of oxalic acid has been investigated. D.c., a.c., and a.c. superposed on d.c. were used, and the temperature, current density, and terminal voltage were varied. The resistance of the films to corrosion was studied by immersing the specimens in 1*N*-hydrochloric acid, and measuring the volume of gas evolved in a given time. The deterioration of the electrolyte during electrolysis was also examined. The most suitable concentration of the electrolyte is from 2 to 6% oxalic acid (weighed as $(COOH)_2 2H_2O$). The essential chemical change occurring is the oxidation of aluminium to Al_2O_3, but roughly one-quarter of the film dissolves in the electrolyte. This solution produces a skeleton sponge-like structure, so that whilst the film has a density only $\frac{3}{4}$ that of pure Al_2O_3, the film thickness is almost that expected from an ideal case where the whole of the electrical energy produces Al_2O_3 and no secondary reactions occur. In a.c. electrolysis the energy efficiency of film formation is less, and the solution of film, and secondary decomposition of oxalic acid are greater than in d.c. electrolysis. Generally speaking, corrosion-resisting films are produced by electrolysis (*a*) in concentrated or in hot solutions; (*b*) at low current densities; or (*c*) by superposing a.c. on d.c. or by a.c. alone.—W. H.-R.

Researches on the Anodic Film of Aluminium. II.—Anodic Behaviour of Aluminium in Aqueous Solutions of Oxalic Acid. Shoji Setoh and Akira Miyata (*Sci. Papers Inst. Phys. Chem. Res. Tokyo*, No. 397, 1932, 237–291).—[In English.] Cf. preceding abstract. The anodic film on aluminium consists of two layers, the comparatively thick visible film of porous structure, below which is a much thinner "active layer," which is also more or less porous. Using oxalic acid solutions studies have been made of the current-time and voltage-time variations in constant-current and constant-voltage electrolysis, respectively, and from these the state of the active layer has been estimated. A rotating switch enabled observations to be made down to $2·5 \times 10^{-4}$ seconds after switching off the current. The speed and mechanism of formation of the active layer, its dielectric capacity and thickness, and the counter electromotive force were measured. S. and M. conclude that the older theories that the active layer is produced by the precipitation of colloidal aluminium hydroxide, and its subsequent hardening or burning by electric sparks must be rejected. The active layer is probably formed by direct attack of the metal by oxygen, which penetrates the pores of the existing film. In this way the visible film is continually formed from the active layer from which it derives its porous structure, whilst the active layer is re-created. The presence of oxygen in the pores gives characteristic phenomena when the voltage is suddenly changed and is an important factor in the anodic behaviour.—W. H.-R.

The Eloxal Process. Hans Schmitt (*Metallwirtschaft*, 1932, **11**, 689–690).—The production and sphere of utility of protective oxide coatings on aluminium, Silumin, and Lautal are discussed.—v. G.

Practising Economy in Carrier Operation. [Corrosion and Protection of Lead Cable Sheath.] F. J. Dommerque (*Telephone Eng.*, 1931, **35**, (2), 33–35).—Ten years after laying, the lead sheath of the Berlin–Cologne underground toll cable had deteriorated in many places, principally where the soil or ground-water contained lime; in other cases electrolytic corrosion had arisen from contact of the lead with the iron casings of the loading coils, and total destruction of the cable was prevented only by attaching large zinc plates to the sheath. Fibre conduit is used with satisfactory results in the U.S.A.—H. F. G.

Corrosion of Magnesium Alloys. I.—Protection of Magnesium Alloys by Oxide Films. W. O. Kroenig and G. A. Kostylev (*Transactions of the Central Aero-Hydrodynamical Institute* (*U.S.S.R.*), No. **128**, 1932, 1–40).—[In Russian, with English summary.] Owing to the growing importance of Elektron in aircraft engineering, the problem of increasing its resistance to corrosion, especially in sea-water, requires immediate solution. This is the first of a series of three papers describing the results of an investigation on the mechanism of corrosion of magnesium, and methods for its protection. The other parts of the work will deal with the corrosion of (*a*) cast and (*b*) rolled alloys. Parallel to the research on oxide films, work is being carried out on the preparation of suitable protective lacquers. The production of corrosion-resisting films on various Elektron alloys has been investigated in solutions of the following reagents: (1) potassium dichromate and nitric acid in concentrated solutions; (2) the same in dilute solutions; (3) phosphoric acid and potassium permanganate; (4) boric acid and potassium permanganate; (5) 10% sodium fluoride; (6) potassium permanganate (saturated); (7) the same with a few drops of nitric acid; (8) sodium fluoride and potassium permanganate; (9) boric acid (saturated); (10) phosphoric acid and potassium dichromate. The specimens were immersed at various temperatures for from 45 sec. to 4 minutes, washed, dried, the corrosion rate determined in sea-water, tap-water, and a moist atmosphere and compared with those of a similar untreated alloy as standard. The most suitable solutions for cast Elektron (aluminium 6·22, manganese 0·20, silicon 0·03, iron 0·10, and copper 0·23%) were No. 2 for 45–60 sec. at 80° C.; No. 2 with a little chromium nitrate (for 1–1½ minutes at 80° C.), and No. 2 with aluminium nitrate (8–10 minutes at 15°–20° C.). For rolled Elektron (aluminium 6·34, manganese 0·25, zinc 0·43, and iron 0·10%), the best solution was No. 2 (very dilute) for 45 sec. at 80° C. The passive films thus obtained increase the stability of Elektron towards sea-water 100–250 times, but still do not give complete protection. With tap-water, no protection whatsoever is obtained, so that if Elektron is to be used in a water-cooled system, it must be protected by some form of lacquer or its composition must be changed. The protection against a moist atmosphere is satisfactory, although not so good as against sea-water. For storing Elektron, therefore, the films may be suitable, although if conditions are adverse the use of a lacquer such as "Dural" is recommended (cf. *Korrosion u. Metallschutz*, 1932, **8**, 147–151; this *J.*, 1932, **50**, 742).—M. Z.

Nickel-Clad Steel. Anon. (*Mech. World*, 1932, **92**, 560–562).—Cf. this *J.*, 1932, **50**, 85, 551. The composite product consisting of nickel rolled on steel is described and vessels made therefrom are illustrated and described. The bond between the two metals, of which a photomicrograph is given, is made at a temperature lower than the melting points of the metals concerned and is effected by diffusion. A commonly-used example is ¼-in. thick plate with 10% of the total thickness as nickel covering.—F. J.

The Biological Factor in the Protection of Metals in Sea-Water. Anon. (*Peintures, Pigments, Vernis*, 1932, 9, 180–187; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (30), 343).—Mainly a review of American, British, and German investigations up to the year 1930, full reference being made in the appropriate places to the original literature from which the information is derived.—S. G.

Spraying Molten Metal to Combat Corrosion. Anon. (*Petrol. Eng.*, 1932, 3, (12), 38; *J. Inst. Petrol. Tech.*, 1932, 18, 392A).—Corrosion of oil equipment is being checked by the use of the metal spraying process, which is described. In spraying metals to combat corrosion, care must be taken that the coating is not porous, particularly when applying metals that are electro-positive to iron. An under-coating of zinc is useful where it is not economical to apply several coatings of the protective metal. Agitators and condenser boxes can be successfully sprayed with lead. A gas-transmission company is applying a 0·006 in. thick coating of aluminium on exhaust ells of gas-driven compressors. These reach temperatures of 1105° F. (596° C.), and have been in service for 10 weeks without any effect on the adhesion of the aluminium coating. The cost of spraying is stated to be 3·5–6 cents per ft.² per coat for softer metals (excluding the cost of sand-blasting). Hard metals cost more because of their slower speed of application. Details are given of the operation of the spray pistol, the method of preparation of the surface, and the conditions of application of the coating.—S. G.

The Battle to Preserve Material. Julius Klein (*Telephone Eng.*, 1930, 34, (5), 25, 46–47).—The use of electroplating, galvanizing, and of "stainless" alloys to prevent wastage of material by corrosion, is noted.—H. F. G.

Metal Protecting Medium "Panzarol." Walther Roeshig (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 380).—The material is a colourless lacquer suitable for protecting the surface of highly-polished metal articles from atmospheric influences; the film is said to remain elastic up to 100° C. and can be washed with warm water without damage.—A. R. P.

Painting Sheet Copper—Copper and Other Metallic Powders in Paints—Copper Stains on White Paint. H. A. Gardner and L. P. Hart (*Amer. Paint Varnish Manuf. Circ.* No. 416, 251–262; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (30), 347).—It has been found that ordinary oil and varnish paints may be used satisfactorily on copper surfaces provided that care is taken to clean grease from the surface before the application of paint. Stains on painted surfaces due to oxidation of adjacent materials may often be removed by a 10% solution of oxalic acid in water, whilst dilute hydrochloric acid appears to be suitable for cleaning copper stains.—S. G.

Some Recent Advances in Protective Coatings on Metals. H. Sutton (*J. Electrodepositors' Tech. Soc.*, 1931–32, 7, 91–102; discussion, 177–182; and (summary) *Met. Ind.* (*Lond.*), 1932, 40, 227–230; discussion, 335–337, 451–452).—A general review. Special reference is made to the relative protection from corrosion afforded to steel by electrodeposited zinc and cadmium coatings, the protection from atmospheric corrosion of light metals and alloys by electrodeposition of zinc, cadmium, or nickel or by anodic oxidation, and of Duralumin by a rolled-on coating of pure aluminium. Recent work on the formation of protective deposits by chemical treatment without current on steel and on aluminium and its alloys; and the protection of iron and steel from oxidation at high temperatures by thick nickel plating, calorizing, aluminium spraying, or dipping is also described.—S. W.

The Testing of Metallic Coatings. C. W. Bergman (*Electrodepositors' Tech. Soc. Advance copy*, 1932; and *Met. Ind.* (*Lond.*), 1933, 42, 107–109).—Workshop inspection tests of metallic coatings should be simple, non-destructive, and positive. Development research tests should be designed to test specific properties such as thickness, distribution, porosity, hardness, stress, and adherence. Broad outlines of suitable tests are given. The mutual effect of the coating and the basis metal under corrosive conditions or by alloying or diffusion must be taken into account.—S. W.

VI.—ELECTRODEPOSITION

(See also "Protection," p. 194.)

(Continued from pp. 136–137.)

Cadmium and Its Application in Electroplating Practice. Paul Gerhardt (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 377–378, 396–397, 417–418, 459–461, 478–481, 498–499, 516–517).—A review of the metallurgy of cadmium and of the development and uses of cadmium plating.—A. R. P.

Untarnishable Cadmium Plating Process. Anon. (*Mech. World*, 1932, **92**, 540).—Notice of a modification of electro-cadmium plating known as "Epalex" whereby the coating is rendered bright and "commercially stainless."—F. J.

The Structure of the Chromic Acid Plating Bath; the Theory of Chromium Deposition. Charles Kasper (*U.S. Bur. Stand. J. Research*, 1932, **9**, 353–375; and *U.S. Bur. Stand. Research Paper* No. **476**; also (short note) *Met. Ind.* (*Lond.*), 1933, **42**, 262).—The structure of solutions that are of importance to the theory of chromium deposition from the chromic acid bath was investigated by cryoscopic and conductivity measurements, and absorption spectra. It was shown that the first step in the reduction of chromic acid is the formation of chromium dichromate, $Cr_2(Cr_2O_7)_3$, a strong electrolyte which forms negative molecular ions. This compound is found not to exist in the "green" form. The next product of reduction is the basic chromium chromate, $Cr(OH)_3 \cdot Cr(OH)CrO_4$. This compound is a colloid, which may exist in relatively acid solutions. If sulphate is present, it forms chromic sulphate, only the green form of which exists in chromic acid solutions. If the basic colloid does not have its electrophoretic velocity reduced, it coats the cathode and prevents further reduction of chromic acid. The beneficial action of the sulphate is due to the fact that it lowers that velocity by adsorption. The sulphate reaches the cathode film by being transported as a non-reactive positive molecular ion, $[Cr_4O(SO_4)_4H_2On]^{++}$. The above theory was confirmed by employing it to correlate facts and principles of chromium plating. A bibliography of 34 references is appended.—S. G.

The Adhesion of Electrodeposited Nickel to Brass. A. W. Hothersall (*J. Electrodepositors' Tech. Soc.*, 1931–32, 7, 115–141; discussion, 188–191; and (summary) *Met. Ind.* (*Lond.*), 1932, **41**, 13–15, 111–113; discussion, 159–160).—Methods of examining the adhesion of electrodeposits of nickel to brass are reviewed and satisfactory qualitative and quantitative tests described. Electrodeposits of nickel applied to a chemically clean but unetched brass surface, which has been prepared by filing or machining, are strongly adherent. Where the brass has been emeried or polished, the adhesion is poor owing to the embrittlement of the inherently weak surface layer by hydrogen, co-deposited with the nickel. The hydrogen embrittlement is removed and the adhesion somewhat improved by heat-treatment, *e.g.*, at 250° C. for 2 hrs. To obtain good adhesion of nickel deposits on such surfaces it is necessary to remove the weak surface layer by etching. Chemical etching with nitric acid mixtures, whilst giving satisfactory adhesion, destroys the polish. A method of controlled etching by electrolytic action, *e.g.*, at 10 amp./ft.^{2} for 30 seconds in either 5% potassium cyanide or 50 grm./litre citric acid neutralized with ammonia plus a further 20 grm./litre citric acid, has been developed which permits strongly adherent deposits to be obtained without appreciable effect on the polished surface. The citric acid solution is preferred.—S. W.

Stopping-Off Materials for Articles to be Nickel-Plated. Anon. (*Oberflächentechnik*, 1932, **9**, 229–230).—The value of various waxes, lacquers, and plastics containing tarry matter or rubber is discussed.—A. R. P.

Problems of Modern Nickel Plating. Anon. (*Oberflächentechnik*, 1932, **9**, 255–257).—Practical hints for obtaining good nickel plating.—A. R. P.

The Electrodeposition of Tin from Alkaline Solutions. L. Wright and F. Taylor (*J. Electrodepositors' Tech. Soc.*, 1931–32, **7**, 103–114, discussion, 183–187; and (summary) *Met. Ind.* (*Lond.*), 1932, **40**, 449–451, discussion, 544–547, **41**, 64–65; also (abstract) *Brass World*, 1932, **28**, 199–201).—Solutions recommended for the electrodeposition of tin coatings are reviewed. A method of analysis is given. A solution of stannous chloride 68, potassium chloride 101, peptone 0·7 grm./litre operated at 60°–70° C. and 4–6 amp./ft.^{2} is found satisfactory for the electrodeposition of thin deposits of tin, although the cathode efficiency is low. Equivalent amounts of sodium hydroxide and glucose may be substituted for potassium hydroxide and peptone without detriment. The stannite is rapidly converted to stannate on electrolysis. A low free alkali content, a high temperature, a large anode–cathode area ratio, and pure tin anodes are advised to assist anode corrosion; frequent replenishment with stannous chloride is also necessary. In the discussion it is stated that smooth tin deposits of any thickness may be prepared from solutions from which stannite ions are rigorously excluded. The accuracy of the analytical methods given is also questioned.—S. W.

The Surface Improvement of Aluminium. Oskar Krämer (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 435–436).—Plating with nickel or with nickel and chromium does not afford prolonged protection of aluminium, as it is impossible to avoid imperfections in the plate, and these set up local corrosion which the plating metals accelerate. It is claimed that it is possible to deposit chromium directly on aluminium as a completely protective coating using a special electrolyte of which no details are given.—A. R. P.

The Galvanic Treatment of Aluminium. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 438–439).—A review of recent journal and patent literature on the plating of aluminium.—A. R. P.

Surface Improvement of Aluminium. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 457).—By a recently developed method, of which no details are given, it is claimed to be possible to deposit firmly adherent electrolytic coatings of nickel on aluminium, such that the metal may be bent and hammered without the coating flaking. New methods of anodic oxidation are also briefly described.—A. R. P.

Practical Experiences on the Importance of Hydrogen Adsorption in the Surface Improvement of Metals [by Electroplating]. Richard Justh (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 335–339; and *Oberflächentechnik*, 1932, **9**, 161–164).—A review of recent work on the effect of hydrogen adsorption on the nature and hardness of various electroplates and on the behaviour of metals after pickling in acid liquors.—A. R. P.

Some Aspects of Throwing Power. Its Quantitative Expression. Samuel Field (*J. Electrodepositors' Tech. Soc.*, 1931–32, **7**, 83–90; discussion, 175–176; and *Met. Ind.* (*Lond.*), 1932, **40**, 403–406; discussion, 501, 549).—The present method for the quantitative expression of throwing power is unsatisfactory because (1) the accepted primary current distribution ratio of 5 : 1 is inconsistent with plating practice, and (2) the numerical expression for ideal throwing power is dependant on the primary current distribution ratio. Throwing efficiency, the ratio of measured throwing power to ideal throwing power is not constant in the same solution operated under different conditions. A new method, more directly applicable to commercial practice, of measuring and numerically expressing throwing power is therefore proposed. The primary current distribution ratio is maintained at 2 : 1 and the throwing power is defined as the percentage deviation of the metal ratio from this. A variation is necessary for negative values. A simple method of measuring throwing power using ammeter readings only, is also described.—S. W.

Notes on the Control of Plating Solutions. H. Riley (*J. Electrodepositors' Tech. Soc.*, 1931–32, **7**, 166–169).—Workshop methods for the preparation and efficient control of cadmium, tin, copper, silver, gold, nickel, chromium, and brass electroplating baths are given.—S. W.

Electrolytic Deposition of Metals on Cathodes Covered by Insulating Films. Ch. Marie and N. Thon (*J. Chim. phys.*, 1932, **29**, 569–576).—Experiments are described on obtaining electrodeposits of copper on a cathode coated with a thin film of insulating organic material. The mechanism of deposition is related to the phenomenon of electrostenolysis. The degree of adherence of the deposit is low.—E. S. H.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-Refining.)

(Continued from pp. 137–138.)

The Metallurgy of Magnesium. Rudolf Hoffmann (*Metallbörse*, 1932, **22**, 1421–1422, 1453–1454, 1485–1486, 1517–1518, 1551, 1615).—A review of modern practice with especial reference to recent developments in the electrolytic baths. More than 100 references are appended.—A. R. P.

Electrolysis of Rare Metals. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 168).—A description is given of a new continuous method of electrolysis for the production of uranium, thallium, tantalum, and other rare metals. For the production of thorium, a cathode is inserted in a bath of sodium and potassium chlorides containing some potassium thorium fluoride, and replaced by a new one when powdered thorium about 1 in. thick has been deposited.—J. H. W.

The Stick Antimony Electrode for the Measurement of Hydrogen-Ion Concentration. Taku Uemura and Hideo Sueda (*Bull. Chem. Soc. Japan*, 1933, **8**, 1–10).—[In English.] The antimony electrode in an unstirred solution in contact with air at equilibrium gives trustworthy data when the p_H lies between 1 and 9. The polished surface becomes covered with a film, apparently of oxide, the colour of which depends on the H-ion concentration; it is black when the p_H is between 1 and 8, but in alkaline solutions it is whitish. The time required for equilibrium to be attained also depends on H-ion concentration, being longer as the solution is more acidic. The influence of stirring is to increase the e.m.f. obtained.—E. S. H.

VIII.—REFINING

(Including Electro-Refining.)

(Continued from p. 139.)

Discussion of C. W. Clark and A. A. Heimrod's Paper on "Recovery of Precious Metals from Electrolytic Copper Refining at the Canadian Copper Refiners Plant, Montreal East, Quebec." F. F. Colcord. T. D. Jones (*Trans. Electrochem. Soc.*, 1932, **61**, 90).—Cf. this *J.*, 1932, **50**, 372, 684. F. F. C. suggests that concentrations greater than 30 grm. per litre of silver and 20 grm. per litre of copper give the most satisfactory conductivity. T. D. J. confirms this and adds that with 38–40 grm. of copper per litre the silver produced is 999·85 fine.—W. A. C. N.

IX.—ANALYSIS

(Continued from pp. 140–141.)

Rapid Industrial Methods for Metallurgical Analysis. R. Arzens (*Bull. Assoc. Tech. Fonderie,* 1931, 5, 33–38).—A discussion of laboratory routine from the points of view of efficiency, economy of time and materials, and an accuracy sufficient for industrial purposes. It includes sections on standard alloys for comparative purposes, the use of analoids or tabloid reagents, the choice of the magnitude in the initial weighings and improvements in technique. Examples are taken from the analysis of steels.—W. A. C. N.

New British Chemical Standard [Copper–Nickel]. Anon. (*Met. Ind.* (*Lond.*), 1932, 41, 473).—It is announced from the headquarters of British Chemical Standards that a new non-ferrous standard of Cu–Ni to serve as a standard for the analysis of Cu–Ni sheet and strip referred to in British Standard Specification No. 374, 1930, has been prepared. Its analysis is as follows: Cu, 68·85, Ni 30·1, Si 0·12, Mn 0·89, Fe 0·05, Mg 0·027, C 0·02, S 0·01, Pb and Co each not more than 0·01%.—J. H. W.

Quantitative Optical Spectral Analysis of Lead Alloys. A. Guenther (*Z. anorg. Chem.*, 1931, 200, 409–418; *Brit. Chem. Abs.*, 1931, [A], 1385).—The systems examined were Li, Cu, Zn, Au, Tl, and Bi in Pb, and Ag in Sn. Tables are giving showing pairs of lines in the emission spectra of the alloys suitable for the characterization of alloys containing up to 10% of the other metal. —S. G.

Some Analytical Applications of Sodium Hydrosulphite. II.—Separation of Tin from Copper, Zinc, Lead, &c., and from Oxalic Acid Solutions. Determination of Tin in Steel. B. S. Evans (*Analyst,* 1932, 57, 362–368).—The solution containing Sn, Cu, Zn, and Pb is treated with 10 c.c. of citric acid (100 grm./200 c.c.), NH_4OH until slightly alkaline, 10 c.c. of saturated KCN solution, 25 c.c. of saturated NH_4Cl solution, 10 c.c. of $(NH_4)_2S$, and 7 grm. of $Na_2S_2O_4$, boiled for 1 minute, cooled slightly, treated with a further 2 grm. of $Na_2S_2O_4$, and again boiled. The SnS precipitate is filtered hot and washed with a solution containing small amounts of all the reagents added above; it contains, in addition to Sn, all the Pb, Bi, and most of the Sb present. It is dissolved in NaOH and H_2O_2, the solution acidified with HCl, and the analysis finished as previously described (this *J.*, 1931, 47, 440). In the analysis of bronze, sufficient KCN must be added to discharge the blue Cu colour and dissolve any ZnS; in the analysis of brass, at least 20 grm. of NH_4Cl must be added. In the absence of NH_4Cl, Pb may be precipitated free from Sn, using NaOH instead of NH_4OH to neutralize the solution; the filtrate from the PbS precipitate is then boiled with a large excess of NH_4Cl and the Sn precipitated as described above. When $H_2C_2O_4$ is used to separate Sb from Sn, precipitation of the latter from the oxalate solution by $Na_2S_2O_4$ is not quite complete. —A. R. P.

On the Method for the Determination of Aluminium in the Presence of Iron. Saburo Ishimaru (*Kinzoku no Kenkyu* (*Journal for the Study of Metals*), 1932, 9, (12), 527–529).—[In Japanese.] The present methods for the separation and determination of Al in the presence of various amounts of Fe leave much to be desired from the points of view of accuracy, ease of manipulation, and speed. The four known methods are reviewed and discussed. I. proposes the following procedure: treat the slightly acidic solution first with $Na_2S_2O_3$ (Chancel's method), cool quickly to room temperature, add alcoholic solution of $C_6H_5\cdot NH\cdot NH_2$ (1 : 1) (Hess and Campbell's method), filter, wash with boiling water, and ignite (above 950° C.) to Al_2O_3. The results (only a single separation) indicate that this procedure is an excellent one.—S. G.

The Determination of Indium and Gallium with 8-Hydroxyquinoline. W. Geilmann and Fr. W. Wrigge (*Z. anorg. Chem.*, 1932, **209**, 129–138).—In is precipitated quantitatively by 8-hydroxyquinoline from a solution containing 1% $CH_3·COONa$ and 1% $CH_3·COOH$ at 70°–80° C.; after keeping for 2–3 hrs. in a cool place the $In(C_9H_6NO)_3$ is collected in a filter crucible, washed with warm water, dried at 120° C., and weighed; it contains 20·99% In. The compound is volatile above 150° C., so the In must be recovered by destruction of the organic matter with H_2SO_4 and HNO_3, followed by treatment of the solution with NH_4OH. Ga may be determined in a similar way in exactly neutral or feebly ammoniacal solutions even in the presence of tartrate. $Ga(C_9H_6NO)_3$ contains 13·89% Ga. The sensitivity of the method in both cases far exceeds that of the hydroxide precipitation.—M. H.

The Use of α-Benzoinoxime in the Determination of Molybdenum. H. B. Knowles (*U.S. Bur. Stand. J. Research*, 1932, **9**, 1–7; and *U.S. Bur. Stand. Research Paper* No. **453**).—Present methods for the determination of Mo in any considerable amount require a number of tedious and time-consuming operations prior to the actual determination of that element. α-Benzoinoxime, advocated as being specific for Cu, has been found to precipitate Mo quantitatively and to isolate it from most of the more commonly encountered elements. As a result of the present study, a procedure has been developed by which Mo can be determined in ores, steels and other products in much less time than by present methods and with all the accuracy of the best methods now in use. —S. G.

The Use of Potentiometric Analysis in Steelworks Laboratories.—V. P. Dickens and R. Brennecke (*Mitt. K.-W.-Inst. Eisenforschung*, 1932, **14**, 249–259).—Mo may be determined potentiometrically in pure solutions of alkali molybdates by precipitation with $HgClO_4$ or $Pb(ClO_3)_2$ using a Mo sheet as indicator electrode. The use of these methods and reduction potentiometric methods in steel analyses is described.—J. W.

Determination of Nickel and Chromium in Alloys and in Cast-Iron. V. Pestelli (*Usine*, 1931, **40**, (43), 29).—Abstract of paper presented to the 6e. Congrès International de Fonderie. See this *J.*, 1932, **50**, 554.—H. W. G. H.

Quantitative Determination of Nickel in Nickel Steels by an Electrographic Method. A. Glazunov and J. Křivohlavy (*Z. physikal. Chem.*, 1932, [A], **161**, 373–388).—The alloy to be tested is separated from a plate of indifferent metal by a filter-paper soaked in dimethylglyoxime solution, and a current is passed from the alloy (anode) to the plate (cathode). The red colour produced on the paper by the formation of Ni dimethylglyoxime is compared with that produced under similar conditions by similar alloys of known Ni content. By this method all types of alloys can be analyzed in a few minutes without destroying the alloy or even making a polished section.—B. Bl.

Molecular Spectra and Spectrographic Analysis. IV.—Determination of Scandium. G. Piccardi (*Atti R. Accad. Nazion. Lincei. Rendiconti Classe Scienze Fisiche*, 1932, **15**, 577–579).—The method is based on the persistence of molecular spectra; it gives good quantitative results.—G. G.

Determination of Sodium in Aluminium. K. Steinhäuser and J. Stadler (*Z. anal. Chem.*, 1932, **89**, 268–270).—The metal (100 grm.) is dissolved in HCl and the Al removed as $AlCl_3,6H_2O$ by saturating the solution with HCl. The filtrate is evaporated and again saturated with HCl, this process being repeated continually until no more Al is present. The final filtrate is evaporated with H_2SO_4, the SiO_2 removed, the heavy metals precipitated with H_2S and Mn and the Fe group with Br and NH_4OH, and the filtrate then evaporated to dryness. The residue is heated to expel NH_4 salts and treated in the usual way to remove Ca. The residual Na_2SO_4 is weighed, any Mg and Zn removed as phosphates, and the corresponding correction made.—A. R. P.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

(See also "Testing" and "Pyrometry.")

(Continued from pp. 142–143.)

The New Universal Vertical Illuminator of the Emil Busch A.-G. H. Pfeiffer (*Z. wiss. Mikroskopie*, 1932, 49, 103–107).—The vertical illuminator serves for light- and dark-field illumination of the object.—B. Bl.

The Ultropak. H. Heine (*Z. wiss. Mikroskopie*, 1931, 48, 450–465).—In contradistinction to the vertical illuminator in which the light passes through the objective in both directions and produces a light field image in the eyepiece, in the Leitz Ultropak the light is reflected on to the object from all sides by a lens system surrounding the objective, so that a dark field image is produced when the reflecting surface is a plane polished surface, and a light-dark field image when the surface is uneven and reflects diffusely.—B. Bl.

Apparatus for Introducing and Removing Photographic Plates, into and out of, a High Vacuum. E. G. Andresen (*Physikal. Z.*, 1932, 33, 771–772).—A simple form of apparatus for moving a photographic plate, into and out of, an evacuated vessel is described.—J. S. G. T.

The Measurement of Elongation on Bending Tests. C. v. Roessler (*Schmelzschweissung*, 1932, 11, 242).—An apparatus for measuring the radius of curvature of bent sheet metal is described.—B. Bl.

On the Viscosity of Molten Metals and Alloys.—V. Outflow Viscometer with a Constant Pressure Height for Substances with High Surface Tension. F. Sauerwald (*Z. anorg. Chem.*, 1932, 209, 277–280).—M. H.

Two Types of Laboratory Pumps for Pumping Mercury. P. B. Zhivotinsky (*Ukrainskii Khemichnii Zhurnal* (*J. Chim. Ukraine*), 1931, 6, (5/6), 241–244).—[In Ukrainian, with Russian summary.] Two simple pumps, constructed of glass and rubber tubing, for pumping mercury are described and illustrated. The throughput is about 100 c.c./minute and the height raised is 35 cm.—M. Z.

XI.—PHYSICAL AND MECHANICAL TESTING AND RADIOLOGY

(Continued from pp. 143–145.)

The First Congress of the New International Association for Testing Metals. Anon. (*Technique moderne*, 1932, 24, 316–318).—A brief review of the discussions at Zürich.—H. W. G. H.

Contribution to the Study of Methods for Controlling Foundry Products. P. Nicolau (*Bull. Assoc. Tech. Fonderie*, 1931, 5, 233–250).—Cf. this *J.*, 1932, 50, 750. A discussion of general methods of foundry control including: (1) old systems; (2) tensile, compressive, and bending tests; (3) tests as to homogeneity; (4) newer methods, such as microscopic analysis, torsion tests, static and dynamic hardness. A useful bibliography is appended.—W. A. C. N.

Inspection of Surfaces for Minute Defects. F. A. Firestone and H. B. Vincent (*Mech. Eng.*, 1932, 54, 647; also *Automotive Ind.*, 1932, 67, 556; and *Mech. World*, 1932, 92, 431).—Illustrates and describes an apparatus for the surface inspection of any kind of metal for defects which change the light reflectivity or transmissivity. Light reflected from the surface under inspection controls the current passing through a photo-electric cell. The current is transmitted to a hot-cathode ionization tube which provides sufficient current to actuate a rejection device if the surface is not up to the standard for which the device is set.—F. J.

The Dependence of Material Damping on the Magnitude and Rate of Deformation. Ernst Bankwitz (*Metallwirtschaft*, 1933, 12, 33–35).—The dependence of the resonance vibration frequency on the magnitude of the torsion angle has been measured in a torsion vibration machine; the frequency is constant for small twists, but decreases linearly above a definite limiting value which must be considered as the beginning of the damping action, and is about half as great as the twist value at which heating of the material becomes measurable. This procedure therefore provides a sensitive method for determining the beginning of damping. The behaviour is the same for vibration frequencies between 200 and 2500 (varied by altering the oscillating mass), and is thus independent of the rate of deformation. The static yield-point rises appreciably after some millions of alternations under torsion vibration loading; this effect is particularly marked with aluminium and an aluminium alloy (Cu 4, Si 1, Mn 0·5%), the rise being 40–50% compared with 15–30% for other metals.—v. G.

Repeated Impact Tests: Dependence of the Impact Number on the Falling Weight and Height. Martin Beilhack (*Forschungheft*, **354**, 1932, 1–22). —The apparatus and procedure for repeated impact tests are described. These tests have a somewhat more limited application than other mechanical tests. The impact number depends largely on the weight of the striker and the distance through which it falls. With decreasing weight and increasing height of fall so that the momentum is constant, the impact number (the number of blows to fracture) increases, and may reach infinity in the case of very small weights at high speed. Calculations show that with a 4-kg. weight dropping through 10 mm., 48% of the energy is lost, which is explained by the deformation-effect being produced not by a single blow, but by the series of continued impulses. This hypothesis was confirmed by measuring the incidence and period of the blow and the deflection of the test-piece by means of an oscillograph. Equations are derived for perfectly elastic material and for partly elastic material for which the energy loss can be approximately calculated. In these tests, not only must the kinetic energy of the falling weight and the impact number be given, but also the size of the falling weight and the height through which it falls, and the deflection of the test-piece to enable the mechanical strength of the material to be approximately calculated. —J. H. W.

The Interference Method of Measuring Thermal Expansion. George E. Merritt (*U.S. Bur. Stand. J. Research*, 1933, **10**, 59–76; and *U.S. Bur. Stand. Research Paper* No. **515**).—This paper is published in response to numerous enquiries for details of the method developed at the (U.S.) Bureau of Standards and described in *U.S. Bur. Stand. Sci. Papers* Nos. **393** and **485**, and several articles in other publications. It is intended as a manual for the use of those who wish to measure thermal expansions by the interferometric method. As such, a more complete description of the apparatus and methods developed can be included than would be in order in a paper dealing primarily with the results of a particular set of measurements. The apparatus, method of making the specimens, forms for taking data, and computation of data are each the subject of a careful exposition. Tables and special calculations are included in an appendix.—S. G.

Notched Bar Impact Testing. P. Field Foster (*Machinery* (*Lond.*), 1932, **40**, 105–107).—An account is given of the method of carrying out notched bar tests; the Izod, Charpy, Mesnager, and Frémont test-specimens are compared, and the Amsler impact testing machine is described and illustrated. —J. C. C.

Adapting Light Rays in Hardness Testing. J. R. C. (*Machinery* (*Lond.*), 1932, **40**, 761).—A simple device for routine hardness testing is described. A mirror system is employed to indicate the depth of penetration of a 1-mm. ball under a load of 500 lb.—J. C. C.

XII.—PYROMETRY

(Continued from pp. 145–146.)

On Micropyrometry. G. Lewin (*Z. tech. Physik,* 1932, **13**, 497–499).—The principles of construction of micropyrometers (see *J.*, this volume, p. 145), the degree of magnification possible and the possibility of increasing the magnification at very high temperatures are discussed.—J. W.

New Thermocouples of Noble Metals for Very High Temperatures. Otto Feussner (*Elektrotech. Z.*, 1933, **54**, 155–156).—Iridium/60 : 40 rhodium–iridium alloy thermocouples can be used up to 2000° C. The brittleness of the pure iridium wire can be appreciably reduced by suitable treatment, and the constituents are relatively only slightly volatile at high temperatures, so that frequent standardization of the couples is unnecessary. The e.m.f. is 1·1 mv. at 200° C., 5·5 mv. at 1000° C., and 10·85 mv. at 2000° C.—B. Bl.

Reference Tables for Platinum to Platinum–Rhodium Thermocouples. Wm. F. Roeser and H. T. Wensel (*U.S. Bur. Stand. J. Research,* 1933, **10**, 275–287; and *U.S. Bur. Stand. Research Paper* No. **350**).—Reference tables for use with platinum/platinum–10% rhodium and platinum/platinum–13% rhodium thermocouples have been prepared. When these tables are used, the deviation curves obtained for individual couples have no points of inflection and are, with few exceptions, linear. These tables are based on the International Temperature Scale, so that the indications of a thermocouple whose calibration is obtained by extrapolation of a deviation curve above the gold point will agree in this region with those of an optical pyrometer.—S. G.

An Optical Method for Measuring Temperature Distribution and Convective Heat Transfer. R. B. Kennard (*U.S. Bur. Stand. J. Research,* 1932, **8**, 787–805; and *U.S. Bur. Stand. Research Paper* No. **452**).—In order to avoid the errors inherent in material thermometers, a method has been devised whereby the temperatures in the region of heated air near a hot surface may be determined from the displacement of the fringes in an interferometer. Photographs were taken of the interference fringes near a hot vertical plate and near horizontal heated cylinders. The temperature distribution and the convective heat transfer were determined from measurements made on enlargements of these photographs. It is shown that the temperature distribution does not correspond with that called for by the film theory.—S. G.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 146–153.)

Metallography and the Foundry. Introduction to the Scientific Study of Casting. Albert Portevin (*Bull. Assoc. Tech. Fonderie,* 1932, **6**, 19–25; and (abstract) *Usine,* 1931, **40**, (51), 31).—A very interesting study of foundry problems from new angles, in which the necessity of metallographic investigations is emphasized. Physico-chemical principles are applied in arriving at a knowledge of what is required both by the founder and by the metallurgist. Of especial interest are the sections which are concerned with the conditions necessary for soundness of castings, exactness of form, and the control of contraction.—W. A. C. N.

Foundry Working on Railways. N. L. Baillie (*J. Inst. Locomotive Eng.,* 1932, **22**, 676–736; discussion, 737–750).—An account of the equipment and operation of a railway foundry, particularly adapted to conditions in the Argentine. Among items of non-ferrous interest are included notes on crucible furnaces, details of non-ferrous mixtures used in railway practice, accounts of moulding and centrifugal casting machines, and a discussion of the characteristics desired in moulding sands and their control.—J. C. C.

Excrescences and Eruptions in Foundry Work. L. Gasquard (*Bull. Assoc. Tech. Fonderie,* 1931, **5**, 137–139).—The remedies suggested for these defects include the following: use of a sand of specific composition and of regular grain; it should be free from all material which might be harmful to the castings; the size of grain should be adapted more or less to the size of the casting to be produced; the maximum moisture content should be 8%; casting must be carried out regularly so as to give as uniform cooling as possible; gates and risers should be placed judiciously.—W. A. C. N.

Security in Using Castings. R. de Fleury (*Bull. Assoc. Tech. Fonderie,* 1931, **5**, 127–131; and (short abstract) *Usine,* 1931, **40**, (23), 29).—A study of the factors which enter into foundry work causing instability or variation in the quality of the castings produced. It includes sections on the falling off in quality during the course of time, or, in other words, the number of remeltings; indirect factors such as the nature of the primary material, and the physical properties of the alloys during solidification; phenomena occurring during casting such as solidification interval, viscosity, and prevalence of gas. It is pointed out that while any of these factors alone may be of comparatively small significance, the possibility of more than one coming into operation at the same time is definitely liable to react on the quality of the finished work. —W. A. C. N.

On the Measurement of the Shrinkage of Castings by Means of an Extensometer. Kôtarô Honda and Rimpei Kikuchi (*Sci. Rep. Tôhoku Imp. Univ.,* 1932, [i], **21**, 575–584).—[In English.] The linear contraction of castings of aluminium, tin, zinc, lead, bismuth, antimony, and the whole series of aluminium–zinc alloys has been determined with an improved extensometer of the Turner type. The total shrinkage consists of contraction (*a*) in the liquid phase, (*b*) during solidification, and (*c*) in the solid phase. Of these the extensometer indicates merely the approximate contraction in the solid phase, and gives no indication of the change of volume during solidification. The values of total shrinkage of castings of various metals and alloys usually adopted are too small, being roughly half the correct values.—E. S. H.

Some Considerations on the Cooling of Castings. E.-V. Ronceray (*Bull. Assoc. Tech. Fonderie,* 1931, **5**, 78–88).—Cf. this *J.*, 1930, **44**, 702. A very full and clear explanation of the course of cooling, and the theoretical principles which underlie the phenomena. Different types of apparatus are described for obtaining the best casting conditions, for obtaining sound castings, and for ensuring that slag and scoria are retained so that they do not enter the moulds.—W. A. C. N.

Some Practical Foundry Methods for Preventing Unsoundness in Aluminium Alloy Castings. H. J. Rowe and E. M. Gingerich (*Bull. Assoc. Tech. Fonderie,* 1932, **6**, 343–352).—The first part deals generally with the causes of porosity, and is followed by a discussion of the factors which affect the soundness of the alloys. Among these are the temperatures during casting, the nature of the melting furnace and the fuel used, the foundry technique, the composition of the alloy and of the materials used, and the condition of the metal as determined by its prior history. Succeeding sections are concerned with experimental investigations of the influence of factors incidental to the foundry and of methods which have been adopted for suppressing porosity. Generally it is found that the following principles should be borne in mind: use of low casting temperatures, control of all melting conditions and speed of solidification, correct moulding practice, intermediate solidification of the metal, the use of certain chlorides, and a strict supervision of the ingredients of the alloy.—W. A. C. N.

Some Causes of Defects in Aluminium Alloys. D. Hanson (*Bull. Assoc. Tech. Fonderie,* 1932, **6**, 431–444).—A resumé of work, most of which has already been published by the Institute of Metals. It deals with gas absorption and the methods which may be adopted to counteract it; with the type of furnace to be employed in melting; and with the experimental investigation of the various factors which are incidental to this problem.—W. A. C. N.

Use of Graphite and Cast-Iron Crucibles in the Aluminium Foundry. P. Girod (*Usine*, 1931, **40**, (23), 33).—Abstract of a paper read before the 10e. Congrès de Fonderie. Graphite crucibles are said to cause the formation of hard spots in castings, and crucibles of grey cast-iron are proposed, to substitute them.—H. W. G. H.

The Deoxidation of Copper with Various Metals. Earle E. Schumacher and W. C. Ellis (*Bell Telephone System Tech. Publ., Monograph* **B 707**, 1932, 1–8).—Reprint of a paper on "The Deoxidation of Copper with Metallic Deoxidizers, Calcium, Zinc, Beryllium, Barium, Strontium, and Lithium," read before the Electrochemical Society. See this *J.*, 1932, **50**, 580.—S. G.

Bronze Founding Industry in 1932. E. G. Cox (*Met. Ind.* (*Lond.*), 1933, **42**, 218).—Another letter on this subject, in favour of the use of crucible furnaces for bronze casting (see Rowe, *J.*, this volume, p. 147).—J. H. W.

Some Remarks on Casting Heads in the Bronze Foundry. M. De Brock (*Bull. Assoc. Tech. Fonderie*, 1932, **5**, 21–29).—The effect of contraction due to liberation of gas and to solidification is considered. The use of heads to take superfluous metal and to feed the shrinkage is discussed. The various factors which affect the size of head to be used and its form are reviewed very thoroughly. Special instances are cited wherein casting by these methods has been successful.—W. A. C. N.

Notes on Brass Casting. F. A. Livermore (*Met. Ind.* (*Lond.*), 1932, **41**, 439–440).—Notes on the use of crucibles for melting, the need for pyrometric control, and defects in castings and their eradication.—J. H. W.

On the Preparation of Manganese–Brass. Edmund T. Richards (*Metallbörse*, 1932, **22**, 1357–1358, 1389–1390).—The composition, preparation, and properties of numerous manganese–brasses are briefly discussed with especial reference to the influence of impurities.—A. R. P.

Die-Castings and Stampings. Anon. (*Iron Age*, 1933, **131**, 48).—A brief review of the trend in die-castings and stampings of brass and alloys containing brass, aluminium, and nickel, as indicated by the practice of large modern firms.—J. H. W.

The Design of Die-Castings. F. A. W. Livermore (*Met. Ind.* (*Lond.*), 1933, **42**, 217–218).—A brief description of the die-casting process is given, and considerations governing design, precautions in venting, and the casting of lettering and threads are discussed.—J. H. W.

Moulds for the Casting of Ingots of Non-Ferrous Metals and Alloys. I. E. Gorshkov (*Metallurg* (*The Metallurgist*), 1932, **7**, (1), 67–83).—[In Russian.] Cf. this *J.*, 1932, **49**, 203, 232. The merits of horizontal, vertical and inclined chill-moulds for casting non-ferrous ingots are discussed, and the characteristics of each method of casting are critically summarized with reference to numerous diagrams.—M. Z.

Some Special Cores. H. Fabre (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 226–235).—Descriptions of special types which have been made in particular circumstances.—W. A. C. N.

Agglomerated Sand Cores. J. Doskocil (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 475–484).—The problem of the choice of a convenient sand mixture is bound up with the following considerations: the quality and general characteristics of the siliceous part of the mixture; the nature of the binder; a proper understanding of the kind of core required for the particular purposes in view; and the heat-resistant qualities. The manufacture of the cores entails a review of the nature of the surface of the core, its permeability, and the rapidity and facility with which it can be disengaged from the casting. These various factors are all discussed fully from the practical point of view.—W. A. C. N.

Application of Sand Testing in the Foundry with the Object of Ensuring Control. H. W. Dietert (*Bull. Assoc. Tech. Fonderie,* 1931, **5**, 281–282).—Tests for moisture, permeability, drying properties, grain-size, and clay content are described.—W. A. C. N.

Methods of Testing and Control for Moulding Sands. A. Deleuse (*Bull. Assoc. Tech. Fonderie,* 1931, **5**, 282–284).—Cf. this *J.*, 1931, **47**, 240.—W. N.

XIV.—SECONDARY METALS: SCRAP, RESIDUES, &c.

(Continued from p. 153.)

Method of Calculating the Yield of Non-Ferrous Metals from Scrap in the U.S.S.R. I. Valk and S. V. Ivanov (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1930**, 725–742; *C. Abs.*, 1933, **27**, 483).—[In Russian.] Statistical data are given for the non-ferrous scrap industry of the U.S.S.R., covering the period 1901–1933 (data for 1930–1933 are obtained by extrapolation).—S. G.

XV.—FURNACES AND FUELS

(Continued from pp. 154–157.)

FURNACES

Developments in Gas-Fired Furnaces. F. Johnstone Taylor (*Machinery* (*Lond.*), 1932, **40**, 613–619).—The principles governing the design of town's gas and producer-gas fired heating furnaces are outlined and some typical examples described and illustrated. The Wellman–Chantraine "multi-flame" system of combustion (to prevent local overheating), the efficiency of recuperation systems, the use of pressure burners, and the advantages of suspended roofs are among the points discussed.—J. C. C.

Procedure in the Industrial Use of Gas. Otto Wolff (*Gas- u. Wasserfach,* 1932, **75**, 617–623).—An illustrated article on the various types of gas-heated industrial furnaces, with special reference to the steel industry, with data on the gas consumption, the efficiency, and the cost of operation.—B. Bl.

Oil Heating Furnaces. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 193–194).—A brief description of a modern type of oil-fired heating furnace.—J. H. W.

The Melting of Aluminium and Its Alloys. Electric or Fuel-Fired Furnace? C. Sonnino (*Bull. Assoc. Tech. Fonderie,* 1932, **16**, (Suppt.), 12–17).—A comparison is drawn between the relative economic advantages and disadvantages of the electric furnace on the one hand and fuel furnaces on the other for the fusion of aluminium alloys. A number of technical points in favour of the electric furnace—exact regulation of temperature atmosphere, and ease of removal of gases—are examined. It is concluded that the rather insignificant advantages of coke or gas firing are more than outweighed by the greater advantages of the electric furnace.—W. A. C. N.

Electric Heat. Victor Paschkis (*Elektrotech. Z.*, 1932, **53**, 1169–1171).—A review of recent literature on welding machines, arc furnaces, induction furnaces, and resistance furnaces.—B. Bl.

Resistance Furnaces for Heat-Treating Aluminium. Anon. (*Machinery* (*Lond.*), 1932, **39**, 631–632).—An illustrated description of an installation of three electric resistance furnaces each equipped for automatic charging, provided with automatic temperature control, fitted with two centrifugal fans in the roof, and designed for heat-treating aluminium. Two of the furnaces have chambers 14 ft. long, 7 ft. wide, and 5 ft. high, and are the largest so far installed in this country.—J. C. C.

XVI.—REFRACTORIES AND FURNACE MATERIALS

(Continued from pp. 158–159.)

Electrical Resistivity of Specialized Refractories. Harold E. White (*J. Amer. Ceram. Soc.*, 1932, 15, 598–610).—Tests were carried out on the electrical resistivity of 12 commercially-used special refractory bricks at temperatures up to 1300° C. Standard 9-in. bricks were tested using apparatus which is standard equipment and readily obtainable. Temperature lag was eliminated by constant heating over a prolonged period of time at given temperatures. The results obtained indicate a decrease in resistivity with prolonged heating for some classes of refractories. Those refractories composed of minerals of the same petrographic classification appear to undergo the least change. A *bibliography* of 41 references is appended.—S. G.

Researches on the Thermal Conductivity of Refractory Materials. Anton Kanz (*Mitt. Forsch.-Inst. Ver. Stahlwerke A.-G., Dortmund*, 1932, 2, 223–234; *Ceram. Abs.*, 1932, 11, 457).—A new method for determining the thermal conductivity of refractory materials is described. Because of the smaller size of the sample and its cylindrical form, it was possible to save much time and to obtain a more uniform heating of the surfaces. The bricks investigated were: 4 silica, 2 grog, 2 bauxite, 1 corundum, 2 sillimanite, and 1 chromite. The figures of thermal conductivity of these bricks agree well with those obtained by other methods, with the exception of those for chromite brick. Silica bricks which have already been fired once are capable of conducting heat which increases with increased temperatures, more below 400° C. than above it. Thermal treatment influences the formation of tridymite in silica brick. It considerably increases the capability of conducting heat, and makes the figure of thermal conductivity dependent on the linear temperature. Irregularities were determined under 300° C. in alumina blocks, *e.g.*, grog, bauxite, corundum, and sillimanite brick, which are probably influenced by the modification changes occurring in the brick. Well-fired bricks did not show these phenomena. In these bricks also, the influence of the dependence of temperature of the figure of thermal conductivity on the firing temperature, in consequence of the formation of crystalline modifications, was determined. The researches showed that the determination of the capability of conducting heat of refractories in the temperature range between 100° and 600° C. may produce important results because of a greater knowledge of the interior structure of refractories. The great differences in the results obtained by different investigators are due to the inexact methods used.—S. G.

Expansion of Refractories. Anon. (*Rev. mat. constr. trav. publ.*, No. 269, 1932, 75–76; *Ceram. Abs.*, 1932, 11, 371).—The continuous expansion of different refractories from room temperature up to the highest reached, is shown by means of curves. A quartz-marl brick showed a weak expansion under 300° C., a partial transformation of quartz at 500°–600° C., and a large expansion at 1400° C. Bricks in which quartz was completely transformed have the highest expansion under 400° C. Their volume remains constant at higher temperatures. The expansion of other kinds of refractories: magnesite grog, dynamidon, electrically-fused silica, and artificial sillimanite are discussed.—S. G.

Reversible Thermal Expansion of Refractories. W. J. Rees (*Brit. Clay-worker*, 1932, 40, (480), 7; *Ceram. Abs.*, 1932, 11, 414).—There is no real difference between "thermal expansion" and "reversible thermal expansion" except in rare cases when the expansion which takes place on heating is of a permanent character and is consequently described as an "after-expansion" and not as "thermal expansion." An increase in the porosity of a fire-brick causes a decrease in the reversible thermal expansion up to a porosity of 50%, but does not produce irregularities in the expansion curve.—S. G.

Influence of Size of Load on the Deformation of Refractories at High Temperatures. V. Zegzhda (*Trans. Ceram. Research. Inst.* (*U.S.S.R.*), No. 34, 1932, 63–77; *Ceram. Abs.*, 1933, **12**, 19).—[In Russian.] Experiments on the deformation under load (from 1 to 5 kg./cm.^{2}) of refractory products at high temperatures are described. It was found that the influence of the load depends on the chemico-mineralogical and granulometric composition of the samples, and that the load of 2 kg./cm.^{2} is the most suitable.—S. G.

Temperature of Incipient Fusion of Refractory Products. M. Lépingle (*Ind. chim. belge*, 1931, **2**, 475–483; *Ceram. Abs.*, 1933, **12**, 19).—L. studied the modifications in height as functions of time and temperatures of cylinders 500 mm. high and 35·7 mm. in diameter, under a constant load of 2 kg./cm.^{2}. The curves obtained showed 3 interesting points: (1) the temperature at which expansion ceases; (2) the temperature at which it begins to collapse; and (3) the temperature at which the rate of collapse tends to infinity. The last two points constitute usual constants, but no consideration is usually given to the first, which, however, must correspond with a modification in the structure of the sample, a transformation which is due to the incipient fusion of the fluxes contained in, and unevenly distributed throughout, the refractory. In aluminous refractories there is a slow and continuous collapse of the sample constituting a true viscous fusion.—S. G.

An Investigation of the Action of Coal-Ash Slags on Firebrick by Microscopic Methods. Harold E. Simpson (*J. Amer. Ceram. Soc.*, 1932, **15**, 520–535).—The action of coal-ash slags on firebrick refractories was studied by microscopic examination of thin sections prepared from quenched samples of ash and refractory heated together. The 8 refractories used varied as to clays, method of fabrication, grind, and firing treatment. Six different coal ashes varied from highly corrosive to non-corrosive ashes. Samples were quenched at intervals in the range of 2200°–2800° F. (1205°–1538° C.) and the critical temperature or maximum safe operating temperature of all combinations of slag and refractory was determined. These values are presented, together with a discussion of the various minerals formed.—S. G.

A Classified Review of Refractory Slag Tests. Harold E. Simpson (*J. Amer. Ceram. Soc.*, 1932, **15**, 536–544).—The literature on refractory slag tests is reviewed. The various methods are divided into 8 different classifications, and references are given to the literature.—S. G.

Protection of Refractory Materials with Colloidal Graphite. Anon. (*Industrie chimique*, 1931, **18**, 838; *Ceram. Abs.*, 1932, **11**, 414).—Researches carried out in the laboratory of the Verein zur Überwachung der Kraftwirtschaft des Ruhrzechen, Germany, did not confirm the hypothesis that a coat of colloidal graphite (Hydrokollag) can protect refractory materials against the action of furnace gases. The tests were made in a blast-furnace with reduced atmosphere in the presence of corrosive cinders. Both diluted and undiluted Hydrokollag were used. In both cases graphite burned up almost completely, and consequently refractories treated with Hydrokollag did not behave better than others.—S. G.

Refractoriness and Standard Methods for Its Determination in Germany, U.S.A., and U.S.S.R. S. I. Perkal (*Ukrainsky Silikaty*, 1931, (8/9), 251–264). —[In Russian.]—S. G.

Ceramic Shops at Metallurgical Plants. I. I. Kuzmenko (*Ukrainsky Silikaty*, 1931, (11/12), 362–366).—[In Russian.]—S. G.

Research Work on Refractories in the U.S.S.R. During the Past Five Years. S. I. Perkal (*Ukrainsky Silikaty*, 1931, (6), 165–178).—[In Russian.]—S. G.

A Useful Range of Plastic Cements [Drykos; Purimachos]. Anon. (*Eng. Rev.*, 1932, **46**, 346).—Some grades of Drykos and Purimachos plastic fire cements are described.—P. M. C. R.

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On Graphite Crucibles. Edmund Richard Thews (*Tonind. Zeit.*, 1932, 56, 60–62).—A correlated abstract.—B. Bl.

Some Experiments with Zircon and Zirconia Refractories. George F. Comstock (*J. Amer. Ceram. Soc.*, 1933, 16, 12–35).—A record of the results of 5 years' research on refractory uses for a chemically purified grade of zircon and electrically-fused zirconia of high purity. The products investigated included semi-permanent foundry moulds, refractory bricks and cements, ladle nozzles, and crucibles. Electric firing and a small oil-fired tunnel kiln are described. The effects of various binders are discussed. Sintered zircon grog was found to be superior to electrically fused grog. Zircon bricks made with 50% grog, using 20% milled zircon for the permanent bond, and fired at 1600° C. for 1 hr., showed no firing shrinkage, very slight volume change, and high compressive strength at 1600° C. They were extremely resistant to spalling, but did not resist basic slags or metallic oxides very well at high temperatures. Zircon-bonded magnesite bricks were more refractory than ordinary magnesite, more resistant to spalling, and had about the same slag-resistance as magnesite. Zirconia was more refractory than zircon and had better slag-resistance. Lime-bonded zirconia crucibles of good spalling-resistance were made, but the cost was higher than that of zircon.—S. G.

Alundum, Refractory Aluminous Product. V. Charrin (*Céram. Verrerie*, 1932, (843), 477; *Ceram. Abs.*, 1933, 12, 20).—The preparation of alundum in an electric furnace is described, and the uses for the finished product are discussed.—S. G.

[Siemensit] A Refractory of High Service Value. Justus Schmauser (*Tonind. Zeit.*, 1932, 56, 1123–1124).—A short account is given of the properties of Siemensit, a refractory material made by fusing a mixture of chromic oxide, magnesia, and alumina in the electric furnace.—B. Bl.

Magnesite. Anon. (*Brit. Clayworker*, 1932, 40, 391–392; *Ceram. Abs.*, 1932, 11, 312).—The varying conduct of the refractory is due to differences both in the chemical composition and physical structure of the raw materials. Trouble with the finished brick is also due to the method of grinding, tempering, and bonding and the system of conducting the drying and final firing. A brief discussion on crucibles prepared from magnesite, and the increased use of magnesite for basic-lined converters in the refining of copper and nickel and in the metallurgy of silver, is included.—S. G.

Researches on the Capability of Conduction of Heat of Magnesite Blocks. Martin Boetticher (*Mitt. Forsch.-Inst. Ver. Stahlwerk A.-G., Dortmund*, 1932, 2, 235–248; *Ceram. Abs.*, 1932, 11, 458).—Different magnesite blocks were investigated for their thermal conductivity, characteristics, and structure by X-rays. (1) The sp. gr. and the grain-size of the block change with a subsequent heating to redness at a temperature which lies considerably above the firing temperature. The time of heating to redness has no effect. (2) The thermal conductivity of magnesite depends directly on the sp. gr. and grain-size because with their increase produced by subsequent calcining the thermal conductivity increases. The change of the thermal conductivity is small. (3) No relationships between the thermal conductivity, gas permeability, and porosity were found in the blocks investigated. (4) The lattice parameter of periclase, contained by magnesite, does not change with a subsequent heating to redness. Its value corresponds with that of pure magnesium oxide within the limits of error. An index of literature on the subject is given.—S. G.

Determining the Effects of the Rate of Firing and Rapid and Slow Cooling on the Physical Properties of Fireclay Refractories. R. C. Hutchison (*J. Amer. Ceram. Soc.*, 1932, 15, 517–519).—This investigation determined that the rate of firing, as specified in the standard test for the firing behaviour of fireclay refractories, could be reduced without materially affecting the accuracy of the data obtained. The rate of cooling was found to be the cause of variations between test results and laboratory and factory results.—S. G.

A Study of Heating and Cooling Rates of Checker Brick. Gilbert Soler and R. M. King (*J. Amer. Ceram. Soc.*, 1932, **15**, 545–549).—A test simulating the heat absorption and emission of checker brick was developed. The results of such tests on firebricks of 2 sizes, made by 3 different processes and procured from 4 fireclay districts, are given and correlated with the bulk, sp. gr., and porosity of the bricks.—S. G.

Magnesite Bricks Insensitive to Temperature Changes. K. Endell (*Stahl u. Eisen*, 1932, **52**, 759–763).—Norton's formula, according to which the sensitivity to temperature change is, *ceteris paribus*, inversely proportional to the change of shape at high temperature, is shown to be applicable to five types of magnesite brick having different sensitivities to quenching. From micrographic examination it has been found that change of shape in the torsion test at elevated temperatures is rendered possible by crystallographic cleavage (and perhaps also by slip and twinning) in the periclase crystallites. A high periclase content of the bricks is therefore a criterion of good temperature stability. —J. W.

Magnesium Orthosilicate as a Refractory. F. Reinhart (*Tonind. Zeit.*, 1932, **56**, 323–324).—The material is prepared by burning at 1500° C. hydrated magnesium silicates such as talc, serpentine, olivine, peridote, or dunite, with a binder and 2% of an alkali silicate and chloride. Stable bricks may be prepared by taking advantage of the property of a certain coarse-grained olivine of expanding during burning and the property of a finely-ground mixture of serpentine and magnesia of contracting under the same conditions.—B. Bl.

Relation of Crushing Strength of Silica Brick at Various Temperatures to other Physical Properties. Sandford S. Cole (*J. Amer. Ceram. Soc.*, 1932, **15**, 611–621).—The failure at elevated temperatures under constant load of silica bricks is reported, using the Dupuy load test apparatus. The crushing strengths at 1500°, 1800°, 2100°, and 2400° F. (815°, 982°, 1149°, and 1316° C.) are recorded, as well as the crushing strength at room temperature. The size of the test-piece normally used was 1 × 1 × 2½ in. A definite relationship is shown to exist between the strength at room temperature and that at elevated temperatures. The effect of variation in lime content, bats content, and fluxes is also given. Data were obtained on bricks made from 3 different quartzites. Additional physical data are reported to give information concerning the properties of the bricks tested.—S. G.

The Evaluation of Silica Bricks by Their Appearance. Robert Selzer (*Tonind. Zeit.*, 1932, **56**, 361–362).—The quality of silica bricks cannot be judged by their appearance as their colour and the presence of spots depend on numerous factors, such as the nature of the raw material, its iron content, and the method of burning, which do not necessarily have a direct influence on the quality of the brick.—B. Bl.

The Bernitz Carbofrax Furnace Blocks. Anon. (*Eng. Rev.*, 1932, **46**, 332).—The properties of Carbofrax (over 88% silicon carbide) are enumerated and its applications described.—P. M. C. R.

A Recently Introduced Plastic Refractory. Anon. (*Eng. Rev.*, 1932, **46**, 310).—Durosil and Peaksil are among the products of silica deposits occurring in the Peak District of Derbyshire. Durosil is especially suitable for the construction of monolithic walls.—P. M. C. R.

Rapid Methods for the Determination of Silica [in Refractories]. Anon. (*Tonind. Zeit.*, 1932, **56**, 597–598).—Evaporation of the solution with perchloric instead of with sulphuric acid for the dehydration of the silica has the advantage that the alkaline earths pass readily into solution on diluting with water. References to the literature are given.—B. Bl.

XVII.—HEAT-TREATMENT

(Continued from pp. 160–161.)

A Study on the Electrochemical Potential in Relation to the Heat-Treatment and Ageing of Duralumin. Hiroshi Imai and Masami Hagiya (*Kinzoku no Kenkyu* (*Journal for the Study of Metals*), 1932, 9, (12), 530–538).—[In Japanese.] Experiments were carried out to examine the influence of heat-treatment and ageing on the electrochemical potential of Duralumin. The potential existing between Duralumin and a *N* solution of potassium chloride was measured against a normal calomel electrode at 20° C. The results show that by quenching at 510° C. Duralumin becomes distinctly electro-negative, and that the potential for the quenched alloy remains unaltered throughout the 10 days of ageing, whilst by tempering at 100° C. it becomes slightly electro-positive; by finally tempering at 200° C. its normal value is restored. Some of the copper–aluminium and magnesium–silicon–aluminium alloys were also examined to confirm the behaviour of the compounds $CuAl_2$ and Mg_2Si. No signs of precipitation of the compounds nor change in the supersaturated solid solution were deserved during the time of ageing.—S. G.

Heating of Sheets of "Elektron AZM" to Remove Internal Stress. M. Abraham (*Jahrb. deut. Versuchsanst. Luftfahrt,* **1932,** 13).—Internal stress in spring-hard Elektron sheets is removed in 1 minute at 250° C. but 1 hr. is necessary at 200° C.—B. Bl.

Retarding the Ageing of High-Resistance Light Alloys. —— Coquelin (*Arts et Métiers,* 1932, 85, 353–356).—A series of aluminium alloys of the Duralumin-type was subjected to heat-treatment and then placed in a refrigerator and maintained at a constant low temperature for various periods of time, after which the breaking stress and Brinell hardness were determined. From the results of these experiments it is concluded that: (1) when ageing has begun, it cannot be stopped even at a temperature of — 10° C.; (2) the temperature at which the metal must be kept (to prevent ageing) is about — 5° C.; (3) after removal from the refrigerator the metal ages normally and resumes its normal mechanical properties; (4) the metal retains its soft state as long as the low temperature is maintained. Experiments with stamping test-pieces after a similar treatment confirmed these results.—J. H. W.

XVIII.—WORKING

(Continued from pp. 161–164.)

Fabrication and Properties of Seamless Phosphorized Arsenical Copper Tubing. G. L. Craig and O. Z. Klopsch (*Amer. Inst. Min. Met. Eng. Preprint,* **1933,** Feb., 1–9).—The effect of arsenic up to 0·2% on the basic properties of tough-pitch and of phosphorized copper has been critically studied and laboratory experiments have been supplemented by mill scale tests. It is shown that the basic properties of copper are not greatly affected by small amounts of arsenic. An increasing strength with an increase in the arsenic content has been noted, whilst at the same time there is no corresponding loss of ductility. It is concluded that, within the range of the reductions with which the paper deals, arsenic has no appreciable effect on the fabricating characteristics of copper.—W. A. C. N.

Developments and Future Trends of the Non-Ferrous Tube Trade. Gilbert Evans (*Metallurgia,* 1933, 7, 111–113).—The position of the non-ferrous tube trade is reviewed and the methods adopted by British tube manufacturers to meet prevailing conditions are considered. Reference is made to modern plant and methods, such as the development of the rotary piercing machine as applied to copper tube production, and the various types of extrusion machines. The relative methods of rotary piercing and extrusion, and the comparative merits of hydraulic and chain benches are discussed, and consideration is given to the merits of a fixed drawing bar and die as applied to draw- or push-benches of the hydraulic type, as compared with a free bar or die. Various methods of annealing are also considered, and the future possibilities for economical production and application of tube in various forms referred to.—J. W. D.

Use of Small Diameter Rolls and Improvements in Multiple Rolling-Mills. W. Rohn (*Stahl u. Eisen*, 1932, **52**, 821–825).—Very small diameter rolls have recently been used in 12-high rolling-mills in which they are supported against 2 loose intermediate rolls which themselves are supported against 3 external rolls. This arrangement renders possible a more economical production of very thin sheets in relatively few steps with increased precision. The technical and constructional principles for such rolling-mills are discussed with examples, an apparatus for the continuous testing of the accuracy of the rolling is described, and information on the economies of the mills is given.—J. W.

Lubricating a 48-in., 3-High, Universal Mill. Louis H. Hein (*Blast Fur. and Steel Plant*, 1933, **21**, 99–102).—Refers primarily to steel mill plant, but the system and principles involved are applicable to rolling-mills in general. 196 bearings were included in the scheme, in which the control equipment is entirely mechanical.—R. Gr.

Care of Large Electrical Apparatus. J. S. Murray (*Blast Fur. and Steel Plant*, 1933, **21**, (2), 114–115, 117, 118).—Outlines the necessary tests to be applied before starting up an electrical plant which has been idle for considerable periods. Testing of the insulation for breakdown due to moisture is essential.—R. Gr.

Dies for Wire Manufacture. Richard Saxton (*Mech. World*, 1932, **92**, 479–480).—Steel for wire-drawing dies is used chiefly because when the bearing shows signs of wear, it can be quickly re-set and used again. The setting by hand is superior to drilling methods. A die for drawing copper and brass is illustrated. It is of shorter bearing length than that for drawing mild steel, the reduction possible being over 3 times as great as that possible in drawing high-carbon steel. The longer the bearing the smaller is the reduction possible. The length of bearing for copper and brass is about the same as the diameter of the wire when drawn. "Stone metal" dies should oust the steel die when they have been improved by research.—F. J.

Structural Change in Drawn Wire. R. Saxton (*Mech. World*, 1932, **92**, 117–118).—The change which takes place in wire or wire rod while undergoing the drawing process is little understood even by many in the trade. Steel wire only is discussed and attention is directed to the improvement which occurs—in the torsion test—when drawn wire is allowed 2 or 3 months' rest.—F. J.

Lime in Wire-Drawing. D. E. Washburn (*Wire and Wire Products*, 1932, **7**, 385–386).—The essential factors necessary for a lime giving the most successful and effective results in wire-drawing are described. Although the limits of chemical composition are difficult to prescribe, the calcium oxide content should probably not be less than 94%, magnesia and silica each less than 2%, and other impurities less than 1%, with carbon dioxide between 1·5 and 0·6%.—J. H. W.

Fourdrinier Wires and Cloths.—II. Kurt Jahn (*Wire and Wire Products*, 1932, **7**, 221–223).—The testing of wires, choice of warp and filler wires, winding on to warp spools, and the spooling of the filler wires are described. (See this *J.*, 1932, **50**, 455.)—J. H. W.

The Deep-Drawing Qualities of Thin Sheets. J. Cunningham (*Mech. World*, 1932, **92**, 53–54).—The deep-drawing expansion test devised by Siebel and Pomp (cf. this *J.*, 1930, **43**, 579, and 1930, **44**, 600), in which annular test-pieces, having a central hole, are drawn into a cup while the outer rim of the cup is firmly clamped in a circular flat-faced die, is favourably compared with the Erichsen test in indicating the ability of the material to undergo deep-drawing. The test is useful in connecting deep-drawing properties with micro-structure, cold-working, and heat-treatment. Another method of testing devised by F. Eisenkolb (*Stahl u. Eisen*, 1932, **52**, 357–364) is described, in which the Erichsen test is used on material, after cold-working it by drawing the test-discs into closed cylinders through a number of dies. —F. J.

Effect of Machine Rigidity on Metal Flow. E. R. Frost (*Canad. Mach.*, 1932, **43**, (15), 17–28, 40; and *Iron Steel Canada*, 1932, **15**, 137–139).—Read before the Ontario Chapter of the American Society for Steel Treating. Very accurate forging and stamping, a stronger product and economy of material are rendered possible by the improved strength and stiffness of modern machinery; these qualities appear to influence the mechanical properties of the product more than does the design of the die, if this be used. It is found that when metal flow is once induced, it should be allowed to continue uninterrupted to completion of the operation otherwise greatly increased pressure is needed for re-starting. Methods of machining based on these observations are outlined, with their effects on quality and cost. —P. M. C. R.

Investigations on Stamping Tools. Bruno Deja (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1933, **9**, 7–8).—The form and the sudden application of some common types of die cause excessive wear of the tool and much distortion and marginal tearing in the stamped piece. An alteration in the form of the tool is proposed; specimen micro-sections show clean-cut edges and an even distribution of stress as against the severe local stresses and torn edges found in work produced by the earlier methods.—P. M. C. R.

Tapered Shell Dies. S. A. McDonald (*Mech. World*, 1932, **92**, 337).—In the production of sheet-metal cones from flat stock, absence of folds or wrinkles cannot be ensured in work produced from dies which might make conical shells directly, and it is necessary to develop a stepped shell with parallel sides to each step, and then convert this into a cone. The secret of success in this conversion lies in closing-in the metal of the stepped cone instead of stretching it. The various operations are described and illustrated. Brass, being a ductile material, lends itself to this kind of work, but by making enough steps to the step-cone and annealing carefully, steel also gives good results.—F. J.

The Production of [Modified] Cylindrical Pieces in Brass. A. Wiedenhoff (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1932, **8**, 107–108).—A combined drawing and pressing process is described, effecting considerable economy of material as compared with machining the cast material. Scale diagrams of the various stages of the process are given.—P. M. C. R.

Hot-Pressing or Machining? Otto Lich (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1932, **8**, 132–133).—Cutting processes decrease strength by interrupting the grain of the material concerned, while hot-pressing produces a deflection of the unbroken grain, together with a structure of increased density. Speed and economy are further advantages of hot-pressing processes, of which several modifications are briefly described and illustrated. —P. M. C. R.

Forging and Stamping of Light and Ultra-Light Alloys. I.—Observations on the Pouring of the Metal (Continued). E. Decherf (*Aciers spéciaux*, 1932, **7**, 329–344).—Cf. this *J.*, 1931, **47**, 600; 1932, **50**, 192. Further examples of forgings and stampings in light alloys are given as follows: (4) rough-shaping a prismatic disc of square or rectangular section; (5) as (4), but where bending over a form or preliminary stamping is required; (6) hammering one end of a billet to a circular section, the other end being unforged; (7) as (6), using dies for forging; (8) as (6), using dies for trimming; (9) hammering the middle part only of the billet; (10) and (11) hammering the ends only; (12) hammering the whole billet, but stamping with one pair of dies only.—J. H. W.

Filling Head for Vertical Lead Cable Presses. A Device for Eliminating Oxides. Anon. (*Met. Ind.* (*Lond.*), 1932, 41, 401, 403).—A description of a device for eliminating oxides in extruded cable sheaths, designed by the Siemens-Schuckert A.-G., Berlin-Siemensstadt, Germany. It consists essentially of a spill-head or annular trough fitted to the top of the container and into which lead overflows after the container is full, carrying oxides and other impurities with it.—J. H. W.

[Moulding from Metal Powder.] Anon. (*Canad. Mach.*, 1932, 43, (16), 57).—A brief description of the moulding process, now applied to tungsten, chromium, nickel, copper, and various alloys, as well as to iron.—P. M. C. R.

Machinery for the Manufacture of Metal Foil Caps. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1932, 8, 62).—A continuous process is described for the making of screw caps from foil consisting of lead or a lead alloy, coated on both sides with tin.—P. M. C. R.

Modern Ideas in Silversmiths' Work. Anon. (*Met. Ind.* (*Lond.*), 1932, 41, 389–390).—A discussion of the use of pure and standard silver in decorative work.—J. H. W.

Machinability of Free-Cutting Brass Rod. Alan Morris (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, 99, (Inst. Metals Div.), 323–330; discussion, 331–344).—For abstract of the paper, see this *J.*, 1932, 50, 260. In the discussion, in which the following took part: *F. V. Hartman, O. W. Boston, J. L. Kimberley, O. W. Ellis, W. B. Price, D. K. Crampton,* and *A. Morris*, the relative machinability of 5 leaded brasses with 59·15–63·25% copper after (1) furnace cooling, (2) air cooling, and (3) quenching from temperatures between 850° and 500° C. are shown graphically; the figures have been determined by Kessner's method (*Carnegie Schol. Mem., Iron Steel Inst.*, 1913, 5, 10) and are referred to an alloy of copper 62–63, lead 2·5–3%, and the remainder zinc (machinability 100%). In series (1) the alloys with less than 62% copper showed a flat curve throughout the temperature range irrespective of the amount of β, but alloys with 62–64% copper showed much better machinability after slow cooling from above 800° C.; similar results were obtained in series (2) except that improvement in the 62–64% copper alloys started at 550° C. The values in series (3) showed that water-quenched alloys have poor machinability irrespective of the quenching temperature or amount of retained β. Cold-working increases the energy required to cut free-turning brass rod, but soft metal cannot be cut efficiently without perfect support. In the Kessner drill tests, the machining time falls to a minimum at 57% copper, rises again to a maximum at 58% copper, and falls to a second but lower minimum at 60% copper, after which it rises sharply to a maximum at 63·5% copper. Satisfactory high-speed rods can be prepared from brass containing copper 59–61, lead 3–4, nickel 0·5, and tin or iron not more than 0·2%. Tests in a standard high-speed screw-cutting machine have shown that the tool life is 30% greater when cutting a 4% lead–brass containing 62·27% copper than when cutting a similar brass with 60% copper. With a copper content of 62·27%, about 15% longer life of the tool is obtained with 4% lead than with 3·4%. Cutting tests on samples of free-cutting rod show that (1) hard-drawn rod exhibits distinct directional properties which diminish, but do not disappear on annealing; (2) a completely homogenized rod has a slightly higher unit cutting energy than one which still contains a small amount of β; (3) the directional properties do not depend on the presence of β; (4) transverse and cross-sectional cuts are more easily made on hard-drawn than on annealed rod.—A. R. P.

Machinability of Free Cutting Brass.—II. Alan Morris (*Amer. Inst. Min. Met. Eng. Preprint*, 1933, Feb., 1–5).—A continuation of an earlier paper (cf.

this *J.*, 1932, **50**, 260, and preceding abstract). It is a record of the results of tests on samples of free cutting brass containing varying proportions of tin, iron, and copper. The apparatus used was the same as in the earlier instance. The cast bars were annealed at 500° C. for 7 hrs., cold-rolled to 0·7 in., annealed at 500° C. for 8 hrs., cold-rolled to 0·562 in., annealed at 500° C. for 2 hrs., and air-cooled. The addition of tin up to 0·75% has little effect on the hardness or resistance to the cutting action of a tool. Iron up to 0·5% improves the cutting properties only slightly, but hardens the material considerably. A variation in copper content from 58% to 63% has little effect on resistance to cutting, but a further increase to 65% results in a moderate increase in unit cutting energy.—W. A. C. N.

A New and Original Process for the Production of Irregularly-Shaped Pieces. —— Schlippe (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1932, **8**, (1/2), 1–4).—A movable arm follows on an enlarged drawing the outlines of the required piece. The movements of the arm are observed through a travelling microscope, the motions of which are made after reduction to regulate the depth of cut of the shaping apparatus. It is claimed that the device eliminates, by its accuracy, much tedious and expensive hand-finishing, and that output is greatly increased.—P. M. C. R.

Useful Hints on Drilling Metals. H. Bentley (*Met. Ind.* (*Lond.*), 1932, **41**, 642).—When a large number of holes have to be drilled in brass, bronze, phosphor–bronze, gun-metal, or similar material, it is preferable to use a high-speed twist drill having a slow spiral, a small cutting angle, and wide flutes.—J. H. W.

Hot-Sawing Machines. Anon. (*Mech. World*, 1932, **92**, 179).—Machines for hot-sawing of metals are briefly described and illustrated.—F. J.

XIX.—CLEANING AND FINISHING

(Continued from pp. 164–166.)

Flexibility in the Metal-Finishing Department. E. E. H. (*Machinery* (*Lond.*), 1932, **40**, 402–403).—In planning a metal-finishing department it is important to make provision for giving special treatment and applying special finishing coats where these are specified. Acid dipping and cleaning vats, the thickness of coatings, washing equipment, and lacquering methods are briefly discussed from this point of view.—J. C. C.

Modern Practice in Metal Cleaning. A. D. Weill (*J. Electrodepositors' Tech. Soc.*, 1931–32, **7**, 157–160).—Aqueous solutions for the degreasing of metals are composed of milder alkalis than formerly, frequently containing phosphates and/or cyanides. Electrolytic cathodic cleaners may contain copper salts; incomplete deposition of a film of copper indicates greasy patches. Typical formulæ are given. Methods for the removal of oxide are described. Suitable methods are given for cleaning stampings or castings of brass and similar metals, die-castings of zinc, aluminium and tin alloys, lead and pewter prior to electroplating.—S. W.

The Theory of Metal Cleaning. E. J. Dobbs (*J. Electrodepositors' Tech. Soc.*, 1931–32, **7**, 161–162).—Wetting power, emulsification, and peptizing action are shown to be necessary functions of a complex aqueous metal-cleaning solution. The constituents contributing each property are discussed. The use of organic solvents, particularly in the vapour phase for removing grease, is reviewed. Etching processes for cleaning steel and brass prior to electroplating are described.—S. W.

The Cleaning of Iron and Steel. S. Wernick (*J. Electrodepositors' Tech. Soc.*, 1931–32, **7**, 163–165).—Methods of degreasing, descaling, and electrocleaning steel prior to electroplating or other finishing processes are described. The functions of soaps deliberately added or formed by saponification of vegetable oils on the emulsification of grease, together with their rinsing properties, methods of providing visual evidence of complete grease removal and the use of inhibitors in acid solutions to prevent over-pickling are also discussed. —S. W.

Symposium on "Metal Cleaning." A. Dudley Weill. E. J. Dobbs. S. Wernick (*Met. Ind.* (*Lond.*), 1932, **40**, 589–591, 621–623, 625).—Abstract of addresses delivered to the Electroplaters' and Depositors' Technical Society. See preceding abstracts.—J. H. W.

Equipment for the Cleaning of Metal.—XIII. R. W. Mitchell (*Metal Cleaning and Finishing*, 1932, **4**, 15–19; *Ceram. Abs.*, 1932, **11**, 229).—Cf. this *J.*, 1931, **47**, 603; 1932, **50**, 192, 707. The question of cleaning solution agitation is further discussed. Descriptions of operation and data on both centrifugal and rotary pumps are presented.—S. G.

Cleaning Castings by Means of Water–Sand Mixtures. Friedrich Huth (*Emailletech. Monats-Blätter*, 1932, **8**, (8), 60–61; *Ceram. Abs.*, 1933, **12**, 9).—In cleaning castings by means of silica sand driven by water under pressure there was formerly a loss of silica sand due to the mixing in of the finer moulding sand that had adhered to the castings. A method for recovering the silica sand by washing through a series of screens is outlined.—S. G.

Pickling Practice. O. L. Thomas (*Metal Cleaning and Finishing*, 1932, **4**, 167–170; *Ceram. Abs.*, 1932, **11**, 349).—A general discussion is given of pickling technique and equipment.—S. G.

Control of the Pickling Bath. Anon. (*Emaillewaren-Ind.*, 1932, **9**, 152–153; *Ceram. Abs.*, 1932, **11**, 443).—Discusses the arrangements, manner of working, and the pickling pills or capsules used for the control of the pickling bath according to the method of Karl Türck.—S. G.

A New Pickling Machine for Sheets, Tubes, Wire, &c. —— (*Anz. Berg.-, Hütten.- u. Masch.*, 1933, **55**, (8), 6).—The machine rotates the goods in the pickling solution.—B. Bl.

Finishes for Zinc. Anon. (*Paint Manuf.*, 1932, **2**, 267; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (30), 346).—Cellulose and oleoresinous types of finish both exhibit signs of decomposition in contact with zinc, losing flexibility and adhesion, apparently due to chemical interactions. The decomposition of nitrocellulose can be demonstrated by incorporating a little alizarin, which, on zinc, changes from brown to red; it can be retarded by adding a small amount of an organic salt. Etching the zinc surface enhances the initial adhesion only, and it is necessary to resort to deposition of a dissimilar metal or a metal compound to secure permanent adhesion.—S. G.

XX.—JOINING

(Continued from pp. 166–168.)

Pressures Required for Heading Duralumin Rivets. George A. Fries (*Machinery* (*N.Y.*), 1932, **39**, 11).—The results of tests on the pressures required to head standard Duralumin rivets are tabulated.—J. C. C.

Practical Notes on Electric Furnace Brazing. H. M. Webber (*Machinist* (*Eur. Edn.*), 1932, **76**, 1153–1155).—The objects to be brazed are passed through an electric furnace with controlled atmosphere; the copper, which has been applied near the joints, melts and is drawn into the joints by capillary attraction and forms an alloy bond which is exceptionally strong, light, and clean. The controlled atmosphere consists of hydrogen or some less expensive reducing gas and takes the place of the flux normally used, although in some cases a flux, such as borax, is applied as well. Typical applications of the process are described.—J. H. W.

Oxy-Welding [of Aluminium] in the Interests of Science. Anon. (*Mech. and Welding Eng.*, 1931, 5, 314–316; and (short note) *Welding J.*, 1931, 28, 315).—An abstract from articles in *Rev. Soudure autogène*, 1931, 23, 2284, and *Soudeur-Coupeur*, 1931, 10, (7), 10, describing the construction of the balloon in which Professor Piccard and M. Kipfer made their ascent of 10 miles. The sphere was made of oxy-acetylene welded aluminium sheet, 3·5 mm. thick, the internal load being carried by vertical tie rods welded in. The welds were all hammered and annealed.—H. W. G. H.

Use of Aluminium. The Welding of Tanks in Aluminium. W. M. Dunlap (*Usine*, 1931, 40, (28), 41).—Abstract of paper read before the International Acetylene Association. See this *J.*, 1932, 50, 500.—H. W. G. H.

Arc Welding of High-Conductivity Joints in Copper. T. C. Stuart (*Engineering J.*, 1931, 14, 600–601).—An account is given of methods investigated for attaching an equilateral triangular section copper bar of about 0·5 in. cross-sectional area along almost the whole length of a copper bus-bar 3 in. × 13·5 in. × 18–19 ft. Sweating the two together by means of silver solder was not satisfactory. In the method ultimately adopted, beads were deposited on the strip to form a current-carrying fillet, and pure copper, or later, on account of its faster flowing qualities, phosphor–copper, was used as filler material. The electric arc method gave entirely satisfactory results.—H. F. G.

The Autogenous Welding of Monel Metal. [R. Meslier] (*Welding News*, 1931, 2, 21).—Translated from *Soudure et Oxy-Coupage*, 1931, 8, 99. The original paper was published in *Rev. Soudure autogène*, 1929, 21, 1756–1757. Emphasizes the danger of cracking due to expansion and contraction.—H. H.

Welding Die-Cast Zinc Alloys. Anon. (*Mech. and Welding Eng.*, 1931, 5, 130–131).—Translated in abstract from *Soudeur-Coupeur*, 1931, 10, (1), 8–10. Describes a method for welding zinc-base die-casting alloys. The envelope of the oxy-acetylene flame is used and the metal is puddled by means of a steel rod.—H. W. G. H.

Ductility: What is Its Significance? How Test for It? H. F. Moore (*J. Amer. Weld. Soc.*, 1932, 11, (4), 35–36; discussion, (5), 26).—Contribution to a symposium on "Ductility." Ordinary ductility is explained as insurance against fracture under occasional overloads, and is thus distinct from "crackless plasticity"—insurance against the formation of a spreading crack by repetitions of normal loads. Cold bend, elongation, notched-bar impact, and notched-bar fatigue tests do not give correlation with the latter property, but the "damping" characteristics, as measured by Föppl and von Heydekamp, may give useful results. In the written discussion, *W. B. Miller* agrees with M. that extreme ductility is not advantageous if it sacrifices tensile strength and crackless plasticity.—H. W. G. H.

Ductility in Arc Welds with Some Reference to Strength Values. Chas. H. Jennings (*J. Amer. Weld. Soc.*, 1932, 11, (4), 37–42; discussion, (7), 28–29).—The ductility of weld metal can be obtained by machining out of it, standard circular test-pieces and measuring the elongation and reduction of area. The same procedure, however, is not suitable for a butt-weld, since the latter is not a homogeneous structure and, the deposited metal usually having a higher yield-point and ultimate stress than the parent metal, fracture takes place outside the weld. This can be avoided by using a specimen, the section of which is restricted at the weld. It can be designed so as to give elongation values which are comparable with those obtained on homogeneous material using standard test-pieces. The ductility of a butt-weld is also measured by the elongation of the outer surface after "free" bending. The values obtained in this way have no apparent relation to the values given by the elongation of tensile specimens, but are comparable in themselves. *J. C. Lincoln*, in a contribution to the discussion, considers that the elongation over a particular gauge-length is not an accurate indication of the ductility of the sample, which is more correctly given by the elongation of holes drilled through the centre of the weld so that fracture takes place there.—H. W. G. H.

Ductility in Metal Structures. C. A. Adams (*J. Amer. Weld. Soc.*, 1932, **11**, (4), 46–47; and *Welding J.*, 1932, **29**, 148).—Contribution to a symposium on "Ductility." Where the welds are sound and the metal between them is ductile, the ductility of the welds need not be high for many types of structure. Further research is required to find the exact amount of ductility which is necessary.—H. W. G. H.

Ductility and Penetration—Two Fallacies. C. J. Holslag (*J. Amer. Weld. Soc.*, 1932, **11**, (4), 47–48; and (abstract) *Welding News*, 1932, **3**, 20).—Contribution to a symposium on "Ductility." Excessive ductility in welds is harmful, since they are cast material and, therefore, inherently unsound. The weld should be regarded in its true light—as a joint. Penetration should not be deep enough to form a zone of weakness at the edge of the weld.—H. H.

Why Ductility of Welds is Important in Welded Pressure Vessels. E. R. Fish (*J. Amer. Weld. Soc.*, 1932, **11**, (4), 32–33; discussion, (5), 25–26; and *Welding News*, 1932, **3**, 26–27).—Contribution to a symposium on "Ductility." Presents the insurance companies' point of view, from which high ductility is regarded as extremely important, and emphasizes the need for co-ordinated research on the part of manufacturers. In the written discussion, *H. E. Rockefeller* states that high ductility is not the most important factor, and does not necessarily mean high resistance to shock and fatigue. Freedom from imperfections is of greater moment. *A. D. Risteen* emphasizes the need for control of material and technique.—H. W. G. H.

The Effect of Ductility on Security in Welded Connections—Methods of Its Measurement. D. Rosenthal (*J. Amer. Weld. Soc.*, 1932, **11**, (5), 5–9).—Contribution to a symposium on "Ductility." Both the parent metal and the weld must be ductile to allow for overstressing which may take place during shrinkage as well as under applied loads in service. The effect of localized stresses, the ductility, appears to be best measured by the notched-bar impact test. Experimental results of the author and other workers are quoted.—H. H.

Ductility : A Measure of Cleanliness. E. Chapman (*J. Amer. Weld. Soc.*, 1932, **11**, (5), 29–32).—Contribution to a symposium on "Ductility." Cases of uneven stress distribution in service are illustrated by photo-elastic analysis, and the way in which ductility allows plastic deformation, readjusts the stresses, and prevents fracture, is described. It is pointed out, however, that this plastic deformation is often not permissible, and ductility is most important as a measure of quality.—H. W. G. H.

Discussion of the Symposium on Ductility of Weld Metal. G. Doan. J. H. Critchett (*J. Amer. Weld. Soc.*, 1932, **11**, (5), 26–29).—G. D. states that in service, where stresses are usually below the elastic limit, ductility plays no part. During cooling, the stress concentration is higher in the weld, due to flaws in it and shrinkage. Ductility is then necessary, being a measure of deformability, or extent of deformation possible before fracture begins. If deformation has occurred, the residual stresses, which can only be a little below the yield stress, should be removed by annealing. J. H. C. reviews the trend of opinion on weld ductility and considers that extreme ductility is much less important than sound design, high-grade materials, careful fabrication, and thorough proof-testing.—H. W. G. H.

Autogenous Welding Practice in France and Abroad. A. Boutté (*Usine*, 1931, **40**, (14), 33).—Abstract of a paper read before the Société des Ingénieurs Soudeurs, February 26, 1931. Deals particularly with the practice of Sulzer Frères, Switzerland.—H. W. G. H.

Multi-Flame Welding Blowpipe. Anon. (*Usine*, 1931, **40**, (15), 33).—Abstract from *Journal de la Soudure*, **1931**, Feb. See this *J.*, 1932, **50**, 115.
—H. W. G. H.

XXII.—MISCELLANEOUS

(Continued from p. 108.)

The Trend of Metallurgical Research. R. T. Rolfe (*Met. Ind.* (*Lond.*), 1933, 42, 65–67, 70).—An indication is given of the trend of metallurgical research in the way of lightness and strength of alloys, corrosion, cathodic and anodic coating metals, stainless steel coatings, protective coatings on light alloys, condenser tube corrosion, improved lead alloys, and other recent researches.—J. H. W.

Research and Development. —— (*Met. Ind.* (*Lond.*), 1933, 42, 68–70).—An editorial on the applications and functions of theoretical and practical research and development in industry.—J. H. W.

Enquiry [Definitions of Technical Terms]. Anon. (*Metallurg* (*The Metallurgist*), 1932, 7, (1), 2).—[In Russian.] Editorial. Owing to differences in interpretation of the following terms: (1) dendrite; (2) single crystal; (3) metal grain; (4) mechanism of grain growth, the editor requests contributors to describe what the above terms mean to them under various conditions.—M. Z.

[Report on] Inorganic Chemistry. H. Bassett (*Ann. Rep. Prog. Chem.*, 1931, 28, 49–65).—Developments during the year 1931 are reviewed. The following systems have been examined: cobalt–chromium, lithium–copper, bismuth–selenium, aluminium–manganese, copper–manganese, iron–manganese, lithium–silver, cadmium–silver, tungsten–rhenium, copper–tin, calcium–sodium, aluminium–silver, chromium–carbon, aluminium–silicon, calcium–bismuth, iron–carbon–tungsten, chromium–iron, iron–tin, aluminium–chromium, silver–bismuth, silver–antimony, silver–arsenic, gold–antimony, silver–tin, copper–magnesium, and silver–cuprous oxide. Considerable activity is noted in the work on rhenium and its compounds.—E. S. H.

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(Continued from pp. 173–176.)

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[Contains the following, with discussions: G. Schikorr: "Über die Bedeutung der chemischen Reaktionen bei der Korrosion der Metalle"; E. K. O. Schmidt: "Der Einfluss des Untergrundes auf das Verhalten der Anstriche"; H. Wolff: "Gesichtspunkte für die Abgrenzung der Anwendungen von Öllack und Nitrozelluloselack"; H. Salmang: "Email als Korrosionsschutz"; R. Grün: "Zement und Beton als Rostschutz"; A. Burkhardt u. G. Sachs: "Die Phosphatrostschutzverfahren"; H. Miedel: "Kautschukderivate als Korrosionsschutz."]

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[Contains statistics regarding: Aluminium; Antimony; Arsenic; Bauxite; Bismuth; Black Plates; Black Sheets; Cadmium; Chrome Ore; Chromium Metal; Cobalt; Copper; Ferro Alloys; Galvanized Sheets; Gold; Iron Ore; Iron and Steel; Lead; Magnesium; Manganese Ore; Molybdenum Ore; Nickel; Platinum Group; Pyrites; Quicksilver; Secondary Metals; Selenium; Silver; Spelter; Tin; Tinplates; Tungsten; Tungsten Ore; Vanadium Ore; Zinc Sheets. Information is given regarding Extreme Price Records, and London Metal Exchange Dealings. Conversion Tables are also included.]

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XXIV.—BOOK REVIEWS

(Continued from p. 176.)

Bericht über die I. Korrosionstagung am 20 Oktober 1931 in Berlin. Veranstaltet vom Verein deutscher Eisenhüttenleute, Verein deutscher Ingenieure, Verein deutscher Chemiker und der Deutschen Gesellschaft für Metallkunde. Demy 8vo. Pp. 136, with 88 illustrations. 1932. Berlin, N.W.7 : VDI.-Verlag G.m.b.H. (Price R.M. 7.50.)

This little book contains 12 papers with discussions on various aspects of the corrosion problem read and discussed at a conference on corrosion of metals held jointly by the four German societies dealing with metallurgical subjects. Most of the papers deal with ferrous metals and with the general principles of corrosion, but the papers on corrosion-testing from the point of view of the constructor and on measurements of the rate of corrosion of copper–tin and copper–zinc alloys are definitely of non-ferrous interest only; the last three papers are devoted to means of protection from corrosion and the development of corrosion-resisting alloys. Whilst none of the papers contains much new work, the book taken as a whole provides a good survey of the phenomena of corrosion, and a broad outline of the methods adopted for testing the corrodibility of metals and in protecting them from attack in corrosive media. The illustrations are well chosen and beautifully reproduced, and many of the papers are accompanied by useful graphs and diagrams. Abstracts of the papers of general or non-ferrous interest have been published in this *Journal*.—A. R. Powell.

A Textbook of Metallurgical Problems. By Allison Butts. Med. 8vo. Pp. xiv + 425, with 13 illustrations. 1932. New York : McGraw Hill Book Co., Inc. ($4.00); London : McGraw Hill Publishing Co., Ltd. (24*s*. net.)

This book will be welcomed in many metallurgical departments, especially as it is dedicated to the memory of Professor Joseph William Richards, the pioneer in metallurgical calculations. The last edition of the well-known book on " Metallurgical Calculations " by Professor Richards was published as long ago as 1918, and there has been in recent years a demand for a similar work. The book under review has been produced on somewhat similar lines to the above-mentioned treatise, although advantage has been taken of the advances made in metallurgical knowledge and practice in recent years, and corrected figures have been used in the case of many of the constants introduced.

The author is an Associate Professor of Metallurgy at Lehigh University, where metallurgical problem courses have been a special feature for many years. The book has been written with the primary object of providing a text-book for metallurgical students and it thus differs from " Metallurgical Calculations," which was written with the needs of the practising metallurgist in mind. There is little doubt that an extended use of a study of metallurgical problems from the mathematical point of view would be helpful in presenting and illustrating the practical applications of metallurgical practice in our colleges and schools. An attempt has been made to grade the work, and in the first chapters the problems are relatively simple, explanation has been given in detail, and illustrative examples have been fully worked out, whereas in the latter part of the book the matter is more advanced and explanatory details are curtailed. The subject-matter covers a large field, including necessary introductory matters, fuels and combustion, production of draught and blast, drying, calcining, and roasting. The calculation of charges for smelting and in connection with the products obtained in the case of the metallurgy of iron and steel, copper, and lead receives attention.

Special chapters are devoted to hydrometallurgy, electrolytic processes, distillation processes, transmission of heat, and volatilization of metals during smelting. Thermochemistry and thermophysics, the heat balance, vapour-pressure and temperature pressure in chemical reactions, and also the thermodynamics of chemical reactions are dealt with. A chapter on alloys is included in which the calculation of metallographical constitution, &c., is explained in the case of binary alloys, and calculations for iron and steel are specially included.

Useful tables of data necessary for the solution of metallurgical problems are given, and the book can be recommended not only to students, but also to many practising metallurgists.

—C. O. Bannister.

Sächsische Zinnbergwerke. Von G. Enderlein (Schriftenreihe " Deutsches Museum, Abhandlungen und Berichte," 3. Jahrg. Heft 4). Demy 8vo. Pp. 127–152, illustrated. 1931. Berlin: VDI-Verlag G.m.b.H. (R.M. 1.)

This little book gives a very interesting, if somewhat discursive, history of the rise and fall of the tin-mining industry in Saxony over a period of about 700 years. The development of the industry is described from the time of the first discovery of tin in Saxony in the year 1240 up to the present day, when it is almost extinct. The decline began with the influx of tin from the East Indies in 1870. The booklet has some good photographic illustrations.

—E. S Hedges.

Principles of Patent Law for the Chemical and Metallurgical Industries. By Anthony William Deller. Med. 8vo. Pp. 483, with 19 illustrations. 1931. New York: Chemical Catalog Co. Inc. ($6.00.)

In writing this book the author's aim has been to explain to chemical and metallurgical inventors in simple language the intricacies of American patent law. The subject matter is divided into twelve chapters dealing with the history, theory and nature of patents, the various classes of patentable inventions, persons entitled to letters patent, principles of patentability, acquisition and termination of letters patent, remedy of defective patents, form and construction of patents, infringement of patents, suits for infringement, incidents of ownership of patents, commercial phases of patents, and foreign patents; there is also an appendix containing statistics of foreign countries and of mineral raw materials, information regarding foreign patents, figures of the production of minerals and metals in the principal countries of the world, and memoranda on developed and potential water power of the world. To illustrate the classes of patentable inventions the author has chosen to quote one claim from several patents in all the numerous classes in which chemical and metallurgical inventions are divided; this catalogue of claims extends over more than 50 pages and is given with practically no comment. Later on in the book a further 20 pages are devoted to illustrating the formulation of claims in an exactly similar manner. The book is liberally besprinkled with long excerpts of judgments given in the Circuit Courts and in the Supreme Court; while these, in general, are interesting to read, the busy commercial or scientific man who desires to get a broad idea of patent procedure would no doubt prefer to have a critical summary of these Court decisions rather than to plough through pages of text in the search for points which cover inventions in which he himself is concerned. Nevertheless the book as a whole makes very interesting reading in spite of the author's prolixity, and the reviewer must admit that he has acquired a great deal of valuable information from a close study of the subject matter which is presented, when the author uses his own words, in a clear and readily understandable manner.—A. R. POWELL.

Chemical Engineering and Chemical Catalogue. A Catalogue of Heavy and Fine Chemicals, Raw Materials, Machinery, Plant and Equipment Applicable to Production Industries, Standardized, Condensed, and Cross-Indexed. Edited by D. M. Newitt. Compiled with the co-operation of leading British manufacturers. Eighth edition. Demy 4to. Pp. 107 + 53 + 27 + 9 + 76 + lxxiii. 1932. London: Leonard Hill, Ltd., 231–232 Strand, W.C.2. (10*s*. net.)

Many changes have been made in this edition of the annual catalogue of British chemical manufacturers. In the first place the bulk of the book has been reduced 50% by using a thinner paper; this is a considerable advantage to those who are constantly using the book for reference and is further enhanced by the provision of thumb indentations to permit of rapidly finding the desired section. The pages in every section are separately numbered and blank pages for memoranda are interspersed between the sections. The Tables and Data section has been still further enlarged (although it occupies no more pages than in the seventh edition) and at last the table of atomic weights has been printed in full with the latest available values. The Main Index and the Book Bibliography sections have been completely revised and brought up-to-date. It is disappointing to find that the number of firms taking space is still shrinking; in the seventh edition there were 101, but in this edition there are only 88, of which 5 are foreign firms with no factory in Great Britain and 8 are publishers of technical books. That only 75 British firms take the trouble to use this method of publicity is a poor tribute to the enterprise of British chemical industry; the corresponding American publication is much more liberally patronized.—A. R. POWELL.

The Directory of Shipowners, Shipbuilders, and Marine Engineers, 1933. Thirty-first year of publication. Demy 8vo. Pp. 824 + 71. 1933. London: The Directory Publishing Co., Ltd., 33, Tothill Street, S.W.1. (20*s*. net.)

This directory forms a handy desk companion, and furnishes particulars of all the leading steamship companies, shipbuilders, ship-repairers, and marine engineering works throughout the world. It also gives the names of the directors and principal officials of the companies and, in the case of shipping concerns, details of the fleets. A supplementary section includes a list of societies, institutions, trade and labour federations, and a directory of consulting marine engineers and naval architects. At the end of the volume are exhaustive indexes covering some 25,000 entries. Important changes in the present edition include alterations to deadweight capacity and draught of tankers occasioned by the new load line regulations.

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

1933 MAY Part 5

I.—PROPERTIES OF METALS

(Continued from pp. 177–180.)

Recrystallization and Hardening of Aluminium due to Plastic Torsion. A. E. van Arkel and M. G. van Bruggen (*Z. Physik*, 1933, **80**, 763–791).—Torsion of fine-grained aluminium rods is found to be, in part, a reversible phenomenon, successive torsion in opposite directions being characterized by the development of a maximum crystal grain-size, dependent on the degree of untwisting effected in the rod. The axis of this maximum recrystallization effect corresponds with the axis of torsion, along which minimum hardening occurs. An elastic after-effect (Nachwirkung) is exhibited by polycrystalline aluminium rods, and, in general, by single crystals subjected to torsion. Some single crystals, however, exhibit an after-effect only when the torsion has been reversed. The difference in the two cases is possibly associated with crystal orientation. Whether the crystal size is greater or smaller after reversal of the torsion than prior to such reversal depends on the relative magnitudes of the torsions in opposite directions.—J. S. G. T.

Relation between Hardening and Recrystallization Properties Associated with the Plastic Deformation of Metals. IV.—Recrystallization of Aluminium Single-Crystals. W. G. Burgers, assisted in the experimental work by J. J. A. Ploos van Amstel (*Z. Physik*, 1933, **81**, 43–65).—In continuation of previous work (see this *J.*, 1931, **47**, 276), it is found that the power of recrystallization, exhibited by a stretched single-crystal of aluminium and expressed in terms of the number of crystallites formed after annealing, is less, for the same total slip, the greater the number of slip planes partaking in the deformation. On the basis of this result, an attempt is made to interpret consistently the apparently contradictory deductions made by different observers concerning the relation between hardening and recrystallization in aluminium single-crystals. The results also enable an explanation to be given of the occurrence of a preferential orientation of crystallization in the production of single-crystals of aluminium by the slight extension of polycrystalline material. —J. S. G. T.

Beryllium. Anon. (*Bull. Assoc. Tech. Fonderie*, 1931, **5**, 93–94).—From *Found. Trade J.*, 1930, **42**, 202. See this *J.*, 1930, **43**, 397.—W. A. C. N.

Commercial Possibilities of the Alloys of Beryllium. Alfred Stock (*Technique moderne*, 1932, **24**, 767).—Abstract of a paper read before the Electrochemical Society. See this *J.*, 1932, **50**, 337.—H. W. G. H.

The Effect of Tension on the Electrical Resistance of Single Bismuth Crystals. Mildred Allen (*Phys. Rev.*, 1932, [ii], **42**, 848–857).—The effect of tension, within the elastic limit, on the electrical resistance of single-crystals of bismuth has been studied, using cylindrical specimens with the current and tension parallel to the axis of the cylinder. The orientation of the crystal may be expressed by means of 2 angles θ and ϕ, where θ is the angle between the normal to the principal cleavage plane and the longitudinal cylindrical axis of the crystal, ϕ is the angle between the projection on the principal cleavage plane of the normal to the secondary cleavage plane, and the major axis of the elliptical section of the principal cleavage plane, where the secondary cleavage plane considered is that one the normal of which makes an angle of 71° with that of the principal cleavage plane. The change of resistance $\Delta R/R$ is directly proportional to the applied tension, and is independent of the current strength, but depends on both θ and ϕ. For $\theta = 0°$, and $\theta = 90°$, the tension coeff. of resistance is very little affected by variations in ϕ, whereas for $\theta = 60°$, the variation with ϕ is a maximum. This variation involves a change of sign as well as of magnitude, so that for some orientations the coeff. is positive and not, as usually, negative. This accounts for discrepancies between the results of previous investigators on polycrystalline metal.—W. H.-R.

The Effect of Oxygen on the Properties of Copper. W. Broniewski and S. Jaslan (*Compt. rend.*, 1933, **196**, 174–177).—Oxygen was introduced into cast electrolytic copper in the form of CuO, the resultant alloys were rolled (cold up to 3% Cu_2O, hot above this) and annealed at 450° C. for 1 hr., and a number of the physical properties of the alloys determined. The thermo-electric force and the e.m.f. of solution did not appear to be affected by oxidation, but the variation of e.m.f. and the elastic limit showed a change of direction above 0·8% Cu_2O. The electrical conductivity is slightly reduced by oxidation, although the variation of electrical resistance increases to a flat maximum. The Brinell hardness increases by 30% up to the eutectic composition and then slowly decreases, and the plasticity behaves similarly. Both the tensile strength and the elongation are the most affected by oxidation. It is considered as established that up to 1% Cu_2O does have an appreciable effect on the mechanical and electrical properties of copper.—J. H. W.

Influence of Deformation and Annealing on the Coefficient of Thermal Expansion of Copper. H. Sieglerschmidt (*Z. Metallkunde*, 1933, **25**, 38–42, 64).—The coeff. of thermal expansion of copper increases considerably after 5–22% deformation by stretching or compression, but is decreased again by annealing at temperatures above 150° C., the " normal " figure being obtained after annealing at 300° C. The increase in the coeff. is attributed to the elastic stress caused by the cold-work. For annealed, cold-rolled copper sheets in which the crystallites are so oriented that the cubic plane lies in the rolling plane the coeff. is practically the same in all directions in the sheet.—M. H.

Recrystallization Phenomena on Synthetic Metal Bodies. W. Trzebiatowski (*Naturwiss.*, 1933, **21**, 205).—A short preliminary report on cold- and hot-pressing tests on very pure copper powder and the hardening and recrystallization phenomena associated therewith.—J. W.

The Phenomenon of Passivity by the Solution of Copper in a Mixture of Potassium Nitrate and Sulphuric Acid. Artur Kutzelnigg (*Z. Elektrochem.*, 1933, **39**, 67–73).—Copper becomes passive in a few seconds in a mixture of potassium nitrate (sp. gr. 1·4) and sulphuric acid (sp. gr. 1·84) at 30° C., owing to the formation of a layer of $CuSO_4.5H_5O$. Passivity occurs when 70–80% of the dissolved metal is precipitated as a strongly adherent, fine-grained layer, and is hastened by raising the temperature. Adding a little water retards the passivity, but further dilution increases it. The proportion of potassium nitrate to sulphuric acid has an appreciable effect on the passivity which increases with the sulphuric acid content. Small amounts of hydrochloric acid do not affect it, but larger amounts retard it.—J. H. W.

Mexican and Ecuadorian Copper and Bronze Axes. Anon. (*Nature*, 1933, **131**, 279).—Comments on a paper by M. A. Clement (*J. Soc. Américanistes Paris*, [N.S.], **24**, 1). Hardness tests have been made on the butt, the middle, and the cutting edge of axes of copper and bronze from pre-Columbian Mexico and Ecuador. The Ecuadorian axes were of pure copper. The Brinell values obtained were: butt 67–112, middle 59–103, edge 72–121. The Mexican axes contained 1·8–3·8% of tin. The Brinell values were: butt 48–56, middle 49–53, edge 50–56. In both the Ecuadorian and Mexican axes some process had been employed to harden the cutting edge of the instruments. There is no evidence against the hypothesis that the hardening was effected by hammering.—E. S. H.

On the Mechanical Properties of Lead. First Report. Masujirō Nakahara (*J. Soc. Mech. Eng. Tokyo*, 1928, **31**, 391–408; *Japanese J. Eng. Abs.*, 1932, **8**, 10).—[In Japanese.] See this *J.*, 1930, **43**, 405.—S. G.

Thermal Expansion of Lead. Peter Hidnert and W. T. Sweeney (*Met. Ind.* (*Lond.*), 1933, **42**, 177–178).—Abstract of *U.S. Bur. Stand. J. Research*, 1932, **9**, 703–709. See *J.*, this volume, p. 2.—J. H. W.

Effect of Small Percentages of Certain Metals upon the Compressibility of Lead at an Elevated Temperature. Lyall Zickrick (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 345–358).—See this *J.*, 1932, **50**, 466.—S. G.

The Sublimation of Magnesium in Vacuo and its Casting in an Atmosphere of Argon. J. Hérenguel and G. Chaudron (*Génie civil*, 1933, **102**, 42).—Previous work by H. and C. (see this *J.*, 1932, **50**, 67, 530) has shown that it is possible to purify magnesium by sublimation *in vacuo*. They now describe a method of obtaining cast ingots of the pure sublimed metal. The sublimed magnesium is melted in argon in a closed vessel to which is fitted a syphon leading to a mould in which the metal is to be cast. By raising the pressure of the argon the syphon is filled with molten magnesium, which is then transferred to the mould. Magnesium thus obtained is very malleable; its Brinell hardness is 29.—W. P. R.

Molybdenum. Alice V. Petar (*Burn's Eng. Mag.*, 1932, **26**, 432).—From *U.S. Bur. Mines Economic Paper* No. 15, 1932. See this *J.*, 1932, **50**, 763. —P. M. C. R.

The Changes in the Magnetic Resistance of Nickel After Transverse Magnetization at Various Temperatures. Angelo Drigo (*Atti R. Istituto Veneto Sci. Venezia*, 1932, **91**, II, 173–214; *Chem. Zentr.*, 1933, **104**, I, 27–28).—The changes in the resistance of nickel wires magnetized perpendicular to the longitudinal axis at temperatures between 20° and 420° C. in fields up to 1600 gauss have been measured, and the results are discussed with reference to Gerlach's ideas of the mechanism of longitudinal magnetization.—A. R. P.

The Chemical and Physical Characteristics of the Photoelectrically-Active Hydrogen Content of Platinum and Palladium. G. Bethe (*Z. Physik*, 1933, **80**, 701–725).—The dependence of the photoelectric effect exhibited by either platinum or palladium containing adsorbed hydrogen on the purity of the gas is investigated experimentally.—J. S. G. T.

Precise Determination of the Magnetic Moments of Potassium and Lithium in Relation to their Magnetic Nuclear Moment. W. Meissner and H. Scheffers (*Physikal. Z.*, 1933, **34**, 48–53).—Read at the VIII Deutsche Physikertag, Sept., 1932. The molecular magnetic moment of potassium and lithium, and accordingly the value of the Bohr magneton, is found to be $0{\cdot}916 \times 10^{-20}$ gauss with a possible error of about 5 parts per 1000. The nuclear moment of lithium is at most 0·5–5% of a Bohr magneton. The values of the heats of dissociation of these metals, deduced from these results, agree to within about 5% with those given by Lewis.—J. S. G. T.

On the Possibility of Following the Recrystallization of Silver by Surface Colouring with Ferric Chloride. Ernst Beutel and Artur Kutzelnigg (*Monatsh.*, 1932, **61**, 189–198).—On treating silver which has been melted and allowed to cool with ferric chloride solution it becomes covered with a dirty reddish-white film of silver chloride; the corresponding film on hard-rolled silver and on worked silver which has been annealed at a high temperature is chocolate-coloured. Intermediate coloured films are obtained at intermediate annealing temperatures, a maximum of brightness being obtained after annealing at 300°–400° C. and a minimum after annealing at 600°–650° C. With increasing annealing temperatures above 500° C. there is a rapid decrease in the rate of corrosion of silver by ferric chloride solution. Prior etching with nitric acid modifies the colour of the film obtained by a subsequent etching with ferric chloride. There appears to be some relationship between the etch colours produced by ferric chloride and the grain-size and crystallographic orientation of the crystals.—A. R. P.

On the Diffusion of Silver and Copper into Glass. Joseph Halberstadt (*Z. anorg. Chem.*, 1933, **211**, 185–194).—According to Nernst's law of distribution, metals dissolve in glass in the monatomic state. The diffusion constants (average values) of silver in glass are 1.14×10^{-8}, 1.31×10^{-8}, and 1.58×10^{-8} cm.^{2}/second at 565°, 590°, and 615° C., respectively, and that of copper 2.07×10^{-9} cm.^{2}/second at 650° C. The application of Stokes–Einstein's formula shows that the diffusion coeffs. are anomalously high, from which it is concluded that silver and copper are solvated in glass.—M. H.

Colloidal Solutions in Metals. E. Podszus (*Kolloid-Z.*, 1933, **62**, 346–347).—The following method gives rise to tungsten filaments, containing thorium dioxide in solid colloidal solution. A concentrated solution of ammonium tungstate is prepared, and thorium nitrate is added until the content of thorium dioxide is about 1·5%. Acid is added, the mixture dialysed, then evaporated to dryness, and the glass-like residue is reduced to metal by means of hydrogen and then ground to a fine powder. The filaments obtained by the usual means from this powder have little rigidity, but those obtained at temperatures above 1200° C. have a higher resistance and less tendency to sinter than those produced by the usual methods.—E. S. H.

Some Theoretical and Practical Aspects of Gases in Metals. Jack H. Scaff and Earle E. Schumacher (*Metals and Alloys*, 1933, **4**, 7–12).—The effects of temperature and pressure on the solubility of gases in metals are discussed with especial reference to the solubility of oxygen in silver, and methods are described for the determination of the gas content of metals. Recent work on vacuum melting of metals is reviewed.—A. R. P.

The Force of Adhesion Accompanying Solidification. A. Sellerio (*Physikal. Z.*, 1933, **34**, 180–181).—Determinations of the force necessary to detach ice frozen in contact with a metal plate indicate that the metals used and their molecular attractions are in the following order of magnitude: brass, 1; copper, 1·25; zinc, 1·33; aluminium, 1·38; iron, 1·49. It is suggested that solidification of a liquid is, in part, an electrical phenomenon. The force of adhesion of sulphur to aluminium is nil at the melting point of sulphur (114° C.) and increases, at first rapidly and then more slowly, to a limiting value of about 55 kg./cm.^{2} at 0° C. as the temperature is decreased.—J. S. G. T.

On the Rate of Softening of Cold-Deformed Metals by Crystal Recovery and Recrystallization. F. Sauerwald and W. Globig (*Z. Metallkunde*, 1933, **25**, 33–38).—Cf. this *J.*, 1932, **50**, 6, 110. Coarse-grained, fully-annealed copper cylinders (Brinell hardness 38) were compressed by a drop hammer at 200°–420° C., then annealed for different periods at various temperatures and quenched. No recrystallization occurred in 24 hrs. at 375° C. after a reduction of 19% under the hammer in the case of copper with an initial average grain-size (g) of 170 μ, but the Brinell hardness (H) gradually fell from 72 to 61, *i.e.* only crystal recovery with partial softening had taken place. With $g =$ 122 μ, H for metal compressed 20% at 420° C. and then annealed at this temperature fell from 74 to 65, 62, 52, 45, and 44 after 20, 40, 60, 90, and 120 minutes, respectively. Recrystallization became evident after 60–70 minutes and was almost completed after 90 minutes. The value of g has a large influence on the course of the isothermal softening, thus whereas with $g = 170\ \mu$ recrystallization is not apparent at 375° C. within 24 hrs., with $g = 140\ \mu$ it becomes visible after 3 hrs., and with $g = 115\ \mu$ it is complete in 3 hrs. Iron behaves similarly. It is concluded that there are 3 temperature ranges in which the relation of softening by crystal recovery to softening by recrystallization is very different. At low temperatures only crystal recovery occurs, and this never results in complete softening even after very long periods.

At the highest temperatures recrystallization is rapid and softening is soon completed. In the middle range crystal recovery is followed by softening by recrystallization which is only slightly affected by the relatively small number of nuclei which grow slowly; the rate of softening increases only after prolonged annealing when recrystallization is almost complete. This effect is characterized by an inflexion in the Brinell hardness–annealing time curve. In the middle range softening can be incomplete in spite of crystal growth. —M. H.

Theories of Strength. A. Nadai (*Amer. Soc. Mech. Eng. Preprint*, **1932**, (Dec.), 1–13).—A mathematical treatment is given of the problem of determining the conditions under which yielding starts in metals subjected to stress. —W. P. R.

Plasticity and Elasticity. A. Nadai (*Electric J.*, 1932, **29**, 510–512).—A general account of methods developed for studying the elastic behaviour and plastic flow of structures and machine parts.—J. C. C.

Measurements of the Pressure-Flow of Metals at Low Temperatures. R. Holm and W. Meissner (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1932, **16**, 24–27).—From *Z. Physik*, 1932, **74**, 736–739; see *J.*, 1932, **50**, 291.—M. H.

The Production of Specific Tensions by Stretching. V. Caglioti and G. Sachs (*Mitt. Material., Sonderheft* **21**, 1933, 49–52).—See this *J.*, 1932, **50**, 291.—J. W.

Recovery [of Metals] from the Effects of Cold-Work. G. Tammann (*Light Metals Research*, 1932, **2**, (18), 9–11).—A translation of extracts from *Z. Metallkunde*, 1932, **24**, 220–222. See this *J.*, 1932, **50**, 725.—J. C. C.

The Formation of Localized Slip Layers in Metals. C. W. MacGregor (*Metals and Alloys*, 1933, **4**, 19–22).—The effect of previous cold-work on the formation of flow layers in aluminium has been investigated in compression tests in which the specimens were provided with conical indentations on their ends fitting a pair of conical compression plates so that the "barrel effect" was eliminated. The cone angle for aluminium is about 14·6° to the horizontal. The results indicate that the more cold-deformation within certain limits that is done on a soft and ductile metal like aluminium the more pronounced will be the flow layers if it is again stressed to the plastic limit. —A. R. P.

The Tenacity of Polycrystalline Materials. W. Kuntze (*Z. Physik*, 1933, **81**, 80–81).—Tensile and tenacity tests of irregular-shaped test-pieces exhibit the difference between polycrystalline and single-crystal materials. It is concluded that the property of separation–cohesion is equally important with that of tenacity in the discussion of the properties of polycrystalline elastic bodies.—J. S. G. T.

The Fatigue of Metals—Its Nature and Significance. H. F. Moore (*Amer. Soc. Mech. Eng. Preprint*, **1932**, (Dec.), 1–3).—The essential feature of fatigue failure is a spreading crack. Studies of fatigue failure in single crystals of metal indicate that such cracks frequently start by slip along planes of atomic weakness. Whilst a ductile metal does not resist repeated stress better than a brittle material, a ductile metal does withstand occasional higher stresses without crack formation, and under such conditions it is better suited to withstand repeated stresses than is a brittle metal.—W. P. R.

Report of Research Committee [of A.S.T.M.] on Fatigue of Metals. H. F. Moore (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 138).—See this *J.*, 1932, **50**, 469.—S. G.

Summary of Present-Day Knowledge of Fatigue Phenomena of Metals. Corrosion-Fatigue of Metals. T. S. Fuller, P. F. Mumma, and H. F. Moore (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 139–142).—Appendix to Report of Research Committee on Fatigue of Metals. See preceding abstract and this *J.*, 1932, **50**, 469.—S. G.

The Significance and Limitations of Fatigue Test Results. R. E. Peterson and H. F. Moore (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 142–147).—Appendix to Report of Research Committee on Fatigue of Metals. See abstracts above and this *J.*, 1932, **50**, 469.—S. G.

Investigations on the Fatigue of Metals. R. Cazaud (*Usine*, 1931, **40**, (21), 37).—Cf. this *J.*, 1932, **50**, 530. Abstract of a brochure published by *Aéronautique*.—H. W. G. H.

On the Dependence of the Endurance Strength on the Crystal Orientation. W. Fahrenhorst, K. Matthaes, and E. Schmid (*Mitt. Material., Sonderheft* 21, 1933, 58–60).—See *J.*, this volume, p. 5.—J. W.

Increasing the Hardness of Metals by the Action of Rotating Magnetic Fields. E. G. Herbert (*Usine*, 1931, **40**, (34), 29).—See this *J.*, 1931, **47**, 196.—H. W. G. H.

Use of Metals at Elevated Temperatures [in the Ceramic Industry]. Clyde E. Williams (*Brick Clay Record*, 1932, **80**, 195–197).—See this *J.*, 1932, **50**, 532.—S. G.

Third Report of the Atomic Weights Commission of the International Union for Chemistry. G. P. Baxter, Mme. P. Curie, O. Hönigschmid, P. Lebeau, R. J. Meyer (*Ber. deut. chem. Ges.*, 1933, [A], **66**, 21–30).—The Commission accepts revised values for the following atomic weights : iodine 126·92, lanthanum 138·92. A complete table of atomic weights, referred to that of oxygen as 16, is given, and recent work on the subject is reviewed.—P. M. C. R.

The Chemical Elements and Atomic Types from the Standpoint of the Investigation of Isotopes. Otto Hahn (*Ber. deut. chem. Ges.*, 1933, [A], **66**, 1–14).—The International Commission for Atomic Weights proposes to retain the "chemical" standard, O = 16, but recognizes the adoption of a correction based on the Mecke–Childs value $O_{18} : O_{16} = 1 : 630$ in physical calculations involving isotopic oxygen. The demonstration of isotopes by spectroscopic methods, with the necessary revision of atomic weights, is recorded in the cases of lithium, oxygen, neon, scandium, zinc, selenium, strontium, niobium, tellurium, barium, tantalum, thallium, lead, eka-cæsium, hydrogen, boron, nitrogen, chlorine. Authenticated cases of isotopy are tabulated, with available relevant details.—P. M. C. R.

The Effect of Pressure on the Electrical Resistance of Fifteen Metals Down to Liquid Oxygen Temperatures. P. W. Bridgman (*Phys. Rev.*, 1932, [ii], **42**, 587).—Abstract of a paper read before the American Physical Society. Measurements made 15 years ago on the pressure coeff. of a number of metals between 0° and 100° C. have been extended to − 78° C. (solid carbon dioxide) and − 183° C. (liquid oxygen). In order to avoid freezing of the transmitting medium, pressure must be transmitted with gaseous helium. This introduces a number of difficulties of technique, which have been so far overcome that routine measurements have been made to 7000 kg./cm.^{2} at − 183° C. Over this range no very striking results have been found. Resistance decreases nearly linearly with pressure, perhaps even more linearly than at room temperatures. There is in almost all cases a numerical increase in the coeff. at low temperatures, but the increase is not usually large, the largest effect being a doubling of the coeff. of aluminium, and there is no simple correlation with other properties of the metal.—S. G.

The Effect of Homogeneous Mechanical Stress on the Electrical Resistance of Crystals. P. W. Bridgman (*Phys. Rev.*, 1932, [ii], **42**, 858–863).—Theoretical. The general methods of Voigt (*Lehrbuch der Kristallphysik*) are used to express the effect of mechanical stress on the electrical resistance of a conducting crystal. Symmetry considerations show that the effect can be expressed in terms of a set of constants, the number of which is equal to the number of elastic moduli, and connect the change of resistance by equations resembling those connecting strain with stress. The equations agree with the results of Allen (*J.*, this volume, p. 225) for bismuth crystals. They suggest that if tension is applied to a monocrystalline rod carrying a current, a transverse e.m.f. may be produced analogous to the Hall effect caused by a magnetic field.—W. H.-R.

Some Thermal Conductivities. L. C. Bailey (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 173–175).—A summary of a paper by B. in *Proc. Roy. Soc.*, 1931, [A], **134**, 57–76. See this *J.*, 1932, **50**, 4.—R. G.

New Methods for the Determination of the Heat Conductivity of Metals. F. Gabler (*Anz. Akad. Wiss. Wien*, 1931, **68**, 142).—See this *J.*, 1932, **50**, 293. —W. A. C. N.

Measurements Employing Liquid Helium. XIII.—Contact Resistance between Super- and Non-Super-Conductors. R. Holm and W. Meissner (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1932, **16**, 1–21).—Reprint from *Z. Physik*, 1932, **74**, 715–735; see this *J.*, 1932, **50**, 344.—M. H.

The Effect of Plastic Deformation on the Superconductivity of Dia- and Paramagnetic Metals. A. Kussmann and H. F. Seemann (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1932, **16**, 261–274).—Reprint from *Z. Physik*, 1932, **77**, 567–580; see this *J.*, 1932, **50**, 660.—M. H.

On the Stress–Elongation Diagram of Ferromagnetic Materials under Very Small Loads. H. Kühlewein (*Z. tech. Physik*, 1932, **13**, 539–541).—The elastic behaviour of wires of copper, nickel, and a 50 : 50 nickel–iron alloy under small deformations such as correspond with the stresses produced by magnetostriction have been investigated by delicate measurements during loading and unloading. The observed elastic after-effects after rapid removal of load have been compared with the simultaneous changes in permeability, and a very close relationship has been established.—J. W.

Some Properties of Homogeneously Distorted Cubic Ferromagnetic Lattices. Francis Bitter (*Phys. Rev.*, 1932, [ii], **42**, 697–708).—Theoretical. The work of Becker and Kersten (this *J.*, 1930, **44**, 456) on the magnetic properties of distorted lattices is extended in such a way that the assumption of an isotropic medium is avoided, and the problem treated with special reference to the crystallographic symmetry. The theoretical results are in qualitative agreement with data for the magnetostriction and magnetization of nickel, iron, and nickel–iron alloys under tension and compression.—W. H.-R.

The Theory of the Ferromagnetic Anisotropy of Single Crystals. Richard M. Bozorth (*Phys. Rev.*, 1932, [ii], **42**, 882–892).—The method of Heisenberg (see this *J.*, 1931, **47**, 374) is extended so as to permit the calculation of the magnitude and direction of magnetization in a single crystal corresponding with selected values of the component of magnetization in the field direction. These may be calculated for any direction of the field with respect to the crystal axes. Diagrams are given for a number of directions, and the results are in fair agreement with the observations of Honda and Kaya (*Sci. Rep. Tôhoku Imp. Univ.*, 1926, [i], **15**, 72) for crystals of iron.—W. H.-R.

The Electron Theory and Magnetism. F. W. Constant (*Trans. Electrochem. Soc.*, 1932, **61**, 275–279).—The electrons in a metal are classed as (1) free, (2) bound, and (3) partly bound, and the magnetic contributions of each type are discussed. It is first shown that the partly-bound electrons are responsible for the structure sensitiveness of the magnetic properties, and then that other structure sensitive properties in general may be attributed to these electrons. As the effect of these electrons depends on the orderliness of their distribution, such properties are crystalline rather than atomic ones. In the discussion, in which *J. Schulein*, *P. H. Brace*, *C. G. Fink*, and *F. W. Brooke* took part, it was stated that certain silver–aluminium–magnesium alloys display greater magnetic hardness than Honda's steel. With reference to the temperature effects on magnetism, when the former is raised thermal agitation commences and thus any orderly arrangement of the atoms and electrons is broken up.

This appears to induce an increase in paramagnetism and a decrease in diamagnetism and ferromagnetism.—W. A. C. N.

Optical and Photoelectric Investigations Relating to Thin Metal Sheets. Rudolf Schulze (*Physikal. Z.*, 1933, 34, 24–37).—An investigation of the photoelectric and optical characteristics of thin gold foil is detailed. The refractive index and extinction coeff. of thin sheets of this metal appear to be constant up to a thickness of 2 mμ. A *bibliography* comprising references to 72 papers referred to in the text is appended.—J. S. G. T.

The Emission of Positive Ions from Heated Metals. Le Roy L. Barnes (*Phys. Rev.*, 1932, [ii], 42, 487–492).—Cf. this *J.*, 1932, **50**, 726. When a metal is heated to a high temperature, two kinds of positive ions may be emitted, namely, (1) positive ions of impurities, usually alkali metals, which may be reduced to zero by sufficient heating, and (2) positive ions of the metal itself. By analyzing the positive-ion emission in a mass spectrograph, B. shows that iron, nickel, copper, rhodium, and columbium emit singly-charged ions of their own metals, as well as those of impurities. In agreement with the results of Wahlin (this *J.*, 1932, **50**, 219) no positive ions of uranium or thorium were detected with these metals.—W. H.-R.

The Temperature Variation of the Positive Ion Emission from Molybdenum. Le Roy L. Barnes (*Phys. Rev.*, 1932, [ii], **42**, 492–497).—Cf. preceding abstract. The temperature variation of the positive-ion emission from molybdenum after thorough outgassing and heat-treatment has been measured in two different types of tube. The mean values of the positive-ion work function determined in the two tubes were 8·14 and 8·20 v., respectively. The reflection coeff. indicates that about one ion out of ten striking the surface is condensed. The results are in better agreement with the theory of L. P. Smith (this *J.*, 1930, **44**, 462) than were the earlier data which Smith obtained.—W. H.-R.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 181–187.)

An Interesting Destruction Phenomenon Observed in an Aluminium Alloy. O. Greger (*Mitt. Staatl. tech. Versuchsamtes* (*Wien*), 1931, **20**, 36–39; *Chim. et Ind.*, 1932, **28**, 1339–1340; *C. Abs.*, 1933, **27**, 1306).—The alloy contained aluminium 55, zinc 45%, traces of lead, and was free from antimony, tin, and copper. A 33-mm. cube was compressed until the edge had decreased 38%; the free faces were bulged, whilst the faces in contact with the plattens of the press remained plane. A rolled sheet 1·6 mm. of the same alloy was fairly strong, although flexible. At the end of 9 years the originally flat faces were concave (deflection of 3·2 mm.), and numerous fissures disintegrated the cube; the surface of the metal sheet flaked off and only the central portion retained some of its original properties. These swelling phenomena are doubtless due to a progressive separation of crystallites composed of aluminium and zinc and to a repulsion of the crystals formed in the course of years.—S. G.

Compression Stressing of Rolled Light Alloys. G. Guidi (*Alluminio*, 1933, **2**, 14–17).—Two alloys of the Duralumin type, having the same tensile strength and elastic limit, showed in the construction of riveted structures for seaplanes quite different behaviour in the areas which, in service, had been subjected to compression stresses. Numerous tests have shown a difference of 12–15% in the compression strength of " 17 ST " and Alclad as compared with Dürener A.-G. Duralumin.—G. G.

Developments in Aluminium Alloys in Relation to Economies in Aircraft Construction. C. F. Nagel and G. O. Hoglund (*Amer. Soc. Mech. Eng. Preprint*, **1932**).—The mechanical properties and corrosion resistance of aluminium-alloy structural material are reviewed.—W. P. R.

Researches on the Aluminium-Rich Binary Alloys of Aluminium and Manganese. M. Bosshard (*Alluminio*, 1932, 1, 361–367).—A lengthy account of a paper already abstracted. See *J.*, this volume, p. 10.—G. G.

Static and Dynamic Properties of Sand-Cast Light Alloys. W. Saran (*Alluminio*, 1932, 1, 368–376).—From *Z. Metallkunde*, 1932, 24, 181–184, 207–210. See this *J.*, 1932, 50, 726.—G. G.

A Review of Recently-Introduced Aluminium Alloys. W. C. Devereux (*J. Inst. Production Eng.*, 1930, 9, 169–185).—See this *J.*, 1931, 47, 649.
—J. C. C.

The Equilibrium Diagram of the Chromium–Carbon System. Kazue Hatsuta (*Tech. Rep. Tôhoku Imp. Univ.*, 1932, 10, 186–194).—[In English.] See this *J.*, 1931, 47, 337.—A. R. P.

On Polynary Systems with Iron. V.—X-Ray Supplements on the Systems Chromium–Carbon and Iron–Silicon–Phosphorus. F. Sauerwald, W. Teske, and G. Lempert (*Z. anorg. Chem.*, 1933, 210, 21–25).—Cf. this *J.*, 1932, 50, 728. X-ray analysis has confirmed the existence of a stable system and a metastable system with relatively large stability in the chromium-rich chromium–carbon alloys. The stable eutectic with 4·2% carbon consists of practically carbon-free chromium and the cubic carbide Cr_4C, the metastable eutectic with 4·5% carbon consists of chromium and a hexagonal carbide the formula of which is Cr_7C_3, according to Westgren and Phragmén. In the metastable state alloys with 6·4–8·5% carbon consist of Cr and Cr_7C_3, on annealing this structure transforms into Cr_4C and Cr_7C_3.—M. H.

The Binary Systems Cobalt–Tungsten and Cobalt–Molybdenum. W. Köster and W. Tonn (*Z. Metallkunde*, 1932, 24, 296–299).—The transformations in the solid state of alloys of cobalt with up to 40% tungsten or molybdenum have been studied by dilatometric, magnetic, and micrographic investigations. (1) The solid solubility of tungsten in cobalt decreases from 39% at 1480° C. (eutectic temperature) to about 14% at 400° C. With increasing tungsten content the temperature of the $\varepsilon \rightleftharpoons \gamma$ transformation of cobalt is raised from 400° C. to 1040° C. (at which temperature the γ-solid solution (28·5% tungsten), the ε-solid solution (about 30% tungsten) and the compound CoW are in equilibrium), and the magnetic transformation point is lowered gradually from 1140° C. to about 700° C. when it occurs simultaneously with the $\varepsilon \rightleftharpoons \gamma$ transformation. The ε-phase saturated with tungsten has a magnetic transformation point at 825° C. Alloys quenched at 1300° C. show a large increase in hardness and coercive force on subsequent ageing at temperatures between 600° and 1000° C. (2) The constitution and behaviour of the cobalt–molybdenum alloys are analogous. The solid solubility of molybdenum decreases from 27·5% at 1325° C. (eutectic temperature) to about 8% at 400° C. The temperature of the $\varepsilon \rightleftharpoons \gamma$-transformation is increased up to 920° C., where the γ-solid solution (20% molybdenum), the ε-solid solution (22% molybdenum) and the compound CoMo are in equilibrium. Molybdenum lowers the magnetic transformation point of cobalt gradually to about 700° C. where it coincides with the $\varepsilon \rightleftharpoons \gamma$-transformation. The ε-phase saturated with molybdenum has a magnetic transformation point at about 750° C.—M. H.

Aluminium–Bronze: Influence of Iron on the Dimensions of the Crystals. C. Vickers (*Bull. Assoc. Tech. Fonderie*, 1932, 6, 161–162).—From *Foundry*, 1931, 59, (9), 55–57; cf. this *J.*, 1931, 47, 517.—W. A. C. N.

Cast "Aluminium–Bronzes." W. Claus and F. Goederitz (*Bull. Assoc. Tech. Fonderie*, 1932, 6, 154–160).—From *Giesserei*, 1930, 17, 153–155; 182–186; 1017–1023; 1931, 18, 319–326. Cf. this *J.*, 1930, 43, 456; 1931, 47, 408; 1932, 50, 13.—W. A. C. N.

Beryllium-Copper—Cast Condition. Anon. (*Machinist* (*Eur. Edn.*), 1933, 77, 25E).—The use of beryllium–copper in the cast condition, precipitation hardened, is based on the increase in hardness and tensile strength with the beryllium content. The heat-treatment and working and the advantages of these alloys are described. In addition to favourable mechanical properties, these alloys, owing to deoxidizing effects of the beryllium, have a high electrical conductivity, and the beryllium does not cause detrimental surface defects on the castings.—J. H. W.

Atomic Arrangement and Magnetic Properties in the Systems Copper–Gold, Copper–Palladium, and Copper–Platinum. H. F. Seemann (*Z. Metallkunde*, 1932, **24**, 299–301).—The composition–atomic magnetic susceptibility curve of copper–gold alloys quenched from just below the solidus (in which state the atoms are irregularly distributed in the crystal lattice) is slightly convex to the axis of composition, *i.e.* in the direction of stronger diamagnetism. If the alloys corresponding with the composition Cu_3Au and CuAu are subsequently annealed at 300°–400° C. the atomic distribution becomes regular, and the diamagnetism increases by about 20% for Cu_3Au and decreases by about 20% for CuAu. The alloys corresponding with the composition Cu_3Pt and Cu_3Pd are also diamagnetic in the quenched state (in spite of the addition of paramagnetic platinum and palladium) and behave similarly to Cu_3Au on annealing, the increases in diamagnetism being about 25% and 50%, respectively.—M. H.

The [Magnetic] Susceptibility and Electrical Conductivity of Copper–Manganese Alloys. S. Valentiner and G. Becker (*Z. Physik*, 1933, **80**, 735–754).—Cf. *J.*, this volume, p. 71. The magnetic susceptibilities and electrical conductivities of the complete series of copper–manganese alloys have been determined between room temperature and − 192° C. The alloy containing 1 atom of manganese and 3 atoms of copper is characterized by a maximum susceptibility at all temperatures. The Curie–Weiss law for the dependence of susceptibility on temperature is obeyed by all the alloys down to a little below − 60° C. At no temperature do the alloys exhibit ferromagnetic properties. The specific electrical resistance at room temperature increases with increasing manganese content from $0{\cdot}31 \times 10^{-4}$ ohm.cm. in the case of the alloy containing 10% (atomic) of manganese to $1{\cdot}73 \times 10^{-4}$ ohm.cm. for the alloys containing 90% (atomic) of manganese. The ratio R_{-183°/R_{20} in the case of alloys containing 10–70% of manganese is 0·92; the corresponding temperature coeff. of resistance is about 0·0004. The specific resistance of pure manganese at 20° C. is approximately $0{\cdot}28 \times 10^{-4}$ ohm.cm.; the corresponding temperature coeff. is 0·0039.—J. S. G. T.

On the Thermal Expansion of Manganin. A. Schulze (*Z. tech. Physik*, 1933, **14**, 89–90).—Between 20° and 500° C. the thermal expansion of Manganin (copper 86, manganese 12, and nickel 2%) is given by the expression $\Delta l = 1{\cdot}776\tau + 0{\cdot}0355\tau^2$, where τ = temperature in ° C. × 10^{-2} and Δl = change in length in mm. of 1 m. Slight variations in the composition have little effect.—J. W.

Copper–Tin Alloys. I.—Bronzes. Anon. (*Tin*, **1933**, Feb., 15–18).—The composition, principal properties, and applications are given of true bronzes, bearing bronzes, and phosphor–bronzes and silicon–bronzes.—J. H. W.

Directional Properties in Cold-Rolled and Annealed Commercial Bronze. Arthur Phillips and Carl H. Samans (*Metal Stampings*, 1932, **5**, 598).—Short abstract of a paper read before the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers. See this *J.*, 1932, **50**, 661.
—J. H. W.

Heading Properties of Brass Wire. D. K. Crampton (*Metal Progress*, 1933, **23**, (3), 21–24).—The alloy most used in heading contains about 65% copper, a little lead, and the remainder zinc. The aim of the present investigation is to determine the effect of variations in composition, and also the influence of initial temper in the ease of the process and on final quality. The results in the case of 16 different samples of given temper and composition are tabulated, the qualities considered being tensile strength, percentage elongation, and tendency to buckling, folding, shearing, and surface roughening. The system of rating is explained and illustrated, and conclusions for moderately worked and for re-headed material are given. Effects of varying composition are graphically recorded.—P. M. C. R.

High-Strength Brass. O. W. Ellis (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 83–88).—From *Trans. Bull. Amer. Found. Assoc.*, 1930, **1**, (4), 65–83. Cf. this *J.*, 1930, **43**, 468.—W. A. C. N.

A Simplified Method of Making Special [Nickel- and Manganese-] Brasses. A. Le Thomas (*Mech. World*, 1932, **92**, 334).—Abstract from *Rev. Mét.*, 1931, **28**, 518–523. See this *J.*, 1932, **50**, 15.—F. J.

Nickel in High Tension Brasses [Turbadium]. Anon. (*Nickel Bulletin*, 1933, **6**, 18).—Turbadium contains copper 50, zinc 45, nickel 2–2·25, iron 0·8–1·0, tin 0·5, and manganese 1·5–2·0%. The use of the nickel is to increase the resistance to erosion, and thus to render the alloy especially suitable for the manufacture of ships' propellers.—J. H. W.

Nickel in Foundry Brasses and Bronzes. Anon. (*Met. Ind.* (*N.Y.*), 1932, **30**, 466–467).—The tensile strength, resistance to compression, and yield-point of 11% tin-bronze, 85 : 5 : 5 : 5 red brass, yellow brass with 1% tin and 2% lead, G-bronze with 8% tin and 4% zinc, 80 : 10 : 10 lead bearing bronze, and 6 : 20 : 74 tin-lead bronze are considerably improved by addition of 0·5–3% nickel. As little as 0·5% nickel in bronze widens the casting range, increases the fluidity, reduces the intercrystalline shrinkage pores, increases the density, and reduces the porosity.—A. R. P.

Precious Metal Alloys. R. C. Brumfield (*Trans. Amer. Soc. Steel Treat.*, 1932, **19**, 333–355; discussion, 355–367).—The composition and properties of dental alloys and solders are discussed and an account is given of the effect of heat-treatment in improving the strength and hardness. Apparatus and methods for testing the hardness, tensile strength, and torsion properties are also described, and a bibliography of recent papers on gold alloys is included. No new results are recorded.—A. R. P.

The Alloys of Gold with Antimony. A. T. Grigoriev (*Z. anorg. Chem.*, 1932, **209**, 289–294).—See abstract from *Izvestia Platinago Instituta* (*Ann. Inst. Platine*), **1929**, (7), 45–51; see this *J.*, 1930 **44**, 502.—M. H.

On the System Gold–Manganese. H. Moser, E. Raub, and E. Vincke (*Mitt. Forschungsinst. Edelmetalle*, 1933, **6**, 109–113, 129–136).—An account of work the results of which have been published in *Z. anorg. Chem.*, 1933, **210**, 67; see *J.*, this volume, p. 124.—A. R. P.

Contribution to the Knowledge of the Electrolytic Potential and the Constitution of Gold Amalgams. Robert Kremann and Robert Baum [with Ludwig Lämmermayr, Jr.] (*Monatsh.*, 1932, **61**, 315–329).—Up to 75% gold the gold amalgams have the same potential as mercury, and hence all compounds which contain more mercury than corresponds with Au_3Hg must be considered as non-resistant compounds from the point of view of Tammann's rule. Alloys with more than 75% gold have practically the same potential as pure gold.—A. R. P.

Measurements Employing Liquid Helium. XIX.—Researches on Alloys of the Lead–Thallium and Lead–Bismuth Series with Respect to Superconductivity. W. Meissner, H. Franz, and H. Westerhoff (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1932, **16**, 201–218).—Reprint from *Ann. Physik*, 1932, [v], **13**, 967–984; see this *J.*, 1932, **50**, 604.—M. H.

X-Ray Determination of the Solubility of Manganese in Magnesium. E. Schmid and G. Siebel (*Mitt. Material., Sonderheft* **21**, 1933, 21–23).—See this *J.*, 1932, **50**, 155.—J. W.

On the Equilibrium Diagram of the Magnesium–Zinc Alloys. A. A. Botchvar and I. P. Welitschko (*Z. anorg. Chem.*, 1933, **210**, 164–165).—The diagram proposed is based on the work of Chadwick (this *J.*, 1928, **39**, 285) and Hume-Rothery and Rounsefell (this *J.*, 1929, **41**, 119), and on B. and W.'s microscopic examination of alloys with 33–42 atomic % magnesium; it shows the existence of the compounds $MgZn_5$, $MgZn_2$, and MgZn, but contrary to the work of H.-R. and R., but in accordance with that of C., $MgZn_2$ is shown as forming solid solutions with zinc and especially magnesium.—M. H.

Influence of Carbon on the "Annealing-Brittleness" of Nickel and Its Alloys. Tokushichi Mishima (*J. Min. Inst. Japan*, 1928, (**518**), 417–446; *Japanese J. Eng. Abs.*, 1932, **8**, 83).—[In Japanese.] See this *J.*, 1931, **47**, 76, 269.—S. G.

Heat-Resistant Special Alloys of the Nickel–Chromium–Iron Group. Wilhelm Herrmann (*Feuerungstechnik*, 1932, **20**, 114–116; *Chem. Zentr.*, 1933, **104**, I, 666).—The brittleness of nickel–chromium alloys in hot gases containing sulphur compounds is reduced by addition of 10–20% iron. Their technological properties are improved by 0·4–0·5% carbon, but if magnesium is used as deoxidizer not more than 0·1% carbon must be present. The best mechanical working properties are obtained with less than 0·05% carbon. The mechanical properties of numerous binary and ternary alloys of this type at temperatures up to 500° C. are tabulated, and the effects of small amounts of other metals on the heat-resisting properties are discussed. Silicon improves the resistance to scaling at high temperatures, but molybdenum and tungsten have a bad effect when the chromium content is less than 10% and a good effect when the chromium exceeds 20%.—A. R. P.

The Properties of Monel Metal. With Special Reference to Power Plant Equipment. Anon. (*Monel Metal* (published by Henry Wiggin and Co., Ltd.), **1933**, 1–8).—The physical and mechanical properties of Monel metal in various states of annealing and working are tabulated and its applications to power plant equipment are illustrated.—J. H. W.

Technical Materials of High Magnetic Softness. F. Stäblein (*Z. tech. Physik*, 1932, **13**, 532–534).—A rapid and accurate method of measuring very small coercivities with the ballistic galvanometer is described. The properties of some technical nickel–iron alloys with low coercivity are discussed.—J. W.

"After-Effect Losses" in Ferromagnetic Materials in Weak Alternating Fields. R. Goldschmidt (*Z. tech. Physik*, 1932, **13**, 534–539).—Besides losses due to eddy currents and hysteresis, additional losses ("after-effect losses") occur in alternating fields; these can be observed particularly well in weak fields, and in many materials they are the predominating losses. This applies especially to iron–nickel alloys in the middle composition ranges; the effect of temperature and frequency in these cases has been investigated.—J. W.

Propagation of Large Barkhausen Discontinuities [in Nickel–Iron Alloys]. III.—Effect of a Circular Field with Torsion. L. Tonks and K. J. Sixtus (*Phys. Rev.*, 1933, [ii], **43**, 70–80).—Cf. previous note, *Phys. Rev.*, 1932, [ii], **41**, 539; see this *J.*, 1932, **50**, 664. The propagation of large Barkhausen discontinuities in wires has been studied under conditions in which the main field, H, was supplemented by a transverse field, H_t, produced by passing a current through the wire, which could be subjected to combined torsion and tension. Critical field characteristics were obtained from which relations were found between the strain and the critical field. These show that the component of the applied field along the direction of maximum extension is almost solely effective in causing the large Barkhausen jump. The component perpendicular to the principal strain axis along which the extension is a maximum has no effect on the reversal of magnetization. This shows that the principal strain axis is a direction of preferred orientation of magnetization, in agreement with R. Becker's theory relating direction of magnetization to strain. The departures from the simple ideal case are discussed in detail.—W. H.-R.

The Alloys of Palladium with Antimony. A. T. Grigoriev (*Z. anorg. Chem.*, 1932, 209, 308–320).—See abstract from *Izvestia Platinago Instituta* (*Ann. Inst. Platine*), 1929, (7), 32–44; this *J.*, 1930, 44, 511.—M. H.

On the Magnetic Susceptibility of Ferro-Silicons Rich in Silicon. C. H. Bedel (*Compt. rend.*, 1933, 196, 262–264).—The magnetic susceptibility of ferro-silicons containing more than 30% silicon and its variation with different kinds of heat-treatment have been investigated. There is a marked maximum of this property at about 50% silicon, which confirms the existence of the silicide, $FeSi_2$, found by other methods.—J. H. W.

On the Behaviour of Phosphorus to Copper and Silver.—I. K. W. Fröhlich (*Mitt. Forschungsinst. Edelmetalle*, 1932, 6, 69–74).—A lengthy summary of a paper in *Z. anorg. Chem.*, 1932, 208, 225; see this *J.*, 1932, 50, 734.—A. R. P.

Cemented Tantalum Carbide Tools. Floyd C. Kelley (*Trans. Amer. Soc. Steel Treat.*, 1932, 19, 233–243; discussion, 243–246).—See this *J.*, 1932, 50, 81.—S. G.

On the Thermo-Electric Forces in the Systems Tellurium–Sulphur and Tellurium–Selenium. A. Petrikaln and Konst. Jacoby (*Z. anorg. Chem.*, 1933, 210, 195–202).—(1) The thermo-electric force (e.m.f.) against silver has been determined of the systems tellurium–sulphur between 0 and 23% sulphur and tellurium–selenium between 0 and 40% selenium. Addition of sulphur to tellurium increases the e.m.f. considerably up to a maximum at 1·5–1·6% sulphur (limit of solid solubility), then gradually decreases it. The e.m.f. of the system tellurium–selenium increases rapidly up to 5% selenium, then more slowly. Two specimens of "Kahlbaum" tellurium gave an e.m.f. against silver of 430 and 550 microvolts/° C., respectively, whereas distilled tellurium gave 300–370. The high e.m.f. given by one of the "Kahlbaum" specimens is due to the presence of selenium and sulphur. The e.m.f. of this specimen was not so much influenced by different rates of cooling as was that of distilled tellurium.—M. H.

On the Recrystallization of Tin-Rich Solid Solutions. A. A. Botchvar and N. E. Merkurjew (*Z. anorg. Chem.*, 1933, 210, 161–162).—The recrystallization at 180° C. of tin containing 0·5–1·5% antimony, lead, bismuth, copper, and aluminium was investigated after cold-deformation in the Brinell machine. The recrystallization power of tin is decreased on alloying, the decrease being smallest for antimony and largest for aluminium in the order given above. The specific influence of the added metal is the larger the smaller the solid solubility in tin (with the exception of bismuth). In this respect the effect of soluble additions on the recrystallization power is similar to that on hardness and electrical conductivity.—M. H.

Properties of Zamak Alloys Used for Die-Castings. Anon. (*Machinery* (*N.Y.*), 1933, 39, 376A).—Tabulated physical data.—J. C. C.

Nitriding of Metals. Daikichi Saito and Hataji Okawa (*Suiyokai-shi*, 1932, 7, 23–49; *C. Abs.*, 1933, 27, 1301).—[In Japanese.] Manganese, chromium, aluminium, iron, nickel, and cobalt powders were nitrided for 5 hrs. in a stream of NH_3 at a temperature of 100°–1000° C. Iron, manganese, and chromium were easily nitrided at 500°–700° C., but the nitrides formed were decomposed above these temperatures; nitriding of chromium began at about 500° C., and it proceeded with increase of temperature. Aluminium was a little more difficult to nitride, and its nitride was unstable at higher temperatures. It was also difficult to nitride cobalt and nickel, and their nitrides were very unstable.—S. G.

On Transformations in Eutectoid Alloys. N. Ageew and G. Kurdjumov (*Physik. Z. Sovietunion*, 1932, 2, 146–148; *Chem. Zentr.*, 1933, 104, I, 559).—Investigations on the copper–aluminium eutectoid show that in the transformation of the β-phase reactions occur similar to those in the austenite transformation in steel. With insufficiently rapid cooling the β decomposes into $\alpha + \gamma$, but with rapid cooling β is converted into β', which has an acicular structure resembling martensite and the β'-crystals are regularly oriented with respect to the original β. From pole figures and X-ray photographs it appears that the β'-lattice deviates only slightly from a cubic lattice and can be considered, like the tetragonal martensite lattice, as a distorted cubic lattice. The symmetry of this distortion has not yet been determined. It is concluded that the β'-phase is an unstable, supersaturated solid solution of aluminium in copper which is produced by deformation of the lattice without diffusion. —A. R. P.

Average Strength Data for Non-Ferrous Metals.—III. Anon. (*Machinery* (*N.Y.*), 1933, **39**, 376A).—Average tensile data for copper and magnesium alloys, copper, and lead are tabulated.—J. C. C.

Influence of Composition of Bearing Alloys. C. Upthegrove (*Bull. Assoc. Tech. Fonderie*, (Suppt.), 1932, **6**, 88–89).—From *Foundry*, 1931, **59**, 72–74; cf. this *J.*, 1932, **50**, 734.—W. A. C. N.

Effect of Temperature upon the Charpy Impact Strength of Die-Casting Alloys. Bert E. Sandell (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 359–362).—See this *J.*, 1932, **50**, 477.—S. G.

The Age-Hardening of Metals. Paul D. Merica (*Aciers spéciaux*, 1933, **8**, 19–30).—Read before the American Institute of Mining and Metallurgical Engineers. See *J.*, this volume, p. 74.—J. H. W.

On the Theory of Formation of Segregate Structures in Alloys. C. H. Mathewson and D. W. Smith (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 264–271; discussion, 271–273).—See this *J.*, 1932, **50**, 478.—S. G.

Tensile Properties of Rods and Wires at Low Temperatures. F. Pester (*Mech. World*, 1932, **92**, 534).—Abstract of paper in *Z. Metallkunde*, 1932, **24**, 67–70, 115–119; see this *J.*, 1932, **50**, 431.—F. J.

Influence of Electromagnetic Waves on the Resistivity and Hardness of Metals and Alloys. G. Mahoux (*Technique moderne*, 1931, **23**, 642–643).—A note presented to the Académie des Sciences. See this *J.*, 1931, **47**, 228; *J.*, this volume, p. 74.—H. W. G. H.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 187–193.)

Etching Characteristics of Constituents in Aluminium Alloys. Anon. (*Metal Progress*, 1933, **23**, (2), facing p. 45).—A tabulated summary of etching methods, with approximate times and temperatures; the characteristic behaviour of 20 common micro-constituents of light alloys is given for etches with 0·5% hydrofluoric acid, 1% caustic soda, 20% sulphuric acid, 25% nitric acid, 10% caustic soda, and a mixture of 0·5% hydrofluoric acid, 1·5% hydrochloric acid, and 2·5% nitric acid.—P. M. C. R.

On the Structure of Hyper- and Hypo-Eutectic Alloys. A. A. Botchvar and K. W. Gorew (*Z. anorg. Chem.*, 1933, **210**, 166–167).—In a microscopic study of binary hyper- and hypo-eutectic alloys of antimony, lead, bismuth, cadmium, and tin (systems not specified) formation of envelopes (halos) of the second constituent around primary crystals of the other constituent was observed in all the systems, but it occurred in a particular system either only in hyper-eutectic or only in hypo-eutectic alloys, more especially around sharply limited primary crystals, *e.g.*, of bismuth or antimony. In the following list any metal forms a halo about any of those preceding it, but not about those following it: bismuth, antimony, cadmium, lead, tin.—M. H.

On the Structure of Some Ternary Eutectics. A. A. Botchvar and K. W. Gorew (*Z. anorg. Chem.*, 1933, **210**, 171–172).—Microscopic examination of the structures of the ternary eutectics cadmium–lead–bismuth, cadmium–lead–tin, cadmium–tin–bismuth has shown that the three constituents are not irregularly distributed. In the cadmium–lead–bismuth eutectic cadmium needles are surrounded by lead crystals, and these by a ground-mass of bismuth. It is concluded that the order of crystallization is determined by the number of crystallization centres, that component having the largest number crystallizing first.—M. H.

Veining or Sub-Boundary Structures. L. Northcott (*J. Iron Steel Inst.*, 1932, **126**, 267–280; discussion, 281–287).—For abstract of the paper see this *J.*, 1932, **50**, 614. *J. Gorschkov* stated that when hydrogen was evolved from molten copper *in vacuo*, ingots with a double structure resulted, light etching revealing a veined structure and deeper etching a crystalline one. The explanation given by N. could not apply, as there was almost certainly no cuprous oxide present in these ingots, owing to their being saturated with hydrogen. He considered that the veining was due to a solid solution of hydrogen in copper, the network representing a solution highly saturated with hydrogen. *W. D. Jones* doubted if veining was invariably due to oxide inclusions, and stated that it had previously been shown that mild quenching obliterated the structure and that veining could be produced in nickel and 67 : 33 copper–tin after etching in acidified ferric chloride. *H. O'Neill* confirmed N.'s conclusions and outlined a third method of removing veining in an X-ray vacuum after cold-working. *F. S. Tritton* thought that N. had been misled by his etching conditions and had reached wrong conclusions. He considered that specimens were usually not polished sufficiently well to show true crystal sub-boundaries on etching. In reply, N. agreed with G.'s explanation, but thought that the term veining should not be applied to that particular network as well as to ordinary crystal structure. He was not convinced by J.'s doubts as to the causative effects of oxygen, and completely disagreed with T.'s views as to the causes of veining.—J. H. W.

Grain Boundary of Aggregates of Metallic Crystallites. Keiji Yamaguchi (*J. Soc. Mech. Eng. Tokyo*, 1928, **31**, (136), 409–419; *Japanese J. Eng. Abs.*, 1932, **8**, 89).—[In Japanese.]—S. G.

The Lattice Spacings of Iron–Aluminium Alloys. A. J. Bradley and A. H. Jay (*J. Iron Steel Inst.*, 1932, **125**, 339–357; discussion, 358–361).—For abstract of the paper see this *J.*, 1932, **50**, 308. In the discussion *C. Sykes* stated that dilatometer curves of iron–aluminium alloys containing 11–17% of aluminium exhibited a change in direction at about 560° C., but without any definite discontinuity. Cooling curves also showed a slight evolution of heat at 560° C. A striking point is that the resistivity of these alloys is a function of the heat-treatment, although this property is independent of heat-treatment in alloys containing less than 11% of aluminium. The maximum effect is observed at about 14% of aluminium, and the phenomenon is completely reversible. A similar change is observed in the lattice-spacing curve when the aluminium content is about 14%. *E. W. Colbeck* said that an alloy containing aluminium 14, carbon 0·05, silicon 0·15%, and the remainder iron showed a very definite break in the resistivity–temperature curve at about 490° C. On quenching this alloy in water from 500° to 800° C. a decrease in hardness of 4 or 5 points on the Rockwell B scale was observed, which was particularly marked after very prolonged annealing at 550° C. The authors stated, in reply, that probably in the region 10–17% of aluminium a contraction due to the electronic interaction between iron and aluminium exactly compensated the expansion caused by substituting the smaller iron atoms by the larger aluminium atoms.—E. S. H.

Effect of Deformation (Pulverization) on the Superstructure Lines and Lattice Constants of an Iron–Aluminium Alloy. K. Schäfer (*Naturwiss.*, 1933, 21, 207).—Pulverized specimens of the regularly-oriented mixed phase (FeAl) of iron–aluminium with a grain-size of 10^{-4} cm. show no distinct superstructure lines; its lattice constant is 0·7% greater than in the massive state, but returns to normal after annealing.—J. W.

Single Crystals of the Intermediate Compound Antimony–Tin. H. S. van Klooster and M. D. Debacher (*Metals and Alloys*, 1933, 4, 23–24).—A single crystal of SnSb has been obtained by cooling the equiatomic alloy from 480° to 300° C. over a period of 15 hrs., using the apparatus of Obreimov and Schubnikov (*Z. Physik*, 1924, 25, 31). The compound has a simple cubic lattice of the NaCl type with 4 antimony and 4 tin atoms at the corners of the unit cell. The atomic distance is 3·061 A., which gives a calculated density of 6·918 compared with an observed density of 6·9104 ± 0·005 at 20° C. —A. R. P.

On the Transformation of Single Crystals of Cobalt. U. Dehlinger, E. Osswald, and H. Bumm (*Z. Metallkunde*, 1933, 25, 62–63).—The transformation of rod-shaped single crystals of cobalt from the face-centred cubic into the hexagonal form takes place in such a way that the angle between the rod axis and that octahedron plane along which slip occurs and which becomes the hexagonal base plane is smaller than any of the angles between the rod axis and the other octahedron planes of the cubic crystal. On heating above the transformation point and cooling, the crystal remains intact, the orientation being unchanged.—M. H.

Lattice Constants and Grain-Size in the Gold–Silver Alloys. P. Wiest (*Z. Physik*, 1933, 81, 121–128).—The lattice constants of gold–silver alloys, both polycrystalline and single-crystal, are investigated by X-ray analysis. The lattice constant of the polycrystalline material differs more and more from that of the single-crystal with increasing gold content, the difference attaining a maximum value in the case of the alloy containing 75% (atomic) of gold. The lattice constant of recrystallization grains alters only very slightly when the material is subjected to a subsequent very considerable increase of grain-size. Cast grains down to a size of about 0·5 mm.² have the same lattice constants as single crystals of like concentration.—J. S. G. T.

Lattice Structure of Indium. E. Zintl and S. Neumayr (*Z. Elektrochem.*, 1933, 39, 81–84).—Goniometric measurements of a crystal of indium confirm face-centred tetragonal structure derived by Hull and Davey from the powder diagram. Accurate measurements of the interference of pure indium in a mixture with sodium chloride as a reference gave: $a = 4·583 \pm 0·002$ A., $c = 4·936 \pm 0·002$ A., $c/a = 1·077 \pm 0·001$. Hence with indium = 114·8, it follows that the density is 7·308 (cf. 7·314 by the pyknometric method). —J. H. W.

Crystal Structure of β-Lanthanum. E. Zintl and S. Neumayr (*Z. Elektrochem.*, 1933, 39, 84–86).—The β-modification of lanthanum, stable at higher temperatures, gives the constants: $a_{La} = 5·296 \pm 0·002$ A., density = 6·17, and atomic radius in the duodecimal system, $r^{[12]}_{La} = 1·872$ A.—J. H. W.

On the Alloy Phases of the Type $NaPb_3$. E. Zintl and S. Neumayr (*Z. Elektrochem.*, 1933, 39, 86–97).—The crystal and lattice structure of the following compounds has been investigated: $CuPb_3$ (cubic, $a = 4·891$ A.), $SrPb_3$ (tetragonal, $a = 4·955$ A., $c = 5·025$ A., $c/a = 1·014$), $CePb_3$ (cubic, $a = 4·864$ A.), $CaTl_3$ (cubic, $a = 4·794$ A.), $CaSn_3$ (cubic, $a = 4·732$ A.), $CeSn_3$ (cubic, $a = 4·711$ A.).—J. H. W.

Structure and Chemical Composition of Some Metallic Alloys. [Manganese–Zinc and Cobalt–Zinc.] N. Parravano and V. Caglioti (*Mem. R. Accad. Italia. Classe: Chimica*, 1932, 3, (3), 1–21; *C. Abs.*, 1933, 27, 1307).—In the system manganese–zinc the ε-phase is hexagonal close-packed and analogous to the ε-phase of the bronzes. It is stable at ordinary temperature between 24·5 and 33% manganese and at temperatures above 293° C. between 24 and 12·5%

manganese. There are 2 atoms in the elementary cell. The lattice constant a_0 varies from 2·754 to 2·764 A. between 33 and 12·5% manganese. The γ-phase has a body-centred cubic structure and contains 52 atoms per elementary cell. The lattice constant a_0 varies between 9·11 and 9·13 A. This phase, which is analogous to the γ-phase of the bronzes, exists between 22·2 and 8·1% manganese at room temperature only. The alloys between 11·1 and 8·1% manganese contain in addition to the γ-phase another phase γ' or β' which could not be accurately identified on account of the insufficient crystallization of these alloys. The η-phase, consisting of a solid solution of 1–2% manganese in zinc, is unstable and changes on ageing to a eutectic of zinc and γ' or β' or $\gamma + (\gamma' + \beta')$. The formation of this phase is connected with Westgren's theory regarding the ratio of the number of valence electrons to the total number of atoms which express the chemical formula. Assuming a valence of -1 for manganese, the authors arrive at a formula of Mn_5Zn_{31} for the compound in the γ-phase (ratio 21 : 13) and of $MnZn_{11}$ for the compound in the ε-phase (ratio 7 : 4). The system cobalt–zinc was studied between the limits of 17 and 24% cobalt, and showed the existence in this interval of a γ-phase in which might be present a compound Co_8Zn_{31} (ratio 21 : 13).—S. G.

On the Capacity of the Elements to Form Negative Ions. E. Zintl and H. Kaiser (*Z. anorg. Chem.*, 1933, **211**, 113–131).—*Inter alia*, the crystal structures of the following compounds have been determined: Mg_2Sn, Mg_2Pb, and Mg_2Ge have a fluorite structure; $a = 6·765 \pm 0·002$ A., $6·836 \pm 0·002$ A., and $6·378 \pm 0·003$ A., respectively. Mg_2Tl, however, has a structure of still unknown nature. PtBi and PtPb have the NiAs structure; the structure of PtTl is still unknown.—M. H.

Lattice Forces and X-Ray Spectrum. R. Glocker (*Naturwiss.*, 1933, **21**, 27).—Amplification of earlier work (see *J.*, this volume, p. 18).—J. W.

On Precision Measurements of Lattice Constants by the Debye–Scherrer Method. K. Moeller (*Naturwiss.*, 1933, **21**, 61–62).—The influence of deviations from Bragg's simple reflection law of X-rays on the precision measurement of lattice constants has been calculated for some substances on the assumption of symmetrical reflection for various lattice planes. With unsymmetrical reflections very great deviations can occur according to the orientation of the lattice plane to the surface of the crystallite; these cannot be eliminated by calibration and have been investigated experimentally for finely-crystallized substances. The results will be given in a paper shortly to be published.—J. W.

A Suitable Standard Substance for the Precision Measurement of Lattice Constants by the Debye–Scherrer Method. K. Moeller (*Naturwiss.*, 1933, **21**, 223).—Thallous chloride best fulfils all practical requirements.—J. W.

IV.—CORROSION

(Continued from pp. 193–194.)

The Behaviour of a Single Crystal of Aluminium Subjected to Stressless Corrosion in a Stream of Tap Water Followed by Test to Destruction in Air, under Alternating Torsional Stresses. H. J. Gough and G. Forrest (*Aeronaut. Res. Cttee. R. and M.* No. **1476**, 1932, 1–11).—To determine whether the general pitting attack observed in some corrosion-fatigue experiments is influenced by the applied stress, observations have been made of the changes in microstructure of a single crystal of aluminium produced by slow oscillations (400/minute) in a slow stream of tap water without the application of straining forces. Comparison of the results with those obtained with a similar crystal subjected to cyclic stresses in running tap water shows that stress alone has little, if any, effect in promoting corrosion during corrosion-fatigue action; and that the fatigue strength is not appreciably affected by the corrosion which occurs during the stressless-corrosion stage.—A. R. P.

On the Action on Aluminium and its Alloys of Fuels Containing Alcohol. O. Bauer and G. Schikorr (*Automobiltech. Zeit.*, 1932, **35**, 583–589; and (abstract) *Z. Metallkunde*, 1933, **25**, 44).—The fuels investigated contained from 10 to 20% of alcohol of about 99·7% purity, the use of fuels of this alcohol content having recently been legalized in Germany. The metals and alloys tested were: half-hard aluminium sheet, Anticorodal AW 15 and Pantal sheet: also a perforated sample of aluminium sheet, coated by the Bauer–Vogel process. Mechanical properties and chemical composition are tabulated, as are some relevant properties of the selected fuels. The preparation of the samples, which were exposed for either 60 or 30 days to the corrosive action of fuels containing stated proportions of alcohol, with or without added water, is described, and the exposure apparatus is illustrated. The results are thus summarized: addition of alcohol up to 20% causes little attack unless more than 0·5% of water is present; attack becomes more marked, especially with the 20% alcoholic fuels, as the proportion of water rises. This applies to the alloys investigated as well as to aluminium. The MBV (Modified Bauer–Vogel) protective process affords complete protection.—P. M. C. R.

Investigations on Stress-Corrosion Cracks of Light Metals. P. Brenner (*Jahrb. deut. Versuchsanst. Luftfahrt*, **1932**, V65–71).—Reprinted from *Z. Metallkunde*, 1932, **24**, 145–151; see this *J.*, 1932, **50**, 738.—B. Bl.

[Corrosion-Resistance of a New Dental Alloy.] "Chrogo U42." H. Choulant (*Met. Ind.* (*Lond.*), 1932, **41**, 612).—Short abstract of an article from *Z. Metallkunde*, 1932, **24**, 263–264. See this *J.*, 1932, **50**, 739.—J. H. W.

Corrosion of Lead by Cement Mortar. Anon. (*Architect*, 1932, **132**, 215).—A case of mortar-corrosion is briefly considered, with reference to *Dept. Sci. Indust. Res.*, *Building Res. Bull.* No. **6**, 1930, 1–4, "The Prevention of Corrosion of Lead in Buildings"; see this *J.*, 1930, **43**, 497.—P. M. C. R.

Effect of p_H on Corrosion of Tin. J. M. Bryan (*Food Manuf.*, 1932, **7**, 82).—Abstracted from *Trans. Faraday Soc.*, 1931, **27**, 606; see this *J.*, 1932, **50**, 26.—E. S. H.

Exposure Tests on Plated Metals. Joint Committee of American Electroplaters' Society for Testing Materials and the Bureau of Standards (*Met. Ind.* (*N.Y.*), 1932, **30**, 226–227, 270–271).—Abstracted from the *Monthly Rev. Amer. Electroplaters' Soc.*, 1932, **19**, (5), 6–15. See this *J.*, 1932, **50**, 609–610.—I. M.

Corrosion-Fatigue of Metals. T. S. Fuller, P. F. Mumma, and H. F. Moore (*Mech. World*, 1932, **92**, 341–342).—Abstract from Report of Research Committee on Fatigue of Metals, American Society for Testing Materials. See this *J.*, 1932, **50**, 469.—F. J.

The Mechanics of Fluids and Ship Propulsion (Section on Cavitation). E. G. Barillon (*Science et Industrie*, 1933, **17**, (228), 5–9).—A summary of the conclusions reached by the first International Conference on the Mechanics of Fluids and Ship Propulsion, held at Hamburg, May 1932. The present state of knowledge as regards cavitation is far more practical than theoretical, and the work of the section was devoted to reviewing such aspects of the problem as its effects on performance, its connection with corrosion, its local incidence in tubing, and in blading of various types, and the nature of the resultant grooving.—P. M. C. R.

The Cause of the Corrosion of Vehicle Parts by Lubricants. —— Wawrziniok (*Automobiltech. Zeit.* (*Mitt. Inst. Kraftfahrwesen Sächs. Tech. Hochschule, Dresden*), 1932, **35**, 428–430).—A series of conductivity determinations on 70 samples of commercial lubricating oils and greases shows that although the permissible limits of fatty acid content are not exceeded, and in most cases are not reached, local electrolytic action may be the cause of severe corrosion. This may be reinforced by stray currents due to defective insulation. It is advisable, therefore, to specify high electrical resistance and low fatty acid content for lubricants. Cf. following abstract.—P. M. C. R.

Attack by Lubricating Oil. —— Steinitz. Paul Nettmann. Curt Ehlers. —— Wawrziniok (*Automobiltech. Zeit.*, 1932, 35, 600–603).—Correspondence on an article by Wawrziniok (cf. preceding abstract), and replies to S. by W. and others.—P. M. C. R.

Foods. G. D. Elsdon (*Ann. Rep. Prog. Applied Chem.*, 1932, 17, 528–546).—References are given to papers dealing with the solubility of such metals as copper and aluminium in milk, and with the corrosion-resistance of metals, including nickel and nickel–chromium alloys, to milk.—H. F. G.

Intercrystalline Embrittlement of Metals. G. B. O'Malley (*Commonwealth Eng.*, 1932, 19, 375–378).—Read before the Melbourne University Metallurgical Society. Describes the phenomenon of season- or corrosion-cracking due to intergranular failure of metals under the action of certain solvents. Embrittling agents may be gases, liquids, or molten metals. The embrittlement of steel by molten brass, the properties of crystal boundaries, and the relation of boundary structures to intercrystalline embrittlement are discussed. —J. H. W.

A Study of the Method of Corrosion and Susceptibility to Corrosion of Metals by Diffused Light. François Canac (*Compt. rend.*, 1933, 196, 51–53).—Metal specimens are immersed in a succession of corrosive baths and, after washing and brushing the surface, the intensity of a pencil of light diffused through an angle of 15° is measured in a Blondel photometer, the angle of incidence being 30°. It is found that the intensity of the diffused light–time curves fall into 2 classes: (1) an exponential curve, concave downwards, of the form $s = S(1 - l^{-kt})$, where S is the surface area, s the portion of the surface attacked, and t the time; (2) a parabola, concave upwards, of the form: $\left(1 - \frac{s}{S}\right)^N = \left(1 - n\frac{s}{N}\right)^N$, where N is the number of points attacked and $n = \frac{N}{S}$. In the first case, corrosion takes place at several points, but does not spread round them, and in the second, it occurs at an invariable number of points and spreads round. Stainless steels treated in sulphuric acid gave examples of the first type of corrosion, light alloys treated in soda baths gave examples of the second. The classification of metals and alloys by this method agrees very well with those of longer and less precise methods, such as loss in weight. —J. H. W.

Results Obtained in Counteracting the Corrosion of Ferrous Metals. R. Arzens (*Bull. Assoc. Tech. Fonderie*, 1932, 6, 147–154).—The electrochemical theory of corrosion is briefly summarized. Steps taken against the inroads of corrosion include the production of intrinsically more resistant materials, the employment of non-ferrous in place of ferrous metals in certain cases where they are more effective, and the protection of the surface of iron and steel. In the last class are metallic coatings, oxide coatings, enamels, and painted coverings. The methods by which these various coatings are applied are indicated. Tests, slow and accelerated, for the evaluation of corrosion-resistance properties are described. In the discussion of the results obtained various illustrations of plant parts which have been subjected to attack under normal working conditions are included.—W. A. C. N.

The Deterioration of Boiler Metal. H. E. Wallsom (*Fuel Economist*, 1933, 8, 377–378).—The phenomenon of boiler-metal corrosion under stress is briefly referred to, and sources of corrosion occurring in the feed-water are briefly discussed.—J. S. G. T.

Results of Corrosion Research and New Methods of Testing Materials for Stability Against Corrosion and Erosion. Walter Denecke (*Giesserei*, 1933, 20, 89–93).—A review of recent work on the causes of corrosion and of new methods of testing the resistance of metals to corrosion and erosion in electrolytes and non-electrolytes.—A. R. P.

Corrosion of Metals and Alloys. J. Jacquart (*Science et Industrie*, 1932, 16, 449–458; 517–521; 1933, 17, 13–15).—(I.—) Some important economic and industrial results of corrosion are enumerated, with its more obvious effects on certain common materials. The principal corrosive agents are classified, and their operating conditions outlined. The importance of internal structure is emphasized. A summary is given of the acid, peroxide, colloidal, pellicular, bacteriological, and electrochemical theories of corrosion; the last of these receives special consideration. Methods of corrosion testing are reviewed, and modifications introducing acceleration are described for each type of test. (II.—) Methods of combating corrosion are classified. A table of relative corrodibilities of many ferrous and non-ferrous metals and alloys in hydrochloric, sulphuric, and nitric acids, a second table giving penetration data for steels in water of different types, and a third comparing mild and alloy steels, cast iron and Monel metal as regards atmospheric, aqueous, alkaline, and saline corrosion, are accompanied by brief notes on the peculiarities and special applications of each material. Protective coatings are classified, with brief descriptions of the method employed. The main headings are: metallic coatings, sprayed or painted coatings, thicker coverings (concrete, asphalt, bitumastic, &c.), and surface treatments (oxidation, Parkerizing). (III.—) Corrosion may be localized by the introduction of easily replaced sections of corrodible material, which to a great extent protect the remainder of the fabric. This method may be combined, as in the Cumberland process, with electrolytic protection. Feed-water treatments are classified; the type adopted must depend on the purpose for which the water is intended. Chemical, de-aerating, and "de-activating" processes are outlined. The treatment of boiler feed-water is discussed. Soil electrolysis may be prevented by careful construction and placing of conductors, so far as the latter is possible; where electric leakage is unavoidable, effective protection may be given by suitable coatings (which should afford electrical as well as chemical insulation), the use of non-conducting material for jointing at suitable intervals, and the provision of electric "drainage areas" with return conductors to the power-station—the dangerous character of this method, however, prevents its general adoption.—P. M. C. R.

Corrosion Apparatus Aids Study of Welds. Anon. (*Electric J.*, 1932, 29, 149).—A short, illustrated description of an intermittent-immersion corrosion apparatus in which specimens are rapidly immersed and withdrawn at predetermined intervals. The time during which the specimens are moving can be made only a small fraction of the complete cycle.—J. C. C.

Eliminating Guesswork in Materials of Construction. Hugh Miller (*Chem. and Met. Eng.*, 1932, 39, 646–650).—The testing of metallic materials for chemical equipment is a more complicated procedure than the testing of non-metallic materials. The selection, preparation for testing, and laboratory testing of metals are discussed in brief. The most suitable material having been indicated as the result of laboratory tests, a test should be made, using the material as part of the plant equipment, *e.g.*, as part or whole of an agitator, as bolts or as a piece of pipe in a hose line. Proper selection of a material from several giving similar results, importance of tests under operating conditions, and the designing of semi-plant equipment are also discussed.—F. J.

German Corrosion Congress. G. Masing and O. Bauer (*Technique moderne*, 1932, 24, 480).—Abstracts of papers presented at Berlin, October 1931. See *J.*, this volume, pp. 131, 132, 133, 134.—H. W. G. H.

V.—PROTECTION

(Other than Electrodeposition.)

(Continued from pp. 194–197.)

Electrochemical Corrosion and Its Prevention. Kurt Nied (*Oberflächentechnik*, 1932, 9, 253–255).—The patent literature is reviewed with especial reference to new methods of galvanizing and tinning metals, of protecting condenser tubes from corrosion, and of insulating joints of two dissimilar metals from the action of corrosive fluids.—A. R. P.

The Alumilite Process. For Decorating and Protecting Aluminium Products. H. Bengston and R. E. Pettit (*Machinist* (*Eur. Edn.*), 1933, 77, 76–79).—The Alumilite process is a method for protecting aluminium surfaces by anodic oxidation with sulphuric acid. The preparation of the surface is very important to the appearance of the final surface. Colouring is effected by immersing the coated articles in suitable aniline dye baths. Still tanks are usually used, but mechanical processes are being developed. The coating is essentially Al_2O_3, and is remarkably resistant to salt spray and to atmospheric and chemical corrosion. Sealing the surface with inert compounds such as oils and wax increases the resistance to corrosion. The applications of the process to articles for various purposes are described.—J. H. W.

Dyeing Gives Aluminium a Colour Finish. Anon. (*Iron Age*, 1933, 131, 357).—The process of colouring aluminium surfaces protected by anodic oxidation (the Alumilite process) is described (see preceding abstract).—J. H. W.

Depositing Oxide Film on Aluminium. A. Eyles (*Met. Ind.* (*N.Y.*), 1933, 31, 17).—Flexible strong adherent oxide films with a breakdown voltage of more than 300 v. have been produced on aluminium wire by anodic oxidation in hot organic acid solutions using also a superimposed alternating current. Such wires have found extensive application in the Russian electrical industry. —A. R. P.

The Anodic Oxidation of Aluminium. H. Schmitt (*Alluminio*, 1933, 2, (1), 18–31).—A descriptive article, similar to that published in *Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1932, 4, 78–94. See *J.*, this volume, p. 84).—G. G.

Protection of Light Alloys against Corrosion. —— Pubellier (*Usine*, 1931, 40, (47), 27).—Abstract of a paper presented to the Salon Nautique. See *J.*, 1932, 50, 162, 304.—H. W. G. H.

How Cadmium Resists Aqueous Solutions. B. E. Roetheli, C. J. Franz, and B. L. McKusick (*Met. Ind.* (*N.Y.*), 1932, 30, 361–363).—In solutions of p_H lower than 5·29 the rate of corrosion of cadmium is approximately inversely proportional to the p_H value when the composition of the solution remains constant and it is uniformly agitated with air. At higher p_H grey to bluish films are formed, but no further attack takes place. It is recommended that cadmium should not be used as a protective plate when the p_H of the corroding solution is less than 6.—A. R. P.

The Determination of the Porosity of Tin Coatings on Steel. D. J. Macnaughtan, S. G. Clarke, and J. C. Prytherch (*J. Iron Steel Inst.*, 1932, 125, 159–174; discussion, 175–189).—For abstract of the paper, see this *J.*, 1932, 50, 356. In the discussion *T. Turner* expressed the view that the pinholes in tinplate are caused by the presence of dirt, either as particles of scale on the sheet or acquired from the grease or oil in which the plates are immersed. Careful elimination of dirt and the use of a slightly thicker tin coating should extend the use of tinplate. *H. S. Thomas* referred to the comparative absence of perforations in the Welsh tinplate industry and in the British canning industry, in relation to experience in the U.S.A., and suggested that apart from the presence of dirt it was possible that steel in some particular form (pearlite, austenite, &c.) does not take the tin coating. *U. Williams* suggested that in the tinplate works' atmosphere small particles of iron-bearing materials might fall on the tinned surface and, without penetrating to the steel, give the test indicating porosity. In general, he thought that the porosity of the tin coating depended more on the way it was put on than on its thickness. *W. L. Knowle* agreed that the ferricyanide–gelatin test was unsatisfactory, and suggested that when tinplates had been tested for porosity by the new method they should be made into cans and their service compared with the porosity data. *G. E. Tregoning* confirmed the diminution of the number of perforations as the thickness of the tin coating is increased, and referred to experience in the canning of meat in the Argentine, where black spots were prevented by using a 6-lb. coating. In their reply the authors suggested that other causes besides the presence of dirt contributed to the formation of pinholes, and referred to the possible influence of minute bubbles of hydrogen retained after the pickling process. Similar holes are found in electrodeposited tin. They regarded the test described as indicating almost exclusively actual breaks in the tin coating. The greater frequency of perforations of cans in the U.S.A. is probably due to the higher average temperature.—E. S. H.

Resistance to Sea-Water of Electro-Deposited Coatings on Iron and Light Metals. Erich K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, **1931**, 525–531).—Reprinted from *Z. Flug. u. Motor.*, 1931, **22**, 141–147. Cf. this *J.*, 1932, **50**, 742.—B. Bl.

Corrosion-Resistance of Aircraft Bracing Cables with Different End-Connections. Martin Abraham (*Jahrb. deut. Versuchsanst. Luftfahrt*, **1931**, 532–536).—Cf. *Wire and Wire Products*, 1931, **6**, 283–289; see this *J.*, 1932, **50**, 742.
—B. Bl.

Protection of Steel at High Temperature by Aluminium. [A.] Hauttmann (*Usine*, 1931, **40**, (32), 39).—Abstract from *Stahl u. Eisen*, 1931, **51**, 65–67. See this *J.*, 1931, **47**, 533.—H. W. G. H.

New Developments in Galvanizing. W. H. Spowers, Jr. (*Iron Age*, 1933, **131**, 270–273).—The principal developments introduced into the galvanizing process during the past year are the perfection of a neutral flux to reduce dross formation, the preparation of a special flux, and a continuous process for galvanizing wire. Improvements in the course of development are the perfection of an automatic wipe for galvanizing wire, a more permanent container for zinc, and a bright coat on galvanized products. The application of the diffusion flame for heating galvanized kettles is described.—J. H. W.

Cadmium Additions to Galvanizing Baths. Wallace G. Imhoff (*Heat-Treat. and Forging*, 1932, **18**, 692–694, 698).—The resistance of cadmium coats to corrosion compares very favourably with that of other metals, and the coat can be appreciably thinner. The addition of cadmium to the galvanizing bath, however, lowers the working temperature and tends to thin the bath; it increases the weight of the coating required and lowers the bending properties. The amount permissible varies greatly and is a matter of considerable contention. One of its advantages is the production of a bright spangled effect in the coating.—J. H. W.

A Note for Galvanizers (Hot-Zincing). James Brinn (*Met. Ind.* (*N.Y.*), 1932, **30**, 277).—It is pointed out that incomplete washing of iron or steel after treatment in the pickling solution may lead to serious contamination of the zinc in subsequent hot-zincing, as the ferrous chloride on the metal reacts readily with zinc at 460° C., producing oxide dross and introducing iron into the zinc bath.—A. R. P.

Report of Sub-Committee VI [of Committee A-5 of A.S.T.M.] on Specifications for Metallic-Coated Products. F. F. Farnsworth (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 110–115).—See this *J.*, 1932, **50**, 549.—S. G.

Report of Sub-Committee VIII [of Committee A–5 of A.S.T.M.] on Field Tests of Metallic Coatings. R. F. Passano (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 116–123).—See this *J.*, 1932, **50**, 550.—S. G.

Report of Committee A–5 [of A.S.T.M.] on Corrosion of Iron and Steel. J. H. Gibboney and James Aston (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 100–104).—See this *J.*, 1932, **50**, 549.—S. G.

Report of Sub-Committee X [of Committee A–5 of A.S.T.M.] on Embrittlement Investigation. V. F. Hammel and C. S. Trewin (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 124–125). **Embrittlement of Hot-Galvanized Structural Steel.** Samuel Epstein (*ibid.*, 1932, **32**, (II), 293–374; discussion, 375–379; and (abstracts) *Mech. World*, 1932, **92**, 478, and *Iron Steel Canada*, 1932, **15**, 142–143).—See this *J.*, 1932, **50**, 550.—S. G.

Effect of Zinc Coatings on Steel. W. H. Swanger and R. D. France (*Power Plant Eng.*, 1932, **36**, 597).—Abstract of paper read before the American Society for Testing Materials. See this *J.*, 1932, **50**, 481, 670.—P. M. C. R.

Report of Sectional Committee [of A.S.T.M.] on Zinc Coating of Iron and Steel. J. A. Capp and A. B. Campbell (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 126–128).—See this *J.*, 1932, **50**, 482.—S. G.

Coating Metals with Zinc or Cadmium. Anon. (*Technique moderne*, 1931, **23**, 509–510).—From *Chem.-Zeit.*, 1931, **55**, 225; see *J.*, 1932, **50**, 360.—H. H.

Thomas Coated Strip Steels. Anon. (*Automotive Ind.*, 1933, **28**, 358).—Soft, ductile, plated coatings of zinc, copper, or tin can now be applied to steel intended for deep stamping, forming, or drawing. The coatings are said to help rather than hinder the working processes, and to be less porous, and consequently more resistant to corrosion, than hot-dipped coatings. Zinc-plated steel is found to be particularly satisfactory in use.—P. M. C. R.

Recent Progress in Metallic Cementation. J. Laissus (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 365–375).—A discussion of modern developments in the cementation of metals—principally iron and steel. Especial attention is given to the conditions that are necessary for the production of good resistant coatings. Cementation with chromium, tungsten, boron, tantalum, molybdenum, and cobalt is fully dealt with.—W. A. C. N.

The Characteristics of Sprayed Metal Coatings.—I. H. Reininger (*Z. Metallkunde*, 1933, **25**, 42–44).—Sprayed metal coatings on metals, wood, and other materials adhere merely by surface tension, *i.e.*, no alloying takes place with a metallic surface. Sprayed coatings can be produced with aluminium, lead, iron, copper, nickel, zinc, tin, bronze, brass, cast iron, &c. Before spraying, the surface of smooth articles (sheets, die-castings) should be increased as much as possible by sand-blasting or etching with dilute acids, otherwise the coating does not adhere if the article is heat-treated. Articles with a natural rough surface (cast iron, sand-castings, unsized paper, pasteboard, ceramic masses, wood) need not be roughened further.—M. H.

On the Diffusion of Sprayed-On Metal Coatings into Solid Iron. P. Bardenheuer and R. Müller (*Mitt. K.-W. Inst. Eisenforschung*, 1932, **14**, 295–305).—The tests were made with (*a*) nickel, (*b*) chromium, (*c*) mixtures of chromium and nickel, (*d*) mixtures of chromium and aluminium, (*e*) mixtures of nickel and aluminium, (*f*) mixtures of nickel and silicon, (*g*) chromium–silicon alloys, (*h*) chromium–nickel–aluminium alloys, and (*i*) chromium–aluminium alloys. The metals were sprayed in the form of powder from a " Versa " pistol (Schori, German Patent No. 477,505) on to rotating cylinders of soft iron which were then heated *in vacuo* at 900°–1350° C., and the degree of diffusion was determined chemically and metallographically. Good diffusion is obtained with *b*, *c*, *f*, *g*, and poor with *a*. Aluminium alone diffused rapidly up to a small aluminium content in the diffusion layer, but it prevents diffusion of other metals. The unavoidable oxide content of the sprayed film interferes seriously with diffusion, and, as nickel and chromium react differently with the oxidic inclusions in the iron, their rates of diffusion are adversely affected in different degrees. Volatilization of the sprayed metal and the iron base has an appreciable effect on the diffusion phenomena; under the conditions of the test the diffusion in all cases appeared to proceed through the vapour phase. The process does not seem to be capable of mathematical expression.—J. W.

Recent Developments of the Schoop Spraying Process. A. Karsten (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1933, **9**, 28–29).—An electrically-operated spraying pistol adapted for the Schoop process is described and illustrated. The metal to be applied is automatically fed into the instrument in the form of wires, which carry a current (a.c. or d.c.). The ends of the wires, by approximating, cause a short-circuit, and the small arc produced melts the metal, which is expelled by compressed air. Greatly increased output is claimed for this type of pistol, which has the further advantage of being applicable to chromium, tungsten, molybdenum, and other metals and alloys of high melting point, the estimated temperature of the arc being above 3000° C.—P. M. C. R.

The Electric Metal Spraying Process. Anon. (*Elektrotech. Z.*, 1932, **53**, 1178; and (translation) *Electrician*, 1933, **110**, 70).—Whereas in the Schoop process the metal is melted by its passage through a high-pressure gas flame, in the electric process an arc is played between two wires of the metal, and the resulting liquid is thrown out of the arc by a stream of compressed air. The temperature at the melting zone is above 4000° C., so that molybdenum, chromium, tungsten, and their alloys can be readily sprayed by this process on to any desired surface.—B. Bl.

The Spraying of Metals. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 255).—A description is given of the apparatus and method of spraying metals with zinc, aluminium, and tin.—J. H. W.

Developments in Metal Lacquers. L. M. Hayden (*Quarterly Rev. Amer. Electroplaters' Soc.*, 1933, **19**, (9), 30–38).—To determine the value of a lacquer as a means for preventing tarnishing of metals a polished strip of silver sheet is coated with the lacquer, air-dried for 30 minutes, baked for 30 minutes at 150° F. (66° C.), aged at room temperature for 24 hrs., and then kept in an atmosphere of hydrogen sulphide under slight pressure until tarnishing develops. The rate of tarnishing is an indication of the value of the lacquer. To determine the tendency to " crystal spotting " small copper-plated strips of iron are given an " oxidized " finish and then buffed in parts until bright copper is exposed; the lacquer is then applied and after storing for 3 days the plates are placed in a desiccator and covered with a filter paper which has been sprinkled with flowers of sulphur. The development of black crystalline spots occurs in a few days with some lacquers but not at all with others.—A. R. P.

Recent Developments in Metal Lacquers. Kenneth R. Longnecker (*Met. Ind.* (*N.Y.*), 1932, **30**, 475–476).—Abstracted from *Quarterly Rev. Amer. Electroplaters' Soc.*, 1932, **19**, (8), 31–36. See this *J.*, 1932, **50**, 743.—I. M.

Evaluating Lacquer Finishes. J. A. Reinhardt and E. A. Woelfel (*Monthly Rev. Amer. Electroplaters' Soc.*, 1932, **19**, (4), 12–19; and (abstract) *Met. Ind.* (*N.Y.*), 1932, **30**, 192–194).—Tests are applied for film building and hiding power, drying qualities, colour and lustre, resistance to perspiration, flexibility, adhesion and ageing, resistance to moisture, hardness, and resistance to abrasion. A good lacquer should hide water-marks produced by drying after plating, should fail to print the pattern of a coarse cloth pressed into it under 1 lb./in.^{2} for 1–2 minutes, should withstand continuous handling at 140° F. (60° C.) for 2 hrs. without becoming soft enough to scratch with the finger-nail, should withstand 6 cycles of alternating storage for 1 day at 150° F. (66° C.) and 1 day at 0° F. (— 18° C.) without cracking when the metal is subsequently bent, should show no signs of cracking or peeling after 2 weeks in air saturated with moisture at 110° F. (43° C.), and should give good resistance to wear in the emery test.—A. R. P.

Paints and Pigments. A. Hancock (*Ann. Rep. Prog. Applied Chem.*, 1932, **17**, 376–391).—References are given to papers published during 1932 relating to the physical properties of paint films; the relation between the corrosion of metals and protective materials; experiments on methods of protecting metallic aeroplane parts, particularly those constructed of Duralumin; the indication of corrosion, before it becomes visible, by changes of the tensile strength and elongation of the metal; and to the durability of paint films.
—H. F. G.

VI.—ELECTRODEPOSITION

(Continued from pp. 197–199.)

Aluminizing Metal Surfaces in a $AlCl_3$–NaCl Bath. W. A. Plotnikow and N. N. Graziansky (*Z. Elektrochem.*, 1933, **39**, 62–67).—Metals were aluminium-coated in a bath consisting of $3AlCl_3 : 2NaCl$ or $2AlCl_3 : NaCl$ using an aluminium liner as the anode. The electrolysis gives a smooth, polished surface, the amount of $AlCl_3$ remaining constant. The thickest deposit (0·08 mm.) was obtained with a current density of 1 amp./dm.^{2} at 200° C. The resulting coat had better resistance to water vapour and sodium chloride solution than rolled Kahlbaum aluminium sheet. Tests in agar-agar proved the compactness of the coat, and metallographic examination showed that a solid solution of aluminium in iron is formed at the junction of the metals. The coat gives increased hardness to the metal and does not crack in the bending test. Coated articles are as stable at high temperatures as those not aluminized.—J. H. W.

The Control of Electrodepositing Solutions. XIV.—The Cadmium Solution. Samuel Field (*Met. Ind.* (*Lond.*), 1933, **42**, 309–310).—Four determinations are desirable in cadmium solutions: free cyanide, cadmium, total alkali, and carbonate. Free cyanide is determined by $AgNO_3$, and cadmium by precipitation and weighing as sulphide or by titrating with ferrocyanide.—J. H. W.

Some New Organic Addition Agents for Cadmium Electroplating. R. A. Claussen and H. L. Olin (*Electrochem. Soc. Preprint*, **1933**, May, 45–52).—The optimum range of current density at which bright deposits of cadmium may be obtained from baths containing cadmium oxide 45, sodium cyanide 120, sodium sulphate 50, and nickel sulphate crystals 1 grm. per litre of water has been determined using various addition agents. For casein (0·4–0·66 grm./litre) the best results are obtained at 1·9 amp./dm.^{2}, for gulac (12 grm./litre) at 3·5 amp./dm.^{2}, for bindex (1 grm./litre) at 2 amp./dm.^{2}, for Steffen's waste (12–21 grm./litre) at 3·5–5 amp./dm.^{2}, and for concentrated steep water, produced in the initial soaking of corn in the starch industry (12–15 grm./litre) at 3·5–5 amp./dm.^{2}. The two last-named agents give the bath a much better throwing power than any of the other additions.—A. R. P.

The Electrodeposition of Ternary Alloys of Cadmium, Zinc, and Antimony. Lawrence E. Stout and Leonard Goldstein (*Electrochem. Soc. Preprint*, **1933**, May, 17–37).—Ternary alloys can be deposited from alkaline cyanide solutions containing zinc and cadmium as complex cyanides and antimony as potassium antimonyl tartrate; the zinc and antimony, however, are more readily deposited than cadmium, hence a large cadmium concentration is required to obtain deposits containing an appreciable amount of this metal. The ratio of the metals in the deposits is a function of the ratio of their concentration in the electrolyte, the current density, and the temperature. When the zinc and cadmium concentrations of the electrolyte are low, increase in current density or temperature increases the antimony content of the deposit, but when the zinc and cadmium concentrations are high, changes in the operating conditions reduce the antimony content of the deposit. Increase in current density at 20° C. reduces slightly the amount of zinc deposited, but increases the amount of cadmium. Deposits with a high cadmium content have a good resistance to corrosion, but antimonial alloys are slightly less resistant than pure cadmium.—A. R. P.

The Electrodeposition of Cadmium from Cadmium Sulphate Solutions.—I. S. Wernick (*Met. Ind.* (*Lond.*), 1932, **41**, 500).—Abstract of a paper read before the Electrochemical Society. See this *J.*, 1932, **50**, 562.—J. H. W.

On the Action of Hydrogen Peroxide in the Chromium-Plating Bath. E. Raub and K. Bihlmaier (*Mitt. Forschungsinst. Edelmetalle*, 1932, **6**, 85).—Addition of hydrogen peroxide to the chromium-plating bath results in the reduction of the equivalent quantity of chromic acid to chromium sesquioxide, which remains in the bath as chromium chromate. With increasing amounts of this compound up to a maximum, which varies with the composition of the bath, the current density range at which bright plates can be obtained is broadened, but the limiting concentration range of sulphuric acid is narrowed. The throwing power of baths with a relatively high content of chromic oxide is improved by increasing the sulphuric acid content of the bath to 1·5–2·2%; conversely, the throwing power of a too-acid bath may be improved by addition of tervalent chromium, *i.e.* by addition of hydrogen peroxide. The current yields are increased by addition of tervalent chromium to an amount not exceeding 10% of the chromic acid present; this addition has no effect on the resistance of the bath, but larger quantities increase the resistance and reduce the current efficiency.—A. R. P.

Chromium Electroplating with Aqueous Solutions of Chromic Acid Containing Hydrofluoric Acid. Erich Müller and Otto Rossow (*Z. Elektrochem.*, 1932, **38**, 883–884).—The effects of the current density (2–16 amp./dm.^{2}), temperature, mixture of fluorides, and current strength on the deposit in chromium plating in chromic acid solutions have been investigated.—J. H. W.

Researches on the Electrochemistry of Chromium. III.—Nature of Deposits from Tervalent Solutions. A. W. Pamfilov and O. S. Fedorov (*Zhurnal Obschtchey Khimii* (*Journal of General Chemistry*), 1932, [A], **2**(64), (2) 208–216).—[In Russian.] Cf. this *J.*, 1932, **50**, 630. Earlier work on the current efficiency and nature of the deposits obtained from tervalent chromium solutions are summarized and further results obtained from numerous similar solutions are tabulated. Satisfactory deposits on relatively large surfaces were not obtained from tervalent chromium solutions except in the case of Liebreich's solutions (*Z. Elektrochem.*, 1921, **27**, 109), which are really of the chromite type, the chromium being present as a complex anion similar to the hexavalent form. In general, deposits from tervalent chromium baths differ sharply in character from those obtained from hexavalent baths, and are very porous and non-adherent.—M. Z.

The Electrodeposition of Chromium from Tervalent Chromium Salt Solutions. II.—Chromium Acetate, Oxalate and Tartrate Baths. H. T. S. Britton and O. B. Westcott (*Met. Ind.* (*Lond.*), 1933, **42**, 155–158).—Read at a joint meeting of the Faraday Society and the Electroplaters' and Depositors' Technical Society. See this *J.*, 1932, **50**, 758.—J. H. W.

The Correction of the Sulphate Content of Chromium Baths. E. Raub (*Oberflächentechnik*, 1932, **9**, 299–212).—See *J.*, this volume, p. 28.—A. R. P.

Chromium Plating of Light Alloys. K. Altmannsberger (*Technique moderne*, 1932, **24**, 507).—From *Chem. Zeit.*, 1932, **56**, 247. See this *J.*, 1932, **50**, 449.
—H. W. G. H.

Chromium Plating Applied to Steel Mill Rolls. N. H. McKay (*Mech. World*, 1932, **92**, 266).—Abstracted from *Iron Age*, 1932, **130**, 2–3. See this *J.*, 1932, **50**, 563.—F. J.

On the Use of Chromium-Plated Screws in the Chemical Industry. Carl Hütter (*Chem. Fabrik*, 1932, **5**, 59–60).—By plating steel screws directly with chromium at a low current density a soft but non-porous coating is obtained which is highly resistant to nitric acid.—A. R. P.

Chromium-Plated Gauges. Anon. (*Machinery* (*Lond.*), 1932, 40, 316).—Chromium-plated gauges have five times the life of hardened steel gauges, and are now available in this country.—J. C. C.

Nickel–Chromium Plating and Its Defects. Hans Hornauer (*Emailletechnische Monats-Blätter*, 1931, 7, 66, 75–78; *Ceram. Abs.*, 1932, **11**, 497).—The modern process of chromium plating is briefly discussed and some of the causes for defective plating are enumerated, including improper bath composition, dirty or oxidized surfaces to be plated, careless and unskilled labourers, &c. Some of the different places in which chrome plating is finding application are enumerated. Complete detailed information regarding the process used in matte chrome plating is given, pointing out its difference from the ordinary bright plating process.—S. G.

Nickel–Chromium Processes. Hans Hornauer (*Emailletechnische Monats-Blätter*, 1931, 7, 96–97, 103–105; *Ceram. Abs.*, 1932, **11**, 497).—Some of the processes used in nickel–chromium plating development are described in detail.—S. G.

Nickel–Chromium [Plating]. Hans Hornauer (*Emailletechnische Monats-Blätter*, 1932, 8, 27–28; *Ceram. Abs.*, 1932, **11**, 497).—Some of the defects of chromium plating are discussed and developments in processes to correct them are described.—S. G.

Theory of Chromium Plating. Anon. (*Automotive Ind.*, 1932, 67, 618).—A brief account of the results of recent investigations by the U.S. Bureau of Standards.—P. M. C. R.

The Importance of Current Density in Chromium Plating. Herbert Kurrein (*Oberflächentechnik*, 1932, 9, 165–166).—The effects of current density and temperature on the nature of the chromium deposits and on the current efficiency are described.—A. R. P.

When is Iron Dangerous in the Chromium-Plating Bath? K. Schuch (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 419).—Some of the troubles attributed to high iron content are really due to incorrect sulphate content.
—A. R. P.

Modern Chromium-Plating. W. Birett (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 358–360).—Cf. *J.*, this volume, p. 136. The value of chromium plating in modern technology is briefly discussed.—A. R. P.

Chromium Plating Electrolytes. Anon. (*Oberflächentechnik*, 1932, 9, 199–201).—The behaviour of numerous types of chromium-plating baths under different conditions of temperature and current density is described.—A. R. P.

Anodes in Chromium-Plating Baths. H. Rüttermann (*Oberflächentechnik*, 1932, 9, 168).—Cf. *J.*, this volume, p. 29. The use of "Ibo-Aktiv" steel anodes is recommended.—A. R. P.

Information on Chromium Bath Anodes. Karl Gebauer (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 360–361).—Polemical against H. Rüttermann (cf. *J.*, this volume, p. 29, and preceding abstract). No iron anode will remain inert in a chromium-plating bath, hence the use of these anodes results in accumulation of iron in the bath and deterioration of the plate.—A. R. P.

New Anodes for Chromium [Plating] Baths. G. Elssner (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 355–358, and *Oberflächentechnik*, 1932, 9, 181–183).—The use of steel anodes of any description rapidly leads to serious contamination of chromium-plating baths with iron, and consequent rapid deterioration of the plates obtained therefrom. The so-called "Ibo-Aktiv" anodes, which consist of a ferrous alloy, are just as dangerous as steel anodes.—A. R. P.

Chromium Anodes "Ibo-Aktiv." Rudolf Stamm (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 398–399, and *Oberflächentechnik*, 1932, 9, 201).—Contrary to the statement of Elssner (cf. preceding abstract) these anodes behave well in the large baths used in practical plating. D.'s experiments were made in 3–5 litre tanks.—A. R. P.

Lead and Lead-Antimony Anodes for Chromium Plating. E. M. Baker and P. J. Merkus (*Galvano*, 1932, (5), 20–23).—Translated from *Trans. Electrochem. Soc.*, 1932, 61, 357–388. See this *J.*, 1932, 50, 95, 566.—E. S. H.

Chromium Plating Light Metals, Especially Aluminium and Aluminium Alloys. Georg Buchner (*Oberflächentechnik*, 1932, 9, 118).—An abstract and discussion of a paper by A. Koenig (see this *J.*, 1932, 50, 46).—A. R. P.

Use of Glue in Polishing Wheels for Preparation of Surfaces for Chromium Plating. R. J. Hazel (*Metal Cleaning and Finishing*, 1932, 4, 593–596; *C. Abs.*, 1933, 27, 1270).—A discussion of the scientific control of glue and its correct application in the production of polishing wheels for the preparation of metal surfaces for chromium plating.—S. G.

Scientific Achievements in the Field of Electrodeposition. L. Zaitzev (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), 1931, (4), 82–88).—[In Russian.] The installation and methods used in chromium-plating precision instruments and measuring appliances in the laboratory and works of the Precision Machinery Trust, are described.—D. N. S.

Potentiometric Determination of Chromic Anhydride in Chromium-Plating Baths. N. V. Chilogin (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), 1932, (3), 74–76).—[In Russian.] A sample of 20 c.c. of the bath is diluted to 500 c.c. and 25 c.c. of the solution are treated with 175 c.c. of water and 30 c.c. of phosphoric acid, *d* 1·4, and titrated potentiometrically with $FeSO_4(NH_4)_2SO_4$ solution previously standardized by a similar method against potassium dichromate.—D. N. S.

The Health of Chromium-Plating Workers. H. B. Trumper (*J. State Med.*, 1932, 40, 696–701; *C. Abs.*, 1933, 27, 1577).—No real danger to health or life is to be anticipated if proper regulations are observed.—S. G.

Hygiene in Chromium Plating Practice. Anon. (*Oberflächentechnik*, 1932, 9, 239–240).—Precautions to avoid danger to the health of the workmen are detailed.—A. R. P.

The Electrodeposition of Iron-Cobalt Alloys.—I. S. Glasstone and J. C. Speakman (*Met. Ind.* (*Lond.*), 1933, 42, 205–206).—Read at a joint meeting of the Faraday Society and the Electroplaters' and Depositors' Technical Society. See *J.*, this volume, p. 29.—J. H. W.

The Electrodeposition of Iron-Cobalt Alloys.—II. S. Glasstone and J. C. Speakman (*Met. Ind.* (*Lond.*), 1933, 42, 259–260).—Cf. *J.*, this volume, p. 29. The results of experiments carried out at 50° and 90° C. are given and discussed. The variation with the current density of the composition of the alloys deposited from buffered solutions containing various proportions of ferrous and cobalt sulphates was studied, showing that the composition tends towards a constant value as the current density is increased, this value being independent of the hydrogen-ion concentration of the electrolyte. A comparison is made of the iron–cobalt, iron–nickel, and cobalt–nickel series.—J. H. W.

A Cyanide-Free Bath for the Deposition of Copper on Steel. Colin G. Fink and Chun Y. Wong (*Electrochem. Soc. Preprint*, 1933, May, 83–90).—By adding a concentrated copper sulphate solution to a hot solution of sodium oxalate until a faint turbidity appears, then adding a slight excess of the oxalate and cooling, the salt disodium diquodioxalatocuprate, $Na_2[Cu(C_2O_4)_2(H_2O)_2]$, separates on cooling as deep blue crystals. It has a solubility of 20 grm./litre at 20° C. and affords a solution having an exceedingly low concentration of cupric ions, hence this solution provides a satisfactory electrolyte for producing a copper "strike" on iron and steel, and has the advantage over the cyanide bath of being more stable and much less poisonous. The best results are obtained from a saturated solution of the salt to which have been added 15 grm./litre of sodium sulphate and 20 grm./litre of boric acid; the steel is plated for 1 minute at 10 amp./ft.^{2} in this bath, then transferred to the ordinary acid bath to obtain a dense, thick plate.—A. R. P.

The Electrodeposition of Ternary Alloys of Copper, Cadmium and Zinc from Cyanide Baths. R. C. Ernst and C. A. Mann (*Trans. Electrochem. Soc.*, 1932, **61**, 363–394; discussion, 394–395).—See *J.*, this volume, p. 247.—S. G.

On the Correction of Acid Copper and Silver Baths. A. Wogrinz (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 475–477).—Mathematical.—A. R. P.

Analysis of Free Cyanide in Brass Plating Baths. L. C. Pan (*Met. Ind.* (*N.Y.*), 1932, **30**, 402–404, 438–439).—Comparative tests have been made of the following four methods: (*a*) titration with silver nitrate without an indicator, (*b*) as (*a*) but with a small quantity of potassium iodide as indicator (*c*) as (*b*) but with a large quantity of iodide, (*d*) titration with copper sulphate. Method (*a*) gives consistent results very close to the theoretical, but the end-point is not sharp; addition of a little potassium iodide gives a sharp end-point, but causes deviations from the theoretical, but addition of a large amount (4–5 grm./70 c.c.) of iodide gives a sharp end-point and theoretical results which are only slightly affected by the presence of ammonia, carbonate, and zinc. Method (*d*) gives results close to the theoretical with a sharp end-point 15–20 seconds after addition of the reagent.—A. R. P.

Electrolytic Gold Baths. A. Wogrinz (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 495–496).—Methods of determining gold in cyanide baths are discussed.—A. R. P.

Indium in Electroplating. —— Altmannsberger (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 477–478; and *Oberflächentechnik*, 1932, **9**, 223–224).—Indium has been suggested for use in plating silver as a protection against tarnishing, but the metal is extremely scarce and much more costly than platinum.—A. R. P.

How to Handle Nickel Solutions. E. Schor (*Met. Ind.* (*N.Y.*), 1932, **30**, 187–188).—Practical plating hints on the maintenance of good nickel-plating solutions emphasizing the need for cleanliness and for avoiding contamination of the electrolyte with impurities of any kind.—A. R. P.

Peeling of Electrodeposited Nickel. E. A. Vueillenmier (*Quarterly Rev. Amer. Electroplaters' Soc.*, 1933, **19**, (9), 10–14; and (summary) *Met. Ind.* (*N.Y.*), 1933, **31**, 130–131).—The tendency to peel of nickel deposits from a given bath may be ascertained by plating on a thin sheet cathode and measuring the amount of curling caused by the stress in the deposited metal. The presence of iron salts in the plating bath increases these stresses very considerably, and hence induces an increased tendency of the plate obtained from such baths to peel when deposited on thick metal which cannot bend to relieve the stresses. Shiny deposits always have a greater tendency to peel than relatively coarse deposits, but this tendency can be overcome to a great extent by improving the adherence of the deposits, *e.g.* by thoroughly cleaning the metal surface prior to plating.—A. R. P.

Nickel Baths and Lead Vats. Anon. (*Oberflächentechnik*, 1932, **9**, 166–167).—Emphasizes the need for proper protection of sides of the vat to avoid short-circuiting with the anodes.—A. R. P.

Nickel in the Printing Industry. Victor Clough (*Met. Ind.* (*Lond.*), 1933, **42**, 158).—Short note from a paper, read at Stationers' Hall, describing the use of nickel plating in the Oscar Kohn method for producing an intaglio-offset plate for printing.—J. H. W.

Modern Procedure in Nickel- and Chromium-Plating. H. Kurrein (*Technique moderne*, 1932, **24**, 572).—From *Chem. Zeit.*, 1932, **56**, 93, 114. See this *J.*, 1932, **50**, 450.—H. W. G. H.

Investigations on De-Nickelling Baths. H. Krause (*Oberflächentechnik*, 1932, **9**, 179–180, 191–193).—See this *J.*, 1932, **50**, 682.—A. R. P.

De-Nickelling Baths. H. Krause (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 515–516).—Electrolytic stripping in sulphuric acid, *d* 1·583, is recommended for removing old or faulty nickel plate from iron or brass; the acid should be free from arsenic.—A. R. P.

On the Electrochemical Behaviour of Platinum. III.—The Electrodeposition of Platinum. G. Grube and D. Beischer (*Z. Elektrochem.*, 1933, 39, 38–45).—Plating details are given for the electrodeposition of platinum in alkali-platinum phosphate baths, in baths of alkali-platinum salts of organic acids, of platinum salts of organic and inorganic acids, and in baths of other compositions. The best deposits were given with sodium-ammonium phosphate and ammoniacal dinitrodiamminoplatinum solutions. The deposition of the metal is accompanied by considerable evolution of hydrogen, even with low current densities. In a solution of potassium platinum cyanide, with all the cathodes investigated except mercury, only hydrogen was liberated and no metal was deposited. With a mercury cathode, a reduction process takes place which does not give a platinum deposit but another reduction product of the divalent platinum salt.—J. H. W.

Platinum Plating. Anon. (*Sci. American*, 1933, 148, 54).—A new technique for platinum plating is being developed, and it is suggested that platinum-plated cutlery will soon be available.—W. P. R.

On the Determination of Output in Electroplating Practice with Special Reference to Silver. Paul Friedrich Wintersberger (*Oberflächentechnik*, 1932, 9, 135–136).—Costing methods are discussed.—A. R. P.

Electro-Tin Plating. R. E. Maeder (*Met. Ind.* (*N.Y.*), 1932, 30, 323–324).—Abstracted from the *Monthly Rev. Amer. Electroplaters' Soc.*, 1932, 19, (7), 12–16; see this *J.*, 1932, 50, 760.—I. M.

The Electrodeposition of Tungsten from Aqueous Alkaline Solutions. M. Leslie Holt and Louis Kahlenberg (*Quarterly Rev. Amer. Electroplaters' Soc.*, 1933, 19, (9), 41–52; and (summary) *Met. Ind.* (*N.Y.*), 1933, 31, 94–97).—After a review of earlier work on tungsten plating, the results of attempts to prepare a more efficient plating solution are described. All the tests were made on tungstic acid or sodium tungstate dissolved in solutions of various alkali salts, but satisfactory results were obtained only with solutions of tungstic acid in trisodium phosphate. Bright silvery deposits may be produced from a solution containing 30 grm. of tungsten trioxide and 100 grm. of $Na_3PO_4,12H_2O$ in 150 c.c. of water using 10 amp./dm.^{2} at 90° C., but the current efficiency is less than 1%, and the bath plates only so long as it retains its original yellow colour, and apparently cannot be regenerated.—A. R. P.

Electroplating Zinc on Aluminium. Harold K. Work (*Quarterly Rev. Amer. Electroplaters' Soc.*, 1933, 19, (9), 26–30).—A review of recent work.
—A. R. P.

The Effect of Mercury in Zinc Cyanide Plating Solutions. E. E. Halls (*Met. Ind.* (*Lond.*), 1933, 42, 261).—The behaviour of amalgamated zinc anodes in a bath consisting of water 1 gall., zinc cyanide (54–55% zinc) 6 oz., sodium cyanide (97% pure) 4 oz., and caustic soda 5 oz., without agitation and at ordinary temperatures was studied, and the resistance of the resulting coat to the salt-spray test was investigated. The process affords specific advantages, but the darkness of the coat may sometimes be an objection, and additional care in operating control is required.—J. H. W.

Zinc or Cadmium Plating. H. Figour and P. Jacquet (*Galvano*, 1932, (2), 20–21).—Abstracted from *Compt. rend.*, 1932, 194, 1493–1495. See this *J.*, 1932, 50, 450.—E. S. H.

Cadmium and Zinc Plating of Aluminium and Duralumin. G. A. Mario Gambioli (*Z. Flug. u. Motor.*, 1932, 23, (21), 650).—Detailed abstract from *Aerotecnica*, 1932, 12, 314–320. See this *J.*, 1932, 50, 669.—P. M. C. R.

Modern Electrodeposition of Metals. S. Cowper-Coles (*J. Inst. Production Eng.*, 1933, 12, 79–86; discussion, 86–90).—Copper sheet can be produced with straight edges and of any thickness by electrodepositing at 200–500 amp./ft.^{2} on a rotating drum of welded sheet steel and stripping the deposit. Energy consumption is 1000 kw.-hr./ton. Sheet sufficiently hard to serve in place of phosphor bronze for electrical spring contacts can be produced by consolidating the deposit by floating rollers. Copper wire can be made by depositing on a cylindrical mandrel having a shallow spiral V-groove cut on its face. The crystals in the deposit grow out at right angles to the surface, and a line of weakness is formed where they meet above the centre of the depressions. A square wire with 2 small fins can then be unwound and drawn to a circular section in one final operation. The flashing of boiler tubes with zinc, the production of parabolic reflectors, the automatic plating of steel sheet, and the deposition of iron, lead, nickel, chromium, and cadmium are briefly reviewed. —J. C. C.

Protective Value of Electroplated Metal Coatings on Steel. Progress Report. Joint Inspection Committee of the A.E.S., A.S.T.M., and Bureau of Standards (*Quarterly Rev. Amer. Electroplaters' Soc.*, 1933, **19**, (9), 3–10; and *Met. Ind.* (*N.Y.*), 1933, **31**, 58–60).—Conclusions reached from examination of the nickel and chromium coatings on steel after 6–8 months' exposure are as follows: good protection is afforded by nickel or nickel–copper–nickel coatings only when the total thickness is at least 0·001 in. Coatings containing a middle copper layer are less protective than pure nickel coatings of the same thickness, but are about as efficient as a nickel coating of the thickness of the nickel in the composite coating. An outer film of chromium 0·00002 in. thick deposited at 113° F. (45° C.) and 150 amp./ft.^{2} slightly decreases the protective value of all-nickel deposits except very thick ones, but increases that of composite copper–nickel deposits. The conditions under which copper or nickel is deposited have no marked effects on the protective value. Deposition of a cadmium or zinc layer before the nickel sometimes increases the protective value, but causes white stains and blisters to develop under severe conditions of exposure.—A. R. P.

Theories of Addition Agent Action [in Electrodeposition of Metals]. Robert Taft (*Electrochem. Soc. Preprint*, **1933**, May, 53–60).—The action of addition agents in electrolytes may be of two distinct types: (*a*) the addition agent is actually adsorbed by the metal as it is deposited; this is the case with gelatin and other colloids in copper electrolytes; (*b*) the addition agent is reduced simultaneously with the deposition of the metal and is not included in the deposit; this is the case with ammonium nitrate in acid copper electrolytes. —A. R. P.

Electroplating Solution Control. L. E. Stout (*Metal Cleaning and Finishing*, 1932, **4**, 607–610; *C. Abs.*, 1932, **27**, 1277).—A procedure is outlined for the determination of copper, free and total cyanide and carbonate in a cyanide copper bath.—S. G.

Calculation of Ampère–Minutes in Plating. Charles H. Eldridge (*Met. Ind.* (*N.Y.*), 1932, **30**, 111–112).—Tables are given showing the number of ampère-minutes per ft.^{2} required to deposit thicknesses of 0·0001–0·0010 in. of copper, cadmium, and nickel assuming current efficiencies of 40–100%.—A. R. P.

The Preparation of Metals for Electroplating. Anon. (*Met. Ind.* (*N.Y.*), 1932, **30**, 359–360, 400–401, 440–441).—Pickling, degreasing, and bright dipping methods of removing dirt and grease from metals prior to electroplating are described.—A. R. P.

The X-Ray Analysis of Electrodeposited Alloys. Charles W. Stillwell (*Met. Ind.* (*N.Y.*), 1933, **31**, 47–50).—The value of X-rays in determining the crystal structure, grain-size, alloying between deposit and base metal, and the constitution of alloy deposits is discussed with reference to cadmium–silver plate. —A. R. P.

Recent Foreign Original Research in Electroplating. M. de Kay Thompson (*Quarterly Rev. Amer. Electroplaters' Soc.*, 1933, **19**, (9), 15–25).—Recent work on chromium, cadmium, and copper plating is briefly reviewed.—A. R. P.

A Model Metal-Coating Research Laboratory. E. F. Berry (*Met. Ind.* (*N.Y.*), 1932, 30, 229–230).—An illustrated description of the testing and research laboratory of a large cadmium-plating works.—A. R. P.

Plating of Cast Aluminium and Jointed Aluminium Parts. E. Smith and C. A. Velarde (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 436–437).—A translation of an article in *Met. Ind.* (*Lond.*), 1932, 41, 15. See this *J.*, 1932, 50, 633.—A. R. P.

Electrolytic Deposits on Aluminium and Its Alloys. M. Ballay (*Z. Metallkunde*, 1932, 24, 310).—Report of a paper published in *Compt. rend.*, 1930, 190, 905–908; see this *J.*, 1930, 43, 606.—M. H.

Preparation of Zinc and Zinc-Alloy Surfaces for Coating. H. A. Nelson and W. W. Kittelberger (*Indust. and Eng. Chem.*, 1933, 25, 27–32; and (abstract) *Met. Ind.* (*Lond.*), 1933, 42, 147–149).—A paper read before the Division of Paint and Varnish Chemistry of the American Chemical Society. See this *J.*, 1932, 50, 743.—H. H. W.

The Manufacture of Phonograph Records. R. A. Dinnan (*Met. Ind.* (*N.Y.*), 1932, 30, 165–167; discussion, 167).—Abstracted from the *Monthly Rev. Amer. Electroplaters' Soc.*, 1932, 19, (1), 7–16. See this *J.*, 1932, 50, 451.—H. M.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-Refining.)

(Continued from p. 199.)

The Potentials of Ferro-Manganese and of Ferro-Chromium Anodes at Different Current Densities and Hydrate Concentrations. M. de Kay Thompson and R. E. Morrissey (*Trans. Electrochem. Soc.*, 1932, 61, 131–138).—The electrode potentials of ferro-manganese and ferro-chromium anodes were measured at different current densities and different concentrations of alkali hydroxide solutions in which they were electrolyzed, and it was found that though the current density–electrode potential curves for the different reactions taking place vary in position with the hydrate concentration, the curve for the sum of the different reactions remains constant over considerable ranges of concentration.—S. G.

Cathodic Films in Electrolytic Condensers. Frank W. Godsey, Jr. (*Electrochem. Soc. Preprint*, 1933, May, 9–15).—The capacity of electrolytic condensers formed in aqueous electrolytes is shown not to be inversely proportional to the formation voltage at the lower formation voltages using either direct or alternating current. Formation of the condensers proceeds regularly as the alternating current is increased until a certain critical value is reached, above which it proceeds to the maximum voltage of the anodes. With a high alternating ripple voltage, film formation may occur at the aluminium cathode of aluminium filter condensers, and thus reduce the effective capacity of the condenser. When the capacity of the film formed is assumed to be inversely proportional to the formation voltage, no formation can occur until a critical voltage is reached, when the cathode will develop a film that increases in thickness until the effective capacity of the condenser becomes inversely proportional to the impressed voltage. The observed film formation at the cathodes for voltages below the critical value is accounted for by the deviation of the film capacity from the inverse proportionality rule.—A. R. P.

The Cæsium–Oxygen–Silver Photoelectric Cell. An Investigation of the Relations in a Composite Photoelectric Surface. C. H. Prescott, Jr. and M. J. Kelly (*Electrochem. Soc. Preprint*, 1932, Sept., 207–232).—Essential conditions for the formation of cæsium–oxygen–silver photoelectric cells are a quantitative control of the degree of oxidation of the silver cathode, the amount of cæsium admitted, and the amount of chemical interaction by regulating the time and temperature of the heat-treatment. The effects of oxygen and free cæsium on the light sensitivity are discussed and it is shown that the active surface of the cathode is probably a film of free cæsium of atomic dimensions adsorbed on a matrix of cæsia and silver containing free cæsium and a little silver oxide. Cf. the work of F. H. Constable.—A. R. P.

VIII.—REFINING

(Including Electro-Refining.)

(Continued from p. 199.)

Liquation as a Metallurgical Operation and Its Aids. Max Moldenhauer (*Metall u. Erz*, 1933, **30**, 81–84, 103–109; discussion, 109–112).—The theory and practice of refining metals and alloys by liquation processes are discussed with special reference to the working-up of lead–tin bearing metals, the removal of iron from zinc and of bismuth from lead, and the desilverizing of lead.
—A. R. P.

Electrolytic Metals. III.—Refining Cast Aluminium. Anon. (*J. Four élect.*, 1933, **42**, 18–19).—The refining of cast aluminium at a temperature between 675° and 735° C. (not above 780° C.) in carefully controlled gas furnaces, as carried out by the Aluminum Company of America, is briefly described and illustrated.—J. H. W.

The Production of Zinc by Electrolysis of Zinc Sulphate Solutions. H. Hey (*Proc. Roy. Soc. New South Wales*, 1932, **65**, M1–M48; *Eng. Abs.*, 1932, (**53**), 57).—Briefly reviews the history of electrolytic zinc production since 1914 and describes the main processes involved in the treatment of ore, purification of electrolyte, winning of zinc, and recovery of by-products.—S. G.

IX.—ANALYSIS

(Continued from pp. 200–201.)

[Report on] Analytical Chemistry. B. A. Ellis and J. J. Fox (*Ann. Rep. Prog. Chem.*, 1933, **29**, 220–238).—A survey of recent advances in the detection and determination of non-ferrous metals is given, with particular reference to the quantitative separation of hydroxides, conductometric titrations, and the use of organic reagents for metals.—E. S. H.

The Rôle of Emission Spectrographic Analysis in the Metal Industry. G. Scheibe (*Mitt. Forschungsanst. G.H.H. Konzern*, 1931, **1**, 123–127; and (short abstract) *Iron Age*, 1932, **129**, 832).—A review of the value of spectrography in the analysis of metals and alloys with especial references to steels.—A. R. P.

A New Photometer for the Spectral Lines in the Visible Region for the Rapid Analysis of Alloys. G. Scheibe and G. Limmer (*Mitt. Forschungsanst. G.H.H. Konzern*, 1932, **2**, 35–42).—A new polarization spectrophotometer is described and the mathematical principles of its construction are explained. Illustrations are given of its value in determining spectrographically various alloying elements in steel.—A. R. P.

Remarks on the Question of Optical Spectrum Analysis. O. Feussner (*Z. tech. Physik*, 1932, **13**, 573–575).—The apparatus for obtaining reproducible electrical discharges in spectrographic analysis is described.—J. W.

Spectrographic Analysis. G. Heidhausen (*Mitt. Forschungsanst. G.H.H. Konzern*, 1932, **2**, 62–78).—Apparatus and methods are described and a brief account is given of their application to metal analysis.—A. R. P.

Application of Solid Cadmium Amalgam in Volumetric Analysis. Seiji Kaneko and Chujiro Nemoto (*Kōgyō Kwagaku Zasshi* (*J. Soc. Chem. Ind., Japan*), 1932, **35**, (5); *C. Abs.*, 1932, **26**, 4006).—[In Japanese, with English summary in supplemental binding, p. 185.] Experiments with Fe and MoO_4 solutions have shown that reduction, prior to titration with $KMnO_4$, can be accomplished by means of Cd–Hg containing 15% Cd as follows: To 25 c.c. of solution in a 300-c.c. Erlenmeyer flask, add 10 c.c. of 18*N*-H_2SO_4 and 20 grm. of the solid amalgam. Add a little Na_2CO_3 to expel air, stopper loosely, and heat carefully to melt the amalgam. Shake and allow the reduction to proceed for 5–6 minutes. Then insert a Pt wire, allow the amalgam to solidify, forming around the wire on cooling, remove it, and titrate in the usual manner.—S. G.

Sampling of Secondary White Metals and Residues, with Special Consideration of American Methods. E. Richard Thews (*Metallbörse*, 1931, **21**, 675–676, 723–724, 771–772; *C. Abs.*, 1931, **25**, 3930).—The methods applied on the various materials commonly found in the secondary metal trade are described.—S. G.

Analysis of White Metals and Their Smelter Products. Hans Neubert (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1933, **5**, 60–61).—Dissolution of the sample in HCl and the minimum amount of $NaClO_3$ is preferable to the use of HNO_3. If much Cu is present, $FeCl_3$ is added, followed by NH_4OH, to separate the Sn and Sb from the greater part of the Cu; the precipitate is redissolved in HCl, the solution reduced, and the $SnCl_2$ titrated with I_2. Pb and Cu are separated from Sb and Sn in a separate portion by boiling with Na_2S and S, the Pb being eventually determined volumetrically as $PbCrO_4$ and the Cu with I_2. In the Na_2S filtrate As is removed by H_2S in 1 : 1 HCl, the Sb filtrate evaporated with $NaClO_3$ almost to dryness, diluted to 100 c.c. with H_2O, and treated with KI, and the liberated I_2 titrated with $Na_2S_2O_3$.—A. R. P.

Studies of Various Methods for the Separation of the Common Elements into Groups. III.—A New Method for the Separation of Zinc, Cobalt, Nickel, and Iron from Aluminium, Chromium, and Manganese. Ernest H. Swift, R. C. Barton, and H. S. Backus (*J. Amer. Chem. Soc.*, 1932, **54**, 4161–4172).—Many of the individual separations by present methods are liable to be incomplete. The improved method evolved consists in precipitation of Zn, Ni, Co, and Fe with H_2S in controlled excess of NaOH. Sufficient oxalate is added to prevent precipitation of Al or Cr. The precipitates are readily coagulated and filtered.
—R. G.

Precipitation of the Hydroxides of Iron, Aluminium, and Chromium in a Pure, Dense, and Easily Filtered Form. Friedrich L. Hahn (*Ber. deut. chem. Ges.*, 1932, [B], **65**, 64–65).—The use of a mixture of $NaNO_2$ and sodium azide in aqueous solution is found to precipitate $Fe(OH)_3$, $Cr(OH)_3$, and $Al(OH)_3$ rapidly and completely from solutions of their salts; the precipitates settle quickly, and are easily filtered. Full directions for preparing the reagent and for precipitation and washing are given. The reagent is especially recommended for the separation of $Cr(OH)_3$.—P. M. C. R.

Microdokimastic Enrichment and Spectrographic Determination of the Precious Metals. Cl. Peters (*Metallwirtschaft*, 1933, **12**, 17–19).—In obtaining a concentrate of precious metal by smelting with Pb and cupelling the button (microdokimastic enrichment) a small quantity of precious metal is lost. On the other hand, spectrographic analysis is not sufficiently delicate for very small quantities. If, however, cupellation is not carried too far, and the residual Pb is examined spectrographically, it is possible to detect as little as 0·1 grm. per ton of Ag, 0·2 grm. per ton of Rh, Pd, Pt, and Au, 0·5 grm. per ton of Ru, 5 grm. per ton of Os, and 1 grm. per ton of Ir.—v. Gr.

A New Method for the Determination of Alumina in Aluminium Alloys. Wolfgang Ehrenberg (*Z. anal. Chem.*, 1932, **91**, 1–5).—The alloy (3 grm.) is dissolved in an excess of boiling $CuCl_2$ solution so that all the Cu deposited is redissolved. The residue is collected, washed well with hot H_2O, then with 1 : 5 HNO_3, ignited, treated with HF and HNO_3, dried, again ignited, and weighed as Al_2O_3. In this way the Al_2O_3 content of virgin Al was found to be 0·04%, that of remelted Al 0·06–0·09%, that of Silumin 0·044%, and that of powdered Al 0·72% (due to the large surface).—A. R. P.

Volumetric Determination of Magnesium in the Presence of Free Acid and Alkali Metals. J. Clarens and J. Lacroix (*Bull. Soc. chim. France*, 1932, [iv,] **51**, 667–668).—The solution is neutralized with KOH until methyl red indicator just turns yellow, an excess of Na_2CO_3 is added, and the solution boiled for 10 minutes, a small quantity of powdered, dried $Al(OH)_3$ being added soon after the solution boils, to cause the precipitate to become granular so that it settles well. The excess Na_2CO_3 in the boiling solution is then titrated with HCl.—A. R. P.

The Direct Titration of Magnesium and Manganous Sulphates using Fluorescein as an Adsorption Indicator and the Extension of the Method to the Direct Titration of Other Soluble Sulphates and Alums. A. W. Wellings (*Trans. Faraday Soc.*, 1932, **28**, 561–564).—Neutral $MgSO_4$ and $MnSO_4$ may be titrated with $Ba(OH)_2$ using fluorescein as indicator; the end-point is indicated by the persistence of a pink colour, which changes to orange on shaking. Some other neutral sulphates may be similarly titrated if $(CH_3COO)_2Mg$ is added to the solution.—A. R. P.

A Simple Electrolytic Micro-Determination of Mercury. F. Patat (*Mikrochemie*, 1932, **11**, (5), 16–21).—The Hg is deposited electrolytically from 0·1*N*-HNO_3 solutions using a Au wire cathode and a Pt spiral anode with 0·015–0·08 amp./dm.^{2} at 3 v. for 15–20 hrs.—A. R. P.

Contribution to the Microchemical Determination of Minute Quantities of Mercury. Vladimir Masjer (*Mikrochemie*, 1932, **11**, (5), 21–30).—The method depends on the deposition of Hg and Cu together on an Fe wire, distillation of the Hg, and micrometric measurement of the drop. A new technique for the latter operation is described.—A. R. P.

Determination of Tellurium as Crystalline Tellurium and as Tellurium Dioxide. Otto E. Clauder (*Z. anal. Chem.*, 1932, **89**, 270–282).—Precipitation of Te in the amorphous form yields high results owing to oxidation during drying. Crystalline Te may be precipitated by adding to the Te solution containing 15–20% of free HCl, 10–20 c.c. of a 5–10% solution of KH_2PO_2, $N_2H_4·H_2SO_4$, $NH_2OH·HCl$, SO_2, or $TiCl_3$ and heating the mixture very slowly in a water-bath. Drying of the crystals at 132° C. proceeds to completion without oxidation. If Bi or Sb is present, the precipitate must be washed with *N*-HCl, 3*N*-HCl, H_2O, and C_2H_5OH in succession. Cu does not interfere, but if more than 0·5 grm. of $PbCl_2$ is present, the precipitate must be redissolved in HNO_3, the solution evaporated twice with HCl, and the Te re-precipitated. Te may be determined as TeO_2 by neutralizing the solution with NH_4OH, adding 10 c.c. of *N*-HCl, diluting to 100 c.c., adding 1 grm. of NH_4Cl, heating to 100° C., and adding drop by drop 10 c.c. of 20% $(CH_2)_6N_4$. The precipitate is collected in a filter crucible on the next day, washed with cold H_2O, then with C_2H_5OH, and dried at 132° C. Se does not interfere.—A. R. P.

Estimation of Thallium after Oxidation with Bromine. Philip E. Browning (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1932, **4**, 417).—The nitrate solution is oxidized with a slight excess of Br_2-water and the Tl precipitated as Tl_2O_3, aq. by addition of NH_4OH or NaOH. The washed precipitate is heated to constant weight (Tl_2O_3) at 150°–200° C.—A. R. P.

A Rapid Method for the Determination of Small Quantities of Thallium in the Presence of Lead and Bismuth. F. Pavelka and Hermine Morth (*Mikrochemie*, 1932, **11**, (5), 30–33).—The method depends on the development of a yellow colour when an excess of phosphomolybdic acid is added to a HNO_3 solution of a Tl salt. The intensity of the colour is compared with that of a standard.—A. R. P.

Quantitative Estimation of the Impurities in Tin by Means of the Quartz Spectrograph. C. Stansfield Hitchen (*Amer. Inst. Min. Met. Eng. Tech. Publ.* No. 494, 1933, 1–20).—The determination of Zn, Cu, Bi, Fe, Pb, As, and

Sb in Sn by the logarithmic sector method is described, and suitable line-pairs are given for various conditions. The method is unsuitable for amounts of As below 0·03% and Sb below 0·07%. Tables are given for the sensitivity of the most important lines in the arc and spark spectra of all the above elements.—A. R. P.

Volumetric Determination of Tin. Application to the Separation of Antimony from Tin. P. Ed. Winkler (*Bull. Soc. chim. Belg.*, 1932, **41**, 115–137).—The Sn is separated in the usual way as SnS_2, the precipitate is dissolved in NaOH, and the Sn reduced to metal by treatment of the solution with HCl and Zn. The Sn together with excess of Zn is dissolved in HCl in a flask fitted with a valve, the H_2 evolved preventing oxidation of the $SnCl_2$ to $SnCl_4$. The $SnCl_2$ solution is titrated with I_2 in the usual way. When Sb has been separated from Sn by means of H_2S in $H_2C_2O_4$ solution, the latter may be destroyed by boiling with $NaClO_3$ and HCl, but there is always a small loss of Sn, which may be allowed for by the use of an empirical factor.
—A. R. P.

On the Colorimetry of Titanium.—II. (A Contribution to the General Method of Colorimetry.) H. Ginsberg (*Z. anorg. Chem.*, 1932, **209**, 105–112).—M. H.

Volumetric Determination of Vanadium and Molybdenum. G. Scagliarini and P. Pratesi (*Atti R. Accad. Nazion. Lincei. Rendiconti Classe Scienze Fisiche*, 1932, **15**, 99–103).—V_2O_5 and MoO_3 are reduced by Cu in solutions free from SO_4'', whereas Ti^{IV} and Cr^{III} are unaffected.—G. G.

Determination of Small Quantities of Zinc in Aluminium. M. I. Choubine (*Zvetnye Metally* (*The Non-Ferrous Metals*), 1932, **7**, 147–162; and (abstract) *Chim. et Ind.*, 1932, **28**, 1344).—[In Russian.] After dissolving in caustic soda and separating the Zn by means of sodium hydrosulphide, the ZnS is dissolved in H_2SO_4 and the H_2S removed by boiling. Oxygenated water is added and the solution neutralized with ammonia while hot. After filtering, excess of ammonia is added and the solution is electrolyzed in the normal way.
—W. A. C. N.

Determination of Zinc in Brass and Red Brass or Other Zinciferous Alloys by the Oxalate-Permanganate Method. E. Knoppick (*Chem.-Zeit.*, 1932, **56**, 663).—The sample is dissolved as usual and the other metals are separated from the Zn by H_2S and NH_4OH. The ammoniacal Zn solution is then treated with $H_2C_2O_4$ and strongly acidified with $CH_3{\cdot}COOH$; on heating to 70°–80° C. the powdery precipitate is converted into crystalline ZnC_2O_4, which is collected, washed, dissolved in H_2SO_4, and titrated with $KMnO_4$. Mn is co-precipitated with the Zn, but may be determined colorimetrically in a separate portion and due allowance made in calculating the Zn.—A. R. P.

Volumetric Determination of Zinc. André Hecquet (*Ann. chim. analyt.*, 1933, [ii], **15**, 10–11).—Modifications of the $K_4Fe(CN)_6$ method are described for use when the solution contains large amounts of sulphate and organic matter.—A. R. P.

Electrolytic Deposition of Zinc from Acid Solutions. Hisashi Kiyota (*Mem. Coll. Sci. Kyōtō Imp. Univ.*, 1932, [A], **15**, 301–310).—[In English.] Quantitative results are not obtained in the electrolysis of the usual Zn solutions, using a Pt basin as cathode. In the presence of 0·15–0·33N-acetic acid (for 0·5–0·1 grm. Zn) a satisfactory deposit is formed and the procedure is suitable for quantitative electro-analysis. Sodium or ammonium sulphate should not be present at a concentration greater than 0·15N; nitrates and chlorides should be absent. The Zn deposit is obtained as a smooth coating, and the electrode may be used directly for the next electro-analytical determination.—E. S. H.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

(See also "Testing" and "Pyrometry.")

(Continued from p. 202.)

An Inexpensive and Easily-Made Lining for Fireclay Crucibles for Laboratory Use. A. H. Jay (*J. Iron Steel Inst.*, 1932, **125**, 427–428).—Alumina is mixed with 7% by weight of dry, powdered fluorspar, a concentrated gum solution is added to form a paste, which is spread over the inside of the crucible to a thickness of ⅛ in. The lining is first dried in a hot-air oven and then fired in two stages : (*a*) by slowly heating in a plentiful supply of air up to 700° C., (*b*) by heating more rapidly to about 1300° C., at which the temperature is maintained for about 2 hrs. The crucible is then allowed to cool in the furnace. The linings are devoid of cracks. Aluminium–manganese alloys, which were melted in them, showed no foreign matter when examined by the X-ray method. The linings can withstand fairly high temperatures and have proved useful in preparing iron–aluminium alloys of high iron content, having melting points of 1200°–1400° C.—E. S. H.

On a Heating Device for X-Ray Specimens. G. Wassermann (*Mitt. Material., Sonderheft* **21**, 1933, 69).—See this *J.*, 1932, **50**, 246.—J. W.

A Method for Preparing Crystals for [X-Ray] Rotation Photographs. H. Kersten and W. Lange (*Rev. Sci. Instruments*, 1932, **3**, 790–791).—Apparatus comprising a flexible shaft dental drill equipped with an emery-paper disc with which crystals can easily be ground to diameters of less than 1 mm. without disturbing the necessary spectrographic adjustments of the crystal, is described.—J. S. G. T.

A New X-Ray-Interference Method [for the Investigation of Multi-Crystalline, more especially Rolled and Fibrous, Materials]. (Object between Two Slits.) H. Seemann (*Physikal. Z.*, 1932, **33**, 755–762).—A form of X-ray interference method, suitable for the investigation, more especially of the crystalline structures of rolled and fibrous materials, is described. Results obtained with copper, aluminium, and nickel sheet and foil are illustrated. —J. S. G. T.

Two New X-Ray Spectrometers. Anon. (*Instruments*, 1932, **5**, 272).—Brief descriptions of the Allison and Compton X-ray spectrometers.—J. C. C.

Metal X-Ray Tube for Characteristic Radiation. C. J. Ksanda (*Rev. Sci. Instruments*, 1932, **3**, 531–534).—An X-ray tube, constructed of stainless steel and having aluminium " windows " is described.—J. S. G. T.

Measuring Movements of 0·000001 Inch. Anon. (*Electric J.*, 1932, **29**, 380–382).—The principles of a magnetic strain-gauge are outlined and some applications described. Movements of an armature are recorded by changes in the reluctance of two magnetic circuits. In conjunction with an oscillograph, the gauge has been used to measure strain in locomotive driving rods and in railway tracks.—J. C. C.

An Apparatus for the Purification of Mercury. W. Burstyn (*Z. tech. Physik*, 1932, **13**, 505).—Air is drawn by means of a water-pump through mercury contaminated with base metal impurities whereby they become oxidized and collect as a scum on the surface of the metal.—J. W.

Laboratory Equipment for Dental Casting. T. C. Trigger (*Oral Health*, 1932, **21**, (5); and (reprinted) *Brit. J. Dental Sci.—Prosthetics Section*, 1932, **76**, 181–183).—General notes on the use of gas for heating and melting.—J. C. C.

The Hard Metal Widia in the Hands of the Chemist. Curt Agte (*Chem. Fabrik*, 1933, **6**, 5–6).—The use of Widia tools for cutting and grinding in the laboratory and for working glass is described.—A. R. P.

XI.—PHYSICAL AND MECHANICAL TESTING, INSPECTION, AND RADIOLOGY

(Continued from pp. 202–203.)

Report of Committee E-1 [of A.S.T.M.] on Methods of Testing. W. H. Fulweiler and R. E. Hess (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 498–506).—See this *J.*, 1932, **50**, 557.—S. G.

Technical Methods of Photo-Elastic Research. R. V. Baud (*Schweiz. Bauzeitung*, 1932, **100**, 1–4, 15–20).—The development, principles of calculation, and technical applications of photo-elastic investigations are described at length and a new graphical and photographic method is given which depends on the sharp changes of colour at phase differences in the region of 0·55 μ and 1·1 μ.—J. W.

Studying How Machine Parts Act Under Stress. A. M. Wahl (*Electric J.*, 1932, **29**, 464–465, 467).—Photo-elastic tests on celluloid or bakelite models, and strain, deflection, and buckling tests on models or full-sized machine parts are briefly reviewed.—J. C. C.

Photographic and Kinematographic Study of Photo-Elasticity. Zirō Tuzi (*J. Soc. Mech. Eng. Tokyo*, 1928, **31**, (136), 334–349; *Japanese J. Eng. Abs.*, 1932, **8**, 10).—[In Japanese.] Cf. this *J.*, 1930, **44**, 595. T. introduces the use of the photographic method instead of the compensator for the numerical calculation of stress in photo-elastic observations. With the green ray of monochromatic light the fringes are photographed by an orthochromatic plate. By this method personal errors can be completely eliminated, but the method fails when a uniform stress exists at any part of the specimen.—S. G.

A Dial-Type Load Indicator for Testing Machines. Anon. (*Machinery (Lond.)*, 1932, **40**, 660–661).—The Olsen pendulum dial indicates directly by a pointer, the load applied by the testing machine. The position of the pointer is determined by the movement of a pendulum to which the load is transmitted by a series of levers. An autographic recorder is incorporated.—J. C. C.

Full-Load Calibration of a 600,000 lb. Testing Machine. H. F. Moore, J. C. Othus, and G. N. Krouse (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (II), 778–782).—See this *J.*, 1932, **50**, 447.—S. G.

On the Properties of the Strain Figure and Its Applications. Ichitarō Takaba and Katsumi Okuda (*J. Soc. Mech. Eng. Tokyo*, 1928, **31**, (136), 350–365; *Japanese J. Eng. Abs.*, 1932, **8**, 10).—[In Japanese.] See *Arch. Eisenhüttenwesen*, 1928, **1**, 511–515; this *J.*, 1928, **39**, 578.—S. G.

Notes on the General Theories of Strain and Elasticity. Chido Sunatani (*J. Soc. Mech. Eng. Tokyo*, 1928, **31**, (136), 635–671; *Japanese J. Eng. Abs.*, 1932, **8**, 14).—[In Japanese.] See this *J.*, 1928, **40**, 608.—S. G.

Applications of Creep Tests. Gleason H. MacCullough (*Amer. Soc. Mech. Eng. Preprint*, 1932, (Dec.), 1–11).—Mathematical analysis of four specific problems which involve creep phenomena, *viz.*, the problem of a flanged and bolted pipe joint, under creep conditions, and the three problems of stress distribution and creep in (*a*) a thick-walled cylinder under internal pressure, (*b*) a beam subjected to pure bending, and (*c*) a solid circular shaft under torsion.—W. P. R.

Stress-Concentration Phenomena in Fatigue of Metals. R. E. Peterson (*Amer. Soc. Mech. Eng. Preprint*, 1932, (Dec.), 1–11).—Stress concentrations are invariably present in machines, owing to fillets, threads, keyways, &c., and the importance of such "stress raisers" on the endurance of metals to alternating stresses is generally recognized. The fatigue stress–concentration factor is defined as the ordinary endurance limit/endurance limit with stress concentration effect. This factor is not independent of the material, and it is doubtful whether it can be correlated with the ordinary properties of materials such as ductility and hardness; it has been suggested that materials having a small stress–concentration effect in fatigue are also materials which possess a large internal damping and *vice versa.* If material and size of a specimen are kept constant and the size of a discontinuity is varied, theoretical stress–concentration factors increase as the size decreases. Fatigue stress–concentration factors show a similar increase except for a marked *decrease* for very small discontinuities. The method of producing a surface discontinuity has an influence on the fatigue stress–concentration factor, since cold-working the surface increases the endurance properties of metals, and the beneficial effect of the cold-work may be greater than the reduction caused by the stress–concentration. In ordinary fatigue specimens the crack usually begins at one place and progresses across the specimen, so that the area of final rupture has a segmental appearance. If a stress–concentration effect is present, the rupture area is generally totally enclosed. The position of the rupture area within the cross section appears to vary with the stress, being centrally located for high stresses and displaced from the centre as the stress approaches the endurance limit. The presence of radial ridges—the so-called " beach marks " —on the fracture usually indicates that failure has commenced at several points.—W. P. R.

Breaking of Metal by Fatigue. Masuhiro Suzuki (*Bull. Research Office, Japanese Govt. Railway*, 1928, **16**, (8), 1177–1201; *Japanese J. Eng. Abs.*, 1932, **8**, 18).—[In Japanese.] The fatigue limit of a material was determined by observing the changes in structure, measuring the electrical p.d. between 2 points on the specimen. The measurement was made by a differential method using an auxiliary specimen, and the change was observed clearly and accurately.—H. Y.

Fatigue Testing of Materials. P. Field Foster (*Machinery* (*Lond.*), 1932, **40**, 404–407).—A general account is given of the method of determining fatigue endurance curves with the Wöhler type of machine.—J. C. C.

Dynamic Testing of Materials. R. E. Peterson (*Electric J.*, 1932, **29**, 377–379).—A note. Photographs of some special fatigue testing machines in an American industrial laboratory are included.—J. C. C.

Breaking Specimens in Fatigue Testing Machines. L. Persoz (*Aciers spéciaux*, 1932, **7**, 428–438).—The question of the graduation marks and shape of the test-pieces is discussed, and the relation between the resistance to alternate torsion and alternate bending is explained. A series of corrosion tests on a number of ferrous and non-ferrous alloys is described, and the significance of fatigue tests after corrosion and the methods of protecting the alloys from corrosion are discussed.—J. H. W.

Tentative Specification II of the DVM-Testing Method A 113, Endurance Bending Test. German Society for Testing Materials (*Z. Metallkunde*, 1933, **25**, 27–28).—Specifications are given for the testing machine, test-piece, experimental procedure, and evaluation of the results.—M. H.

The Haigh Alternating Stress Testing Machine. P. Field Foster (*Machinery* (*Lond.*), 1932, **40**, 621–624).—A general illustrated account of the construction, use, and method of calibration of the Haigh machine.—J. C. C.

Recent American Researches on " Fatigue of Metals."—II. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 167–168).—A continuation of a review of recent work on the subject, including that by P. L. Irwin, *Proc. Amer. Soc. Test. Mat.*, 1925, **25**, (II), 687 (cf. this *J.*, 1926, **35**, 687), by France (*ibid.*, 1931, **31**, (II), 176), and by Gough, *Aeronaut. Res. Cttee.*, *R. and M.* No. **864**, 1925.
—R. G.

Fatigue Strength and Resistance to Slip. P. Ludwik (*Met. Ind.* (*Lond.*), 1932, **41**, 613–615, 635–636).—Translation of a paper on " Schwingungsfestigkeit und Gleitwiderstand," *Z. Metallkunde*, 1930, **22**, 374–376. See this *J.*, 1931, **47**, 102.—J. H. W.

Fatigue of Metals. Methods for Determining the [Fatigue] Limit. P. Vernotte (*Usine*, 1931, 40, (34), 29).—Abstract of an article in *Science et Industrie*, 1931, 15, 223. See this *J.*, 1932, 50, 43.—H. W. G. H.

A Proposed Method for Determining the Fatigue Limit [of Steel]. Yūji Nagasawa (*J. Soc. Mech. Eng. Tokyo*, 1928, 31, (135), 259–274; *Japanese J. Eng. Abs.*, 1932, 8, 9).—[In Japanese.]—S. G.

Amsler Torsion Testing Machines. P. Field Foster (*Machinery* (*Lond.*), 1932, 39, 616–617).—Illustrated descriptions are given of the Amsler pendulum-type torsion testing machines of 1200, 2400, and 4800 lb.-ft. capacity and of the Amsler wire testing machines in which the torsion is measured by the twist of a calibrated measuring wire.—J. C. C.

Obtaining a Steady Curvature in Technical Bending Tests. M. Moser (*Stahl u. Eisen*, 1932, 52, 409–411).—In bending tests, especially on welded specimens, it is recommended that the mandrel about which the specimen is bent should not be semi-cylindrical, but should have a definitely flattened surface, so that the specimen is bent into a circular form when the bending angle is large. If this angle exceeds 170°–180°, an additional apparatus in the form of a hollow wedge is used so as to avoid local nicking.—J. W.

Notched-Bar Tests. Max Moser (*Amer. Soc. Mech. Eng. Preprint*, 1932, 1–6).—Unlike the tensile test, the notched-bar test does not give comparable results using test-pieces the dimensions of which, although of the same proportion, are not identical, and before such tests can be of real use the relationship existing between the conditions of tests and the test results must be understood. Although the notched-bar test does not provide any practical design data, it does give an indication of the ductilities of materials. Moreover, the test does to a certain extent give an indication of whether a material can be improved or deteriorated by "ageing." Steps are being taken by the New International Association for Testing Materials to establish a standard test-specimen for the notched-bar test. Cf. this *J.*, 1932, 50, 369.—W. P. R.

On the Relation between Stress and Strain in the Impact Test. Ryônosukè Yamada (*J. Soc. Mech. Eng. Tokyo*, 1928, 31, (136), 420–446; *Japanese J. Eng. Abs.*, 1932, 8, 11).—[In Japanese.] See this *J.*, 1930, 43, 580.—S. G.

An Automatic Autographic Extensometer for Use in Tension Tests of Materials. R. L. Templin (*Proc. Amer. Soc. Test. Mat.*, 1932, 32, (II), 783–792).—See this *J.*, 1932, 50, 490.—S. G.

A Method for Studying Strain-Hardening Susceptibility and Ageing after Cold-Work Deformation. Albert Sauveur and John L. Burns (*Metals and Alloys*, 1933, 4, 6).—The strain-hardening susceptibility of a metal may be determined by making a depression in the metal with a 10-mm. ball in the Brinell machine using a standard load and then measuring the hardness at the bottom of the depression by the Rockwell B test. The susceptibility for a constant depth of depression may be similarly measured, and the effect of ageing in either case may be determined by suitable heat-treatment after the Brinell depression has been made. Examples of the results obtained with Armco iron are given, but the method can be applied to any metal.—A. R. P.

Portable Hardness Testing Machine with Diamond Pyramid Indenter. S. R. M. Porter (*J. Sci. Instruments*, 1933, 10, 18–20).—P. describes briefly a portable hardness tester designed for use on large or fixed surfaces (*e.g.*, the head of a railway line). A 136° diamond pyramid indenter is used with a load of 10 kg., which is supplied by hand through a spring, mounted so that a stop prevents overloading. The size of the indentation is measured by a portable microscope, and the hardness number determined from a table. The accuracy is estimated as 5% under all conditions, and greater under favourable conditions.—W. H.-R.

A Useful Micrometer [for Measuring Brinell Impressions, &c.]. Anon. (*J. Sci. Instruments*, 1933, 10, 20).—A note. Describes briefly a small micrometer mounted on a tripod, and suitable for measuring Brinell impressions, &c. The instrument contains an illuminating device, and a scale divided to 0·001 in. The standard magnification is × 25, but additional scales and objectives can be supplied by the makers.—W. H.-R.

The Hardness of Metals at High Temperatures. Anon. (*Engineering*, 1932, **134**, 604–605).—Illustrated article describing a method for determining true hardness at high temperatures. See *J.*, this volume, p. 97.—W. P. R.

RADIOLOGY

X-Ray Examination of Aero Materials by the D.V.L. Kurt Matthaes (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1932, V59–64).—Identical with *Z. Flug. u. Motor.*, 1932, **23**, 459–464. See this *J.*, 1932, **50**, 755.—B. Bl.

Laue Diagrams with Large Diffraction Angles. W. Boas and E. Schmid (*Mitt. Material., Sonderheft* **21**, 1933, 66–68).—See this *J.*, 1932, **50**, 165.—J. W.

Measurements of Elasticity by Means of X-Rays. G. Sachs and J. Weerts (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1931**, (2–3), 90–92).—[In Russian.]—See this *J.*, 1930, **44**, 594.—D. N. S.

XII.—PYROMETRY

(Continued from p. 204.)

Temperature Measurement and Control. Anon. (*Engineering*, 1932, **135**, 67–69).—The various types of instruments and apparatus for measuring temperatures are described. A very useful and complete table is given of all types of pyrometers, ranging from mercury-in-glass thermometers to the Joly meldometer, in which temperatures are measured by observing the expansion of a platinum strip.—W. P. R.

The Naeser Colour Pyrometer. M. A. Vernon (*Metallurgia*, 1933, **7**, 159–160).—A description is given of a new optical pyrometer in which temperature measurements depend on variations in colour, and in which light is passed from the hot body successively through 3 filters. Filter 1 transmits 2 colours, filter 2 absorbs one of the colours in gradually increasing amounts, whilst filter 3 absorbs the second colour and transmits the first. The three filters are joined together and an eye-piece is made to slide along the compounded filter and a pointer on the eye-piece moves along a rigid scale of temperatures on the filter, so that the required temperature is read off directly. For the greatest accuracy the colours chosen must be such that as the eye-piece is moved along the wedge one component predominates, until there is a sudden change to the standard compound tint, followed immediately by a change to the other colour, and this condition is satisfied by making the colours complementary and the standard tint white. Temperatures ranging from 500° to 3000° C. can be measured, and a high degree of accuracy can be obtained.—J. W. D.

A New Thermocouple for the Determination of Temperatures up to at Least 1800° C. G. R. Fitterer (*Amer. Inst. Min. Met. Eng. Preprint*, **1933**, Feb., 1–8).—The couple consists of a carbon tube through which is run a silicon carbide rod spaced from the walls by means of a refractory ring at the upper end and screwed into the lower end to form the hot-junction. Comparison of the readings of this couple with those given by a platinum|platinum–rhodium couple and by an optical pyrometer show that the calibration curve may be expressed by the equation: $t = 50 + 3{\cdot}32x$, where t is the temperature required in ° C., and x is the reading in millivolts. The couple is extraordinarily stable and highly resistant to chemical contamination.—A. R. P.

A Design for Precision Platinum Resistance Thermometers. J. A. Hall (*J. Sci. Instruments*, 1933, **10**, 4–10).—Full details are given of the design and construction of a resistance thermometer in which the platinum element is wound on a frame of fused quartz in a hermetically-sealed envelope. This type of mounting is lighter than one of porcelain, and stronger than one of mica.—W. H.-R.

Ageing of Nickel-Chromium Thermoelements. A. Grunert (*Chem. Fabrik*, 1933, **6**, 39–40).—Thermocouples consisting of very pure wires of nickel and nickel-chromium alloy, both of which have been melted in a vacuum, retain their calibration at 1280° C. after 200 hrs.' continuous heating. The presence of small quantities of impurities causes rapid deterioration in this test, manganese, silicon, aluminium, and carbon being especially harmful.—A. R. P.

Maintenance of Pyrometers. J. F. Martin (*Met. Ind.* (*Lond.*), 1933, **42**, 104, 111).—A letter commenting on a paper by F. J. Brookes on "Practical Notes on the Installation and Upkeep of Thermo-Couple Pyrometers" (see *J.*, this volume, p. 98).—J. H. W.

Measurement of Temperature of Non-Ferrous Alloys. [H. M.] St. John (*Usine*, 1931, **40**, (23), 31).—Abstract of a paper read before the 10e. Congrès de Fonderie. See this *J.*, 1931, **47**, 546.—H. W. G. H.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 204–207.)

Oxide in Metal Castings. F. Höhne (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 13–14, 35–36, 78–79).—The mechanism of deoxidation of metals is discussed. The heat of combustion of the deoxidizing agent must be considerably greater than that of the metal to be deoxidized, a small excess of the deoxidizer must have no detrimental effect on the metal, and any oxide formed must be easily slagged off. The use of magnesium, aluminium, silicon, manganese, zinc, phosphorus, and carbon as deoxidizing agents for copper and for alloys of copper with zinc, tin, nickel, aluminium, and silicon is discussed.
—J. H. W.

Factors and Faults in the Foundry. A. Portevin (*Usine*, 1931, **40**, (43), 37).—Abstract of a paper presented to the 6e. Congrès International de Fonderie. See this *J.*, 1932, **50**, 770.—H. W. G. H.

The Contraction of Metals During Casting. [C. M. Saeger, Jr., and Eugene J. Ash] (*Technique moderne*, 1932, **24**, 633).—Abstract from *U.S. Bur. Stand. J. Research*, 1932, **8**, 37. See this *J.*, 1932, **50**, 263.—H. W. G. H.

Pouring Castings with Large Flat Faces. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 73–74).—The special precautions to be taken in making castings with large flat faces are described.—J. H. W.

Some Notes on Aluminium and Aluminium Alloy Founding. N. F. Budgen (*Aluminium Broadcast*, 1933, **3**, (42), 4–9).—Read before the Manchester Metallurgical Society, 1932, Nov. 16. Aluminium alloys suitable for sand, permanent mould, and pressure castings are enumerated, and furnaces for melting the alloys briefly reviewed. Pinholing is well established as being caused by gases such as hydrogen derived from water vapour, or absorbed by the virgin metal when exposed to corrosive conditions. Preventive methods include pre-solidification or treatment with nitrogen or chlorine. Experiments to show the effect of melting and pouring temperatures were made by using an alloy, for which the lowest pouring temperature was 720° C., to cast a shallow dish. If the metal was heated above 760° C. and then allowed to cool to 720° C. before pouring, the crystal-size and the depth and number of eutectic draws increased. These bad effects were even more pronounced if the metal was poured above 720° C. Metal which has been overheated can, however, be made to give good castings if it is allowed to solidify and carefully remelted.

Reference is made to the use of agents such as boron trichloride to effect grain-refinement.—J. C. C.

Casting of Aluminium Alloys. A. Courty (*Usine*, 1931, 40, (2), 39).—Abstract of paper published in *Compt. rend.*, 1930, **191**, 1128. See this *J.*, 1931, **47**, 238.—H. W. G. H.

Organization of a Foundry for Varied Small Castings in Bronze and Iron. —— Castelain (*Usine*, 1931, **40**, (43), 39).—Abstract of a paper presented to the 6e. Congrès International de Fonderie, describing the reorganization of the Chemin de Fer du Nord Foundry at Hellemmes. See this *J.*, 1932, **50**, 580.
—H. W. G. H.

Casting Bronze which Retains Fluids under High Pressure. J. E. Crown (*Industria Meccanico*, **1932**, (5), 300–332).—The methods used at the U.S. Naval Gun Factory are described; see this *J.*, 1932, **50**, 123, 196.—G. G.

Casting Properties of Nickel Bronzes. N. B. Pilling and T. E. Kihlgren (*Met. Ind.* (*Lond.*), 1932, **41**, 631–633; 1933, **42**, 11–13).—Read before the American Foundrymen's Association; see this *J.*, 1932, **50**, 772.—J. H. W.

What is Wrong with the Brass Foundry? William J. Reardon (*Met. Ind.* (*N.Y.*), 1933, **31**, 15).—A brief outline of the present economical conditions in American brass foundries.—A. R. P.

A Specialist in the Production of Difficult Alloys. Anon. (*Met. Ind.* (*N.Y.*), 1932, **30**, 310–314).—An illustrated description of an American works producing high-grade nickel–brass and phosphor–bronze.—A. R. P.

The Fundamentals of Brass Foundry Practice.—XXVIII., XXIX. R. R. Clarke (*Met. Ind.* (*N.Y.*), 1932, **30**, 62–63, 280–281).—The concluding parts of an article on the basic laws which control the melting and casting of brass. The subjects discussed are fuels and fluxes for the melting of brass.—A. R. P.

The Chief Causes of Porous Brass Castings. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 53–54).—The chief kinds of porosity in brass castings are: (1) lack of compactness as shown by mechanical tests; (2) fine pores which show up as small black points in the polished specimens; (3) blisters under the skin which appear after the casting is turned in a lathe. These 3 forms of porosity are explained and methods of preventing their occurrence are described.—J. H. W.

Casting Small Paddle Wheels in Green-Sand. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 14–16).—Small paddle wheels were formerly cast in dry sand. Green-sand, however, has the advantages that the red brass and bronze usually used cast well in it and a more nearly seamless and a smoother casting can be obtained. Details of the moulding and mould-dressing are given.—J. H. W.

Fluxes for Brass. [Edmund R. Thews] (*Usine*, 1931, **40**, (49), 39).—From *Metallurgist* (Suppt. to *Engineer*), 1931, **7**, 94–96. See this *J.*, 1931, **47**, 572.
—H. W. G. H.

Phosphorus in Red Brass. R. W. Parsons (*Met. Ind.* (*N.Y.*), 1932, **30**, 433–435).—Abstract of a paper read before the American Foundrymen's Association. See this *J.*, 1932, **50**, 773.—I. M.

Casting Brass in Chills under Pressure. [L. H. Morin] (*Usine*, 1931, **40**, (33), 35).—Abstracted from *Iron Age*, 1931, **127**, 1552. See this *J.*, 1931, **47**, 608.—H. W. G. H.

White Bearing Metals. E. Fleischmann (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 182–184).—A summary and discussion of a publication on white metals for bearings by F., in *Forschungsarbeiten über Metallkunde und Röntgenmetallographie.* See this *J.*, 1932, **50**, 774.—R. G.

Viscosity of Fluxes and Slags for Magnesium Melting. —— Hardouin, —— Cochet, and —— De Fleury (*Technique moderne*, 1932, **24**, 573).—Abstract of a paper presented to the Académie des Sciences. See this *J.*, 1932, **50**, 710.
—H. W. G. H.

Flux for Protecting, Refining, and Eliminating Chlorides in Casting Magnesium. R. de Fleury and A. Caillon (*Compt. rend.*, 1933, **196**, 53–55; and *J. Four élect.*, 1933, **42**, 56).—When magnesium chloride is used as a flux in casting magnesium and its alloys, all traces of chloride must be eliminated from the casting. A better method is to melt the metal under 0·5–5% by weight of a " base flux " consisting of magnesium chloride 60% + sodium chloride 40%. After melting, 20% (by weight of the base flux) of a " correcting flux," consisting of MgF_2 50% + B_2O_3 50% or MgF_2 35% + BaF_2 15% + B_2O_3 50%, is stirred in to increase the viscosity of the flux, facilitate pouring, and eliminate the chlorides. The melt is then dusted with flowers of sulphur and $NH_4F + HF$. A " casting flux," consisting of B_2O_3 15% + $Na_2B_4O_7$ 85%, is added 20–25 minutes before pouring. This mixture must be accurately made up with strictly anhydrous salts. It becomes viscous at 850° C. and adequately protects the metal without entering the mould.—J. H. W.

Melting and Casting Nickel and Non-Ferrous Metals Containing Nickel. B. Trautmann (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 11–13).—Nickel and high-nickel non-ferrous alloys are characterized by high melting points, large shrinkage, and a pronounced tendency to absorb gases, particularly oxygen, sulphurous and carbonic. In pure nickel and Monel metal, silicon can be present up to 2%, manganese up to 0·5%, and iron up to 3% without harmful effects, but carbon and sulphur must be absent. The melting, moulding, and pouring operations for these alloys and for copper alloys containing less nickel are described.—J. H. W.

Saving Babbitt by Covering Melting Pot. James J. Baule (*Machinery (N.Y.)*, 1933, **39**, 480).—An asbestos board cover for floating on the metal in a Babbitt melting pot is described. After 54 hrs., 78 lb. of oxide were formed in a 24-in. diam. pot fitted with such a cover, as against 232 lb. in an open pot and 198 lb. in one having a layer of charcoal.—J. C. C.

Directions for Running White Metal Bearings for Machinery and Motors. Carl Krömer (*Automobiltech. Z.*, 1932, **35**, 284–286).—For heavy duty, a bearing metal of the composition tin 75–83, antimony 12–15, copper 3–5% is suggested; no lead should be present. The selection of crucibles, the time taken in melting, treatment of excess metal, method of temperature control, preparation of the ladle, and rate of pouring are considered in detail; the avoidance of premature separation of copper–tin crystals and of included air-bubbles is specially considered. The preparation and tinning of the mould are fully described, and details of melting furnace, pyrometers, arrangements prior to pouring, and rapid cooling of the bearing are given, together with particulars as to shrinkage.—P. M. C. R.

Widening the Scope of Aluminium Permanent Mould Castings. Harry L. Smith (*Iron Age*, 1933, **131**, 312–313, 340).—Permanent mould castings lie between sand- and die-castings, and are used where accuracy, lightness, strength, and a smooth finish are required for castings with intricate shapes and complicated cores. The alloys used contain up to 10% copper, 5·5% silicon, 1·5% zinc, and 0·2% magnesium, and have an ultimate tensile strength of between 21,000 and 33,000 lb./in.^{2}, a minimum elongation of 0–4·5% on 2 in., and a Brinell hardness of 45–125.—J. H. W.

Centrifugal Casting of Non-Ferrous Metals. ——Dubercet (*Rev. Fonderie moderne*, 1933, **27**, 17–21).—General considerations in centrifugal casting and its effects on segregation are discussed, and the methods of horizontal and vertical centrifugal casting are described. The process has many advantages, but its applications are somewhat severely limited to special cases, *e.g.*, where severe friction is to be encountered by the casting.—J. H. W.

Centrifugal Casting in the American Navy. Joseph F. Crowell (*Usine*, 1931, **40**, (22), 31).—Abstracted from *Iron Age*, 1930, **126**, 994, 1047. See this *J.*, 1931, **47**, 53.—H. W. G. H.

The Production of Aluminium Die-Castings. C. R. Norwood (*Machinery* (*Lond.*), 1933, 41, 499–500).—Correspondence on C. Vaughan's paper (see *J.*, this volume, p. 151). The use of steel and brass inserts and the effects of correct venting in gravity die-castings are illustrated.—J. C. C.

Die-Cast Silumin. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 54, 55–58).—The casting and mechanical properties of Silumin (aluminium + 13% silicon), both modified and unmodified, are described and these properties are compared to those of other common die-cast aluminium alloys. For ordinary Silumin, the casting temperature is 750° C. and the mould temperature 200° C., increasing to 800° and 500° C., respectively, when special security against cracks is required. The casting of test-pieces is described and the structures of the various kinds of Silumin are explained.—J. H. W.

Mould Construction in Silumin Die-Castings. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 54, 74–78).—A description of the construction of iron moulds suitable for casting Silumin and examples of such castings are given.—J. H. W.

Die-Cast Screw Threads. Anon. (*Machinery* (*Lond.*), 1933, 41, 529–530).—Methods of constructing dies for casting screw-threads are discussed and illustrated.—J. C. C.

Kipp Die-Casting Machines for Small Parts. Anon. (*Machinery* (*N.Y.*), 1933, 39, 483–484).—Brief descriptions of some recently introduced machines. —J. C. C.

The Luting of Joints in Moulds. Anon. (*Maschinenkonstrukteur*, 1933, 66, 34).—Slaked lime, mixed with water to a pasty consistency, preserves its plasticity long enough to penetrate and fill the joints; the water is very gradually given up to the moulding sand, and the lime possesses a penetrability by air equal to that of clay. Contact with molten metal causes no evolution of gases. Lime is of great use when moulds are of porous material, consisting of sand and a binding medium which requires further hydration; it may also be advantageously used in the protection of cores.—P. M. C. R.

Modern Moulding Machines. Anon. (*Giesserei*, 1933, 20, 94–96).—An illustrated description of the "Rekord," "Herman," "Pluto," and rotating moulding machines.—A. R. P.

A Study of Moulding and Core Sands. Marcel Girault (*Rev. Fonderie moderne*, 1933, 27, 23–26, 28–29; discussion, 29).—The chemical composition, clay content, absorption, granulation, permeability and cohesion, refractoriness and hardness required by moulding sands, and the choice of core sands with a silicious base and the selection of a good binder are described. The control of these various properties is discussed.—J. H. W.

Contribution to the Study of the Expansion of Sand Moulds and Cores. J. Varlet (*Bull. Assoc. Tech. Fonderie*, 1932, 6, 275–284).—Results of laboratory experiments are given confirming the expansion of moulds and cores. The influence of the composition of the sand is discussed.—W. A. C. N.

On the Testing and Evaluation of Core Sand and Core Sand Binders. Th. Klingenstein (*Mitt. Forschungsanst. G.H.H. Konzern*, 1931, 1, 175–185).—Core sand should be tested for grain-size and clay content. Binders can be tested only by making standard cores with varying quantities of binder and testing these cores for strength and permeability to gases. The optimum moisture content of the core mixture can be determined only by experiment. Methods and apparatus for carrying out these tests are described, and the results obtained on a standard sand using 30 different binders are tabulated. Recent literature on the subject is briefly reviewed and a list of 30 references is appended.—A. R. P.

Introduction to a Study of Moulding Sands. L.-F.-C. Girardet (*Bull. Assoc. Tech. Fonderie*, 1933, 7, 43–58).—After a survey of the prominent characteristics of sands in general G. proceeds to consider the causes which may operate in destroying a mould when once formed. Mechanically, the two main factors are erosion and excess pressure. Physically, the thermal stability of the mould and the core, the temperature of vitrification, and the expansion of the sand are important. The chemical constitution, bearing in mind the necessity for the absence of alkalis and other low temperature slag-forming constituents, is equally important. The various tests which determine the value of a moulding sand are described and discussed. Among them are those for ascertaining the agglomerating power, the amount of colloid material, flocculation, and the expansion. The apparatus used in the tests is fully illustrated.—W. A. C. N.

Management and Warehousing of Foundry Sands. Metals and Materials Having Good Resistance to the Abrasive Action of Foundry Sand. J.-R. Delin (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 109–114).—A discussion of the effects of various sands on the usual constructional materials of bins, silos, elevators, &c., in the foundry. Typical layouts of foundry plants are discussed, as well as the necessity of having a true conception of the angles of rest and frictional resistances that are likely to be present, and must be taken into account. Tests on the abrasive resistances of rubber, nickel–chrome steel, laminated steel, and cast-iron with respect to sand are described.—W. A. C. N.

Foundry Sand Control. A. A. Grubb (*Met. Ind.* (*N.Y.*), 1932, **30**, 64–65, 100–101).—Abstracted from *Trans. Bull. Amer. Found. Assoc.*, 1931, **2**, (11), 8–17. See this *J.*, 1932, **50**, 510.—I. M.

Practical Tests for Sands in the Foundry. P. Aulich (*Usine*, 1931, **40**, (43), 33).—Abstract of a paper presented to the 6e. Congrès International de Fonderie. See this *J.*, 1932, **50**, 641.—H. W. G. H.

Dust Removal from Used Sand. B. Trevis (*Usine*, 1931, **40**, (43), 33).—An account of a paper read before the International Foundry Congress, Milan, 1931. See this *J.*, 1932, **50**, 641.—H. W. G. H.

Materials Handling in the Small Brass Foundry. D. G. Anderson and B. F. McAuley (*Met. Ind.* (*N.Y.*), 1932, **30**, 349–351).—Abstract of a paper read before the American Foundrymen's Association. See *J.*, this volume, p. 42. —I. M.

Mechanical Handling Equipment in Small Foundries. H. L. Hoefman (*Mechanical Handling and Works Equipment*, 1933, **20**, 12, 42–43).—Abridged report of an address to the National Founders' Association, New York. The possibilities of utilizing mechanical handling systems in foundries casting as little as 25 tons per day are briefly reviewed.—J. C. C.

XIV.—SECONDARY METALS: SCRAP, RESIDUES, &c.

(Continued from p. 207.)

Metal Scrap will Provide World's Need is Predicted. Anon. (*Daily Metal Reporter*, 1933, **33**, (19), 5).—The report of the President's Research Committee (U.S.A.) on Social Trends states that since 1911 recoveries from scrap have increased much more rapidly than has production of virgin metal. In 1926, the following percentages of the total production were derived from scrap: aluminium 38, copper 35, antimony 31, tin 28, lead 23, zinc 19%. It is considered that these proportions are likely to increase until the bulk of the world's metal supply can be obtained from scrap.—P. M. C. R.

Secondary Metals. Thomas A. Wright (*Met. Ind.* (*N.Y.*), 1932, **30**, 16–18).—A review of new developments during 1931 in the recovery and utilization of non-ferrous metal scrap.—A. R. P.

XV.—FURNACES AND FUELS

(Continued from p. 207.

FURNACES

Some Developments in Metal Melting and Heat Furnaces. Anon. (*Metallurgia*, 1933, 7, 137–142).—The increasing demand for better and cheaper products has involved considerable development in melting and heating equipment, and a number of furnaces in which progress has been made are briefly surveyed and reviewed. Types of heating furnaces considered include pulverized-fuel melting furnaces, oil-fired oscillating furnaces used for melting brass, bronze, nickel–bronze, nickel–brass, and similar alloys as well as for copper refining, and oil- and gas-fired tilting furnaces of various designs for the rapid and economical melting of copper and aluminium alloys. Recent developments in heating furnaces for rolling-mill use and for forging purposes, and in heat-treatment furnaces for the heat-treatment of aluminium alloys and the bright-annealing of copper wires and strip, are also dealt with, special reference being made to the careful selection of heating units in the case of pulverized coal, oil, and gas. The developments which have taken place in the mechanical handling of the material to be treated in furnaces are discussed.
—J. W. D.

Continuous Metal Melting. Anon. (*Gas J.*, 1933, 201, 749).—A thermostatically-controlled continuous-melting furnace, heated by low-pressure gas or using air at 18 in. water pressure, capable of melting 600 lb. of aluminium, is described. Under test, the furnace melted 338 lb. and 652 lb. of aluminium per hr. at different gas rates, with respective efficiencies of 48·6% and 39·8%.
—J. S. G. T.

The Use of Gas for Making Money at the Mint. Anon. (*Gas World* (*Indust. Gas Suppt.*), 1933, 5, (2), 16–18).—Furnaces and other equipment used for coin-making at the Royal Mint, London, are briefly described and illustrated.
—J. S. G. T.

Large Scale Brass Annealing in Gas-Fired Muffles. W. Wirt Young, Jr. (*Met. Ind.* (*N.Y.*), 1932, 30, 102–104).—See *J.*, this volume, p. 45.—I. M.

Furnace Bright-Anneals Copper Wire. J. B. Nealey (*Heat-Treat. and Forging*, 1932, 18, 599–600).—Cf. this *J.*, 1932, 50, 582, 776, and this volume, p. 48.—J. H. W.

The Electric Furnace and the Alloy Age. John A. Mathews (*Trans. Electrochem. Soc.*, 1932, 61, 143–160).—The First Joseph W. Richards Lecture. Metallurgical developments resulting from the steady advance in electric furnace practice are historically reviewed.—P. M. C. R.

Induction Furnaces (International Congress of Electricity). P. Bunet (*Science et Industrie*, 1933, 17, 144–145).—Report No. 11. A historical review is followed by a consideration of induction furnaces from the points of view of metallurgy and of economical shop practice; the cooling of the primary coil, on the efficiency of which depends that of the entire plant, is of great importance. The question of safety is considered, and notes are appended on low-power furnaces, on induced currents in cylindrical conductors, and on transformers.—P. M. C. R.

Lead-Bath Furnaces. S. Z. Owen (*Electric J.*, 1932, 29, 525–526).—Lead-bath furnaces are economical below 1600° F. (871° C.) and heat 2–3 times as rapidly as air furnaces. By using two-point control, with thermocouples in the bath and near the heating elements, the temperature gradient can be kept a minimum. A circular pot has least top surface and is most economical. Variations in temperature in a 17-in. pot can be kept below ± 5° F. (± 3° C.) at 1450° F. (788° C.), at which temperature radiation losses are 25 watts/in.^{2}

or 8 kw./hr. Losses can be halved by using a cover. Curves are given showing the relation between the weight of steel parts treated and the power consumption per day.—J. C. C.

Electric Heat-Treatment Furnaces. A. G. Lobley (*J. Inst. Production Eng.*, 1930, **9**, 186–199).—See this *J.*, 1930, **44**, 717.—J. C. C.

Control of Atmosphere in Heat-Treatment Furnaces. Robert M. Keeney (*Technique moderne*, 1932, **24**, 23).—From *Iron Age*, 1931, **128**, 690. See this *J.*, 1931, **47**, 612.—H. W. G. H.

Induction Furnace with Ferromagnetic Muffle and Automatic Temperature Regulation. R. Perrin and V. Sorrel (*Technique moderne*, 1931, **23**, 481, and *Usine*, 1931, **40**, (20), 29).—Abstract of a paper read before the Académie des Sciences. See this *J.*, 1932, **50**, 270.—H. W. G. H.

FUELS

Fuels in Heat-Treating Furnaces. H. J. Gregg (*Metal Progress*, 1933, **23**, (3), 37–40).—The increasing importance of automatic temperature control and of continuous or cyclic operation in heat-treatment must influence the choice of fuels, especially in view of the stress now laid on furnace atmosphere and of the undesirability of expensive part-time running. The advantages and limitations of fuel oil, electricity, artificial and natural gas, " diffusion " combustion, and butane, are considered and compared.—P. M. C. R.

On Metallurgical Coke. Seiji Tanaka (*Tetsu-to-Hagane*, 1928, **14**, (6), 463–477; *Japanese J. Eng. Abs.*, 1932, **8**, 79).—[In Japanese.] T. investigated the properties of metallurgical coke manufactured in Japan by measuring its relative reactivity for carbon monoxide and also the relative reactivity of coke substance. A test was finally carried out to estimate the permeability of coke to gases.—S. G.

The Use of Pulverized Coal in the Foundry. Raymond Moine (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 75–82).—A discussion of powdered-coal firing—historical, theoretical, and practical. Diagrams of crushing and storage plants, and a number of illustrations of actual plant are given. The discussion tends to bring out the essential advantages of this means of coal utilization over other earlier means.—W. A. C. N.

Distribution of Pulverized Fuel for Metal Working. Frank S. O'Neil (*Power Plant Eng.*, 1932, **36**, 162–163).—The application of a pulverized coal system to an existing metallurgical plant is described. Stress is laid on the method of automatic distribution, the adaptation of the burners to the type of work, and on the reduced fuel consumption and annealing time, improved products and saving on the operating costs of the boilers.—P. M. C. R.

Pulverized Coal for Forge Furnaces is Excellent and Cheap. C. P. Blair and C. E. Pond (*Metal Progress*, 1932, **22**, (6), 24–28).—An account, illustrated by photographs and scale drawings, of an installation of heavy forge furnaces now in operation at Roanoke, Va., U.S.A. Pulverized Pocahontas coal is used as fuel, the escaping flame being utilized to maintain the preheating furnace. Much of the equipment was made locally. Systems of distribution, aeration, and feed, of capacity and of temperature range are described. It is found that a reducing atmosphere can be maintained continuously and that there is comparatively little wear on the furnace refractories, whilst the coal consumption is reduced by 25%.—P. M. C. R.

The Trend of Pulverized Fuel Practice in U.S.A. and Canada. John Rogers (*Fuel Economist*, 1932, **8**, 13–18).—Recent progress in pulverized fuel technology in U.S.A. and Canada is briefly discussed. The subjects dealt with include unit and central systems of firing, mills and fuel transport systems, furnaces, boilers and boiler control, and results obtained with various plant.—J. S. G. T.

Unit Firing v. Storage System in Pulverized Fuel. Anon. (*Fuel Economist*, 1932, 8, 121–128).—The respective advantages of the unit and central systems of pulverized fuel supply are discussed, reliability of plant and the influence of drying the coal being amongst the subjects referred to. The two methods of firing are illustrated.—J. S. G. T.

The Grindability of Coal. Anon. (*Fuel Economist*, 1932, 8, 157).—A memorandum on this subject prepared by a Committee appointed by the Institution of Mining Engineers is briefly referred to.—J. S. G. T.

Furnace for the Determination of the Ash of Solid Fuels. Horst Brückner and Gert Seufert (*Gas- u. Wasserfach*, 1932, 75, 276–277).—Combustion of the fuel is accelerated by continuously withdrawing the gaseous products formed through a tube placed over the crucible. In the apparatus described the crucible is heated by radiation from the walls of the furnace and by preheating the air used for the combustion of the fuel.—B. Bl.

Coal Nomenclature. H. Clifford Armstrong (*Fuel Economist*, 1932, 8, 67–68).—Confusion in the existing classification of coals of different sizes and descriptions, and the economic and commercial necessities of standardizing coals marketed are very briefly referred to.—J. S. G. T.

Coal and Coke. Ivan A. Given (*Mineral Ind.*, 1932, 40, 74–108).—Statistical.—E. S. H.

Report of Committee D–5 [of A.S.T.M.] on Coal and Coke. A. C. Fieldner, H. C. Porter, and W. A. Selvig (*Proc. Amer Soc. Test. Mat.*, 1932, **32**, (I), 436–438).—See this *J.*, 1932, **50**, 512.—S. G.

XVI.—REFRACTORIES AND FURNACE MATERIALS

(Continued from pp. 208–211.)

Refractories, Refractorers, and the Non-Ferrous Metal Industry. Frank S. Russell (*Met. Ind.* (*Lond.*), 1933, 42, 57–58).—A description of the use of refractories and a discussion of the behaviour of refractorers in the non-ferrous metal industry.—J. H. W.

Refractory Materials for Melting Pure Metals. H. B. Wahlin, O. D. Fritsche, and J. F. Oesterle (*Phys. Rev.*, 1932, [ii], 42, 911).—Abstract of a paper read before the American Physical Society. A study of various refractories has shown that porcelain as well as magnesia crucibles volatilize and reduce sufficiently, when heated in a vacuum, to contaminate pure metals contained in them. Crucibles of pure, fused thorium oxide are the most satisfactory and will withstand heating in a vacuum for long periods of time. Special shapes of crucibles may be readily prepared by using moulds made of a fusible alloy which is melted off before firing. The crucibles should be fired to a temperature of 1800° C., care being taken to prevent the formation of thorium carbide, which, because of interaction with the moisture of the air, will cause the crucibles to break up.—S. G.

The Use of Unburnt Bricks for the Linings of Induction Furnaces. J. H. Chester and W. J. Rees (*Trans. Ceram. Soc.*, 1932, 31, 243–252).—A method is described whereby an induction furnace can be lined with tongued and grooved unburnt bricks, the linings being sintered, without the aid of a metal former, by the melting of the first charge. An account is given of 3 experimental trials.—S. V. W.

Sinterkorund—A New Ceramic Material. Anon. (*Indust. Chemist*, 1932, 8, 150–152; also *Ceramic Age*, 1932, 19, 28–29, 36–37; and *Automobiltech. Z.*, 1932, 35, 133).—Sinterkorund is made by sintering precipitated alumina at about 1800° C. It is highly resistant to alkalis and acids and also to molten aluminium, ferromanganese, and other alloys. As a crucible material it shows the greatest resistance of all known substances towards blast-furnace slag, lead carbonate, lead, and other metal silicates, &c. Sinterkorund is very resistant to temperature changes and is impermeable to gases even at 1720° C.; the thermal conductivity is high. These properties make it useful as a refractory material for furnaces. The reaction of Nichrome heating elements with many supports and cements, forming silicates, is obviated by using Sinterkorund. —E. S. H.

Refractories. Anon. (*Refractories Bull.* (*John G. Stein & Co., Ltd.*), **1932**, Nos. 1–12).—A series of 2-page monthly Bulletins presenting some of the interesting features connected with silica and fire-clay refractories. Among the properties dealt with are refractoriness, refractoriness under load, the significance of the chemical composition of firebricks, silica volume changes, the burning of a firebrick, firebrick bonding, refractory cements, thermal expansion of firebricks, carbon monoxide disintegration, and refractories in service.—J. W. D.

Economics of the Use of Refractories. S. P. Mason (*Blast Fur. and Steel Plant*, 1932, **20**, 512–514; *Ceram. Abs.*, 1932, **11**, 495).—The items which enter into the cost of the brick are: (1) cost of material f.o.b. manufacturer's plant; (2) freight to consumer's plant; (3) unloading into storage at consumer's plant; (4) delivering from storage to the furnace; (5) dismantling old furnace brickwork; (6) masons' labour in building new brickwork; (7) mason helpers' labour; (8) carpenters' labour on forms; (9) lumber for forms; (10) cement; (11) fuel for drying furnace to start next run, and (12) idle furnace time. Methods for calculating the unit cost of the refractory are explained. Factors entering into materials and labour costs are enumerated and discussed.—S. G.

Castable Refractory. —— (*Chem. and Met. Eng.*, 1932, **39**, 626).—"Cast-Refract," a new material, is said to be capable of being cast or moulded on the job, and also to produce a monolithic structure, air- and gas-tight, free from shrinkage, highly resistant to spalling, and of excellent refractory properties up to its temperature limit of 2,600°–2,800° F. (1427°–1548° C.).—F. J.

High-Alumina Refractory Bodies. R. Rieke (*Ber. deut. keram. Ges.*, 1932, **13**, 88–90; *Ceram. Abs.*, 1932, **11**, 493).—R. discusses the natural high-alumina refractory materials and the methods whereby the alumina content of refractories can be increased with an accompanying increase in refractoriness and an improvement of various other properties.—S. G.

Expansion Behaviour of Chassov-Yar Firebrick at High Temperatures. P. P. Budnikov and W. Müller (*Ber. deut. keram. Ges.*, 1932, **13**, 153–157; *Ceram. Abs.*, 1932, **11**, 493).—Firebricks made up of the different kinds of Chassov-Yar clays were studied in regard to their expansion behaviour at high temperatures.—S. G.

Expansion Behaviour of the Regular and Black Silica Brick. P. P. Budnikov and W. Müller (*Ber. deut. keram. Ges.*, 1932, **13**, 28–31; *Ceram. Abs.*, 1932, **11**, 492).—A comparison was made of the expansion behaviour of a regular silica brick and a black silica brick. The latter is made with a mineralizer of furnace dust and has a higher sp. gr., bulk gravity, per cent. expansion, resistance to compression, and a lower porosity and water absorption. A check also shows the black silica brick to consist of tridymite 40, cristobalite 20, and quartz 40% compared to tridymite 52, cristobalite 18, and quartz 30% for the regular silica brick.—S. G.

Chromite-Dinas Bricks. P. P. Budnikov and L. L. Mandelgrin (*Zhurnal Prikladnoi Khimii* (*Journal Applied Chemistry*), 1932, **5**, (3/4), 299–302).—[In Russian, with German summary.] Attempts have been made to combine the high resistance of chromite bricks to the action of acid and basic slags with the high refractoriness and high deformation temperature of dinas bricks. Bricks made from 50 : 50, 70 : 30, and 80 : 20 mixtures of quartzite (silica 96·92, alumina 0·5, ferric oxide 1·35, and lime 0·73%), and chromite (silica 12·76, alumina 10·59, ferric oxide 32·68, chromic oxide 29·13, lime 0·33, and magnesia 10·80%) after heating to 2100° C. contained undissolved Cr_2O_3, showing that chromic oxide does not form a compound with silica but remains dispersed in a finely-divided state throughout the conglomerate of crystalline tridymite and cristobalite and amorphous cement. Addition of chromite reduces the refractoriness and deformation temperature of dinas bricks owing to the high iron content, so that with a purer chromite, higher values for these properties should result. On the basis of the experiments it is recommended that chromite-dinas bricks be produced from chromite containing a minimum of ferric oxide and their resistance to acid and basic slags carefully studied. —M. Z.

Properties of Refractory Materials. Anon. (*Eng. Rev.*, 1932, **46**, 297–298).—Expansion, spalling, erosion, and chemical attack are briefly reviewed as possible sources of failure in refractories. British, American, and Continental methods of testing are summarized. The chemical constitution of firebrick is considered and the influence of certain ingredients pointed out. A table of melting-points for various compositions of brick is given, with the approximate silica or alumina content of several refractories.—P. M. C. R.

The Thermal Conductivity of Fire-Resisting Ceramic Material. Its Calculation from the Conductivity of the Constituents. A. Eucken (*Forschungsheft* **353**, 1932, 1–16).—A series of experiments was undertaken to determine the thermal conductivity of the following refractory materials and its dependence on the properties of the constituents: silica, fireclay, sillimanite, carborundum, magnesite, and corundum. The conductivity depends less on the chemical than on the physical and crystallographic properties of the material, especially on the ratio of crystalline to amorphous material. A suitable formula for calculating the thermal conductivity is derived from a formula of Maxwell's for electrical conductivity, suitably modified to take into account the high degree of expansion of the crystalline material. The application of this formula involves some difficulties in many cases, and extrapolation and approximation must be resorted to, and although the calculations will not give individual increments in the conductivity, they can be used to confirm the observed absolute values and to check the experimental temperature curves of a number of refractories.—J. H. W.

The Corrosion of Refractories—A Quantitative Durability Test. J. F. Hyslop and H. C. Biggs (*Trans. Ceram. Soc.*, 1932, **31**, 173–176).—After briefly referring to the chief types of corrosion tests for refractories, that developed by H. and B. is described. The test-piece is rotated in a furnace and flux fed on to it from a water-cooled spoon. The time taken for the flux to sever the test-piece is a direct measure of the durability of the refractory under the conditions of test.—S. V. W.

Apparatus for Measuring the Thermal Expansion of Refractory Materials in the Temperature Range 0°–1700° C. H. Reich (*Ber. deut. keram. Ges.*, 1932, **13**, 157–166; *Ceram. Abs.*, 1932, **11**, 493).—A new apparatus for determining the thermal expansion of refractory materials over a range of 0°–1700° C. in a normal carbon-resistance furnace with comparatively simple auxiliary equipment is described. The reproducibility of the measurements was demonstrated by results of measurements. The serviceability of the apparatus for regular practice was demonstrated by two examples.—S. G.

Mistakes in Pressing Refractory Bricks. Hans Kremski (*Tonind. Zeit.*, 1932, **56**, 814–815).—A description of faults, *e.g.*, edge cracks, formation of bars, &c., which occur in moulding refractory bricks, and methods for avoiding them.—B. Bl.

Heat Insulation. H. N. Bassett (*Eng. Rev.*, 1932, **46**, 152–155).—A survey of the requirements of heat-insulation for high-temperature work, together with a summary of the properties of kieselguhr, asbestos, rock wool, slag wool, magnesia mixtures, aluminium foil, and various more complex proprietary materials.—P. M. C. R.

Asbestos for Insulating Purposes. Anon. (*Eng. Rev.*, 1932, 46, (1), 13).—A short account of the sources, properties, and preparation of blue asbestos. —P. M. C. R.

XVII.—HEAT-TREATMENT

(Continued from p. 212.)

Research in Bright-Annealing Brass and Other Metals. Anon. (*Met. Ind.* (*N.Y.*), 1933, 31, 16).—A review of improvements made during the year 1932. —A. R. P.

On the Heat-Treatment of Metal Strip in Continuous Annealing Furnaces.—II. O. Junker (*Z. Metallkunde*, 1932, 24, 301–302).—See this *J.*, 1932, 50, 694. The influence of different methods of pickling brass strip and of the rate of passage through the annealing furnace on the course of the heating curve of the strip is graphically shown. The influence of heat-treatment on the quality of metal strip is discussed with reference to the annealing conditions in the continuous annealing furnace.—M. H.

Progress in the Annealing of Wire. O. S. Haskell (*Wire and Wire Products*, 1933, 8, 37–39).—An electric furnace for batch-type annealing and the method of low uniform bright-annealing of copper wire are described and the various requirements for the equipment are given.—J. H. W.

XVIII.—WORKING

(Continued from pp. 212–216.)

The Hot-Extrusion of Hard-Brass "Ms 58" [58 : 40–41 : 2–1 Copper–Zinc–Lead Alloy]. R. Hinzmann (*Z. Metallkunde*, 1933, 25, 67–70).—In the rear end of hot-extruded rods the $(\alpha + \beta)$-structure is granular owing to the temperature having fallen too far in the last stages of the extrusion. This structure causes cracking on subsequent hot-pressing; its development can be prevented by the use of smaller ingots or by increasing the rate of extrusion. The extrusion temperature should be as high as possible without overheating of the front ends of the extruded rods. The temperature of the material for the subsequent hot-pressing should, however, be as low and the heating period as short as possible.—M. H.

Investigations on the Stress Distribution in the Roll-Gap. E. Siebel and W. Lueg (*Mitt. K.-W. Inst. Eisenforschung*, 1933, 15, 1–14).—The vertical rolling pressure over the whole breadth and length of the roll gap has been measured by means of a piezo-electric device for copper, aluminium, and iron in various conditions. The results for unrestricted broadening of the metal in the roll confirm those deduced theoretically by E. Siebel (this *J.*, 1929, 42, 648; 1930, 44, 678) and T. von Kármán (this *J.*, 1925, 34, 604). The maximum of the rolling pressure, however, is less sharply defined. As the material enters the roll gap the vertical stress S_v rises very rapidly to a mean value about 15% above that of the resistance to flow in the cone-compression test; as it leaves the roll gap, which, owing to the deformation of the rolls, extends a little to the far side of the middle plane of the unloaded rolls, S_v falls rapidly to zero as the metal springs back elastically. The maximum value of S_v occurs slightly beyond the point of closest approach of the rolls and then decreases both in the direction of rolling and also laterally. Compression stress models have been determined for various rolling conditions. The resultant of the vertical rolling pressure lies nearer to the end of the roll gap the greater is the specific reduction in thickness. With the same absolute reduction in thickness the influence of the horizontal component of the force on the specific rolling pressure increases with decreasing initial thickness of the metal being rolled. With artificially increased friction between the rolls and the metal S_0 and its decrease on both sides of the gap increase markedly. In the longitudinal direction in the metal, compression stresses are produced in the roll gap, whereas on the sides tensile stresses develop; both are increased by increasing the friction. The rolling pressure is reduced in drawing rolls which are not power-driven. In hot-rolling tests on rectangular rods the specific rolling pressure rises only a little above the compression resistance when the diameter of the rolls is large. The relative movement of the metal against the roll surface has been estimated; it appears to proceed generally in the direction of the maximum fall in pressure and is, in the region of the roll gap at the edges of the rod, greater in the transverse direction than in the direction of rolling.—J. W.

The Non-Ferrous Rolling Mills. William J. Pettis (*Met. Ind.* (*N.Y.*), 1932, **30**, 13–14).—A brief review of modern rolling-mill practice with special reference to the non-ferrous metal industry.—A. R. P.

Effect of Temperature and Impurities on the Rolling of Zinc. I.—Rolling Tests on Electrolytic and Refined Zinc at Different Temperatures. II.—Effect of Impurities on the Rolling of Zinc. O. Bauer and P. Zunker (*Mitt. Material.*, *Sonderheft* 21, 1933, 93–102).—See this *J.*, 1932, **50**, 701.—J. W.

Structure of Cold-Drawn Tubing. John T. Norton and R. E. Hillier (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 190–201; discussion, 201–202).—See this *J.*, 1932, **50**, 191.—S. G.

Aluminium Cases and Boxes. J. Bally (*Rev. Aluminium*, 1932, **9**, 1941–1947).—The manufacture of aluminium cases and boxes by stamping and pressing and the methods of finishing these articles are described.—J. H. W.

Workability of High Brass Sheet. M. H. Medwedeff (*Metal Progress*, 1933, **32**, (2), 18–22).—The correct framing of specifications for commercial α-brasses is of the first importance to the user; for maximum efficiency and cheapness a balance must be arrived at between hardness and ductility. Works methods for rapidly measuring these qualities are discussed; the Erichsen or Olsen ductility tests may be substituted for ordinary tensile testing if the latter is considered too lengthy and cumbrous a method, and, subject to certain definitely formulated limitations, the Rockwell hardness test is recommended. The influence of grain-size is discussed; the addition of a provision for grain-size to the specification is desirable. Typical analyses of commercial brasses are given, and Rockwell figures for "high-brass" sheets of varying degrees of temper and thickness are appended. Certain special brasses are discussed.
—P. M. C. R.

Hot Brass Pressings. J. Willis Beard (*Machinery* (*Lond.*), 1932, **41**, 249–252).—An illustrated account of a paper to the Scottish Local Section of the Institute of Metals. A general review is given of the use of friction or screw-type and crank-type presses for making hot-pressings. The importance of correctly designing dies so that the metal will flow to the best advantage is emphasized and questions relating to die steels, split dies, provision for air release, and lubrication are briefly discussed. Metals commonly used for pressings include forging quality brass (copper 58–60, lead up to 2%, zinc balance), manganese–"bronze" (copper 58, lead up to 1, manganese 1, iron 0·1%, zinc balance), Naval "bronze" (copper 61, tin 1%, zinc balance), and high-conductivity copper. Nickel–bronze, aluminium–"bronze," silicon–copper, aluminium–zinc, and aluminium–silicon alloys can also be used for pressings.—J. C. C.

Straightening of Alloy Airscrew Blades. H. E. F. (*Aircraft Eng. Workshop and Prodn. Section*, 1932, **4**, (46), 4).—Aluminium alloy blades which have been bent or twisted in minor accidents can usually be straightened. If the deformation is slight, the blades can be straightened by a qualified engineer.

If the deformation is considerable, the blades are annealed, re-formed, heat-treated, and finally straightened, but this should be done by the manufacturer. —H. S.

Machine Tools for Light Metals. Ph. Kelle (*Z. Metallkunde*, 1931, **23**, 309–313; and (summary) *Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 46–47).—The nature and operation of tools for the working of light metals are explained. The tungsten carbide tools have proved most suitable for drilling light alloys containing silicon (Silumin, Alusil); for the other aluminium alloys high-speed tool steels are sufficient. In connection with the description of certain machine tools, the machining of a light-metal piston by turning the outside, the grooves, and the convex face is discussed.—M. H.

Diamond Tools in the Machining of Metals. A. Meyer (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1932, **8**, (17/18), 101–103).—M. reviews the construction, application, and performance of diamond tools, which, he considers, should be used to supplement those of Widia (see F. K. Böck, *Maschinenkonstrukteur*, 1931, **64**, 220; *J.*, this volume, p. 52). Light alloys, bearing metals, copper, brass, synthetic products, hard rubber, and paper, and commutator materials containing mica are easily cut by diamond tools, which show no signs of wear after an output of more than 100 times that given by other high-grade tool materials. For iron and steel the performance of diamond does not justify its adoption, but the Widia or Stellite tools preferable here are improved by finishing with diamond dust of suitably selected grain-size. Suitable forms, cutting angles and speeds, for diamond tools are quoted from results obtained in use.—P. M. C. R.

Diamond-Hard High-Speed Cutting Alloy [Ardoloy]. Anon. (*Mech. World*, 1932, **92**, 277).—Ardoloy is a high-speed cutting alloy made from British materials. Examples are given of the cutting speeds possible with this alloy, including the following: copper, aluminium, and soft brass as fast as the machine will allow; cupro-nickel 350–500 ft./minute; hard brass, phosphor-bronze, manganese-brass, gun-metal, Admiralty bronze, &c., 750–1250 ft./minute; aluminium alloys 300–750 ft./minute.—F. J.

Armstrong Armide Cutting Tools. Anon. (*Automotive Ind.*, 1932, **67**, 499).—Armide, a carbide cutting alloy, is said to remain cool and securely brazed, although the cutting edge runs red-hot, because of the low thermal conductivity of the material. Since Armide does not alloy with steel or iron, the edge remains smooth and clean, thus obviating grooving.—P. M. C. R.

The Grinding of Tools with Widia Cutting Parts. J. Alberts (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1932, **8**, (5/6), 32).—Silicon carbide (carborundum) gives the best results in preparing Widia tools. Instructions are given for wet and dry grinding, attention being directed to speed of grinding wheel, pressure, and the avoidance of overheating. The last consideration makes it desirable to avoid dry grinding when possible: for the same reason, automatic grinding may prove unsatisfactory. Semi-automatic and other special methods are briefly described.—P. M. C. R.

XIX.—CLEANING AND FINISHING

(Continued from pp. 216–217.)

Industrial Metal Degreasing. Anon. (*Met. Ind.* (*N.Y.*), 1932, **30**, 473–474).—Liquid-phase and vapour-phase degreasing with organic grease solvents are briefly described and a modern type of vapour degreasing plant is illustrated.—A. R. P.

Additions to Pickling Baths and Disposal of Waste Liquors in Metal Pickling. —— Freitag (*Oberflächentechnik*, 1932, **9**, 99–100).—The function of inhibitors in pickling baths is briefly discussed and hints regarding the recovery of valuable materials from waste liquors are given. Spent pickles from copper and brass works should be treated with scrap iron to recover the dissolved copper, which may amount to 7–10%; as the acid used in pickling may contain arsenic, the vats used in recovering the copper should be well ventilated to remove the highly dangerous arsine evolved with the hydrogen.—A. R. P.

Electrolytic Production of Protective Oxide Films on Aluminium and Its Alloys Especially for Subsequent Colouring. Georg Buchner (*Oberflächentechnik*, 1932, **9**, 127–128).—The production and colouring of these films are briefly outlined.—A. R. P.

The Alumilite Process. Anon. (*Machinery* (*N.Y.*), 1932, **39**, 217).—The Alumilite process is an electrolytic process for applying a plain or coloured coating to aluminium and its alloys. It is worked at 200° F. (93° C.). Cf., *J.*, this volume, p. 245.—J. C. C.

Colouring of Cadmium-Plated Articles. H. Krause (*Z.V. d. Kupferschmied.*, 1932, **44**, 192–196).—Recipes are given. See also this *J.*, 1932, **53**, 192, 504.
—M. H.

Researches on Potassium Permanganate–Copper Sulphate Pickles [for Colouring Copper Alloys]. H. Krause (*Mitt. Forschungsinst. Edelmetalle*, 1932, **6**, 64–67).—Cf. this *J.*, 1932, **50**, 706. Substitution of 10% of the copper sulphate content of permanganate–copper sulphate pickles for colouring copper and its alloys by an equal amount of copper nitrate gives a deeper brown colour on copper and a brown colour free from greenish tint on brass; larger proportions of copper nitrate increase the depth of colour and rate of formation, but reduce the adherence of the film, whilst copper chloride additions produce totally unsatisfactory results. Substitution of part of the copper sulphate by nickel, zinc, or cadmium sulphates yields paler films with a slight greenish tint. Addition of iron salts invariably results in poorly adherent films of unsightly colour. Potassium chlorate additions produce brighter, more yellowish, or reddish films.—A. R. P.

Colouring of Copper and Iron in Fused Salts. H. Krause (*Mitt. Forschungsinst. Edelmetalle*, 1932, **6**, 74–81).—The colours produced under various conditions of time and temperature on iron, copper, copper-plated iron, and Tombak in fused nitrate, hydroxide, nitrate–hydroxide, nitrite, nitrite–nitrate, nitrite–hydroxide, nitrate–nitrite–hydroxide, nitrate–permanganate, and nitrite–permanganate baths, are tabulated.—A. R. P.

Patina. Carl Rancke (*Oberflächentechnik*, 1932, **9**, 111–113).—The composition of numerous solutions used to produce various coloured surface films on copper or copper-plated metals is given.—A. R. P.

Investigations on Brass Colouring by Pickling [in Sodium Lead Thiosulphate Solution]. Georg Gross (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 455–456).—By pickling 63 : 37 brass in a solution containing 124 grm. of sodium thiosulphate crystals and 38 grm. of lead acetate crystals per litre various coloured patinas can be obtained, varying from pink through golden-brown to different shades of blue and grey, according to the time and temperature of immersion and the pre-treatment of the surface. By addition of tartrates the bath can be operated at room temperature, at which it is much more stable; a deep steel-blue tone can be obtained in 12 minutes.—A. R. P.

Polishing vs. Plating Standards. Ernest Lamoureux (*Met. Ind.* (*N.Y.*), 1932, **30**, 153–154).—Polishing is considered to be the weak spot of the plating industry; methods for improving it are briefly discussed. Most of the polishing, it is considered, should be done on the base metal before plating, so that only the minimum of buffing is subsequently required to produce a bright plate.—A. R. P.

Mass Production Polishing of Aluminium Ware. Anon. (*Giesserei*, 1932, **19**, 169).—The articles are first pickled in dilute caustic soda solution, then rotated in an iron drum with steel balls and a polishing mixture consisting of 6 parts of pumice, 4 parts of vaseline, 1 part of montan wax, 2 parts of rouge, and 10 parts of Vienna chalk.—A. R. P.

Polishing Operations for Aluminium Ware. E. A. France, Jr. (*Abrasive Ind.*, 1932, **13**, (11), 16–17; *Ceram. Abs.*, 1933, **12**, 1).—In the plant of the Aluminium Cooking Utensil Co. (U.S.A.), aluminium cooking utensils are produced in large quantities. The grinding and polishing operations are interesting.—S. G.

Modern Polishing Methods in Cleaning Ornamental Castings. Anon. (*Abrasive Ind.*, 1932, **13**, (2), 32–33; *Ceram. Abs.*, 1932, **11**, 220).—Modern ornamental cast metal is superior to that formerly made. This article illustrates and describes briefly some abrasive operations followed in cleaning and finishing aluminium and Monel metal castings.—S. G.

Fine Finishing of Metal Surfaces. Friedrich Huth (*Emailletech. Monats-Blätter*, 1932, **8**, (10), 75–76; *Ceram. Abs.*, 1933, **12**, 1).—A brief discussion of the materials used in producing different types of finishes on metal surfaces indicates that the polishing media include silica sand, chalk, iron oxide, chrome oxide, and tripoli. The separation of these materials according to the different grain-sizes for different steps in the polishing process, the relative merits of each as a polishing medium for different types of metals, and the preparation thereof for most efficient polishing are discussed.—S. G.

Shape of Abrasive Grains. Henry R. Power (*Metal Cleaning and Finishing*, 1932, **4**, 563–564; *Ceram. Abs.*, 1933, **12**, 1).—In order to test the uniformity of shape and size of abrasive grains so as to meet specifications, an apparent density or shape test was developed. This is carried out by bumping or jolting a known weight of each variety in a vessel and then measuring the volume occupied by each. The grain that " packs " best and is of apparent high density is that which is most uniformly shaped. The equipment used is briefly described.—S. G.

Matching Abrasive Grain Samples. Torrey Allen (*Metal Cleaning and Finishing*, 1932, **4**, 105–106; *Ceram. Abs.*, 1932, **11**, 285).—The reasons for differences in gradings of abrasives are discussed.—S. G.

XX.—JOINING

(Continued from pp. 217–219.)

Treatment of Duralumin Rivets with Solid Carbon Dioxide. K. L. Meissner (*Z. Metallkunde*, 1932, **24**, 310–311).—Age-hardening of quenched rivets can be almost completely suppressed by storage in solid carbon dioxide (so called " dry ice "), so that they are in a forgeable condition for a longer period. It is stated that quenched Duralumin rivets can be satisfactorily hammered after 4 hrs.' and even after 8 hrs.' ageing at room-temperature. This time is considerably longer than that generally in use in the U.S.A. (0·3–1 hr.).—M. H.

Brazing and Welding Technique. D. J. Thomas (*Mech. World*, 1932, **92**, 285–287).—Blowpipe brazing, dip-brazing, the Hyde process of welding or soldering, electric, and oxy-acetylene welding, and burning-on are discussed. The technical details and limitations of each process are described, joints in both ferrous and non-ferrous materials being considered. Dip-brazing appears to give better and more reliable results than blowpipe brazing, and electric welding has a less harmful effect on the metal adjacent to the weld than oxy-acetylene welding.—F. J.

Brazing Alloy. Anon. (*Chem. and Met. Eng.*, 1932, **39**, 628).—Quick penetration, self-fluxing characteristics and a low melting point of 1300° F. (704° C.) are important features of a new brazing alloy containing silver, copper, and phosphorus, under the trade name of " Sil-Fos." It is used for producing joints in copper, brass, and bronze, and gives an average tensile strength of 33,000 lb./in.^{2} (14·7 tons) in copper to copper joints.—F. J.

Small Blowpipe. Anon. (*Mech. World*, 1932, **92**, 395).—A small blowpipe, for use on any ordinary gas supply, suitable for soft and hard soldering, light brazing, &c., is illustrated. It can be worked by mouth-blowing, or, if long, continuous blowing is required, by connecting a football bladder to the air supply by means of a tee-piece.—F. J.

Aluminium Solder [N.U.E.]. Anon. (*Machinery* (*Lond.*), 1932, **40**, 540).—An aluminium solder is marketed under the name N.U.E.—J. C. C.

Aluminium Solder [Sterlinite]. Anon. (*Machinery* (*Lond.*), 1932, **41**, 354).—Sterlinite melts at 250° C., needs no flux, and is applied by contact with the previously heated metal.—J. C. C.

Facts about Soft Solder. George O. Hiers (*Dutch Boy Quarterly*, 1932, **10**, (1), 6–8).—Cf. this *J.*, 1932, **50**, 111. Discusses the composition and properties of lead–tin solders, the technique of soldering, and the use of fluxes.—E. H.

Cadmium Soldering. G. Montelucci (*Aerotecnica*, 1932, **12**, 291–313).—Recalls the use of some lead–cadmium solders during the war and some recent researches, especially those by Deeley on cadmium–zinc solders, which are 6 times more resistant to slow stresses than tin–lead alloy. Tests are described on the suitability of the cadmium–zinc eutectic as a substitute for the usual solders. The shear strength is about twice that of the lead–tin alloys; another advantage is in the soldering of iron or copper in the corrosion-resistance of the soldered joint. The use of the zinc–cadmium eutectic as a substitute for brazing, is also anticipated.—G. G.

Applying Solder with Air Under Pressure. Anon. (*Compressed Air Mag.*, 1932, **37**, 3989).—Solder finds increasing application in automobile work since the introduction of the all-steel body, especially in the filling of dents. A spraying apparatus is described for the mechanical application of solder, the use of which is claimed to obviate warping, damage to paint, and waste of metal, gas, and time.—P. M. C. R.

Economy in Soldering. E. E. H. (*Machinery* (*Lond.*), 1932, **40**, 362–363; correspondence 434).—Figures are quoted to show how the composition of solder wire and the size and form of its cross-section (whether round or rectangular) can affect the quantity of solder used and the time taken in carrying out a particular soldering operation.—J. C. C.

Temperature of Wiping Solder is Most Important. G. P. Dillon (*Telephone Eng.*, 1933, **37**, (1), 17–18).—Antimony is sometimes added to solder to produce a bright appearance, but it causes loss of strength and brittleness. Traces of zinc render solder worthless, as does more than 0·08% of copper. Sulphur, bismuth, mercury, cadmium, arsenic, and phosphorus are possible and undesirable impurities. Old scrap solder is usually unsatisfactory, but if it must be used it may be improved by the following treatment: the metal is heated to 800° F. (427° C.), sulphur and resin are added, and after being well stirred, the metal is skimmed; tallow is added to liberate most of the remaining sulphur, and the required degree of fineness is produced by adding the necessary quantity of tin.—H. F. G.

Soldering and Its Importance to the [Telephone] Industry. Roy Blain (*Telephone Eng.*, 1930, **34**, (5), 17–18).—Practical notes are given. Resin, without other admixture, is considered the only suitable flux for small electrical connections. Solder made from scrap metals is most objectionable, as traces of antimony, zinc, and/or aluminium, which are frequently present, prevent a good electrical joint being made, and may give rise to corrosion. —H. F. G.

Acid Core Solder Used in Telephone Work. B. C. Burden (*Telephone Eng.*, 1932, **36**, (10), 13–14).—Acid core solder is recommended for use on galvanized, copper, and bronze wire, but acid remaining on the wire should be neutralized with soda.—H. F. G.

Copper to Iron Connections Must Be Soldered. Anon. (*Telephone Eng.*, 1931, **35**, (3), 30).—A brief note on telephone cable connections.—H. F. G.

XXI.—INDUSTRIAL USES AND APPLICATIONS

(Continued from pp. 168–172.)

British Standard Specification for Wrought Light Aluminium Alloy Bars for General Engineering Purposes. —— (*Brit. Stand. Inst.*, No. **477**, 1933, 1–13).—This specification covers the alloy known as Duralumin and is for alloys of sp. gr. not greater than 2·85. The aluminium used is to be in accordance with British Standard Specifications Nos. 359 (98%) or 360 (99% aluminium), the copper is to be electrolytic, with only scrap of maker's own manufacture. The chemical composition specified is: copper 3·5–4·5, manganese 0·4–0·7, magnesium 0·4–0·7%, with aluminium the remainder and iron, as impurity, not more than 0·75%. The bars may be extruded, rolled, or forged as required. The minimum specified tensile strength (tons/in.^{2}), proof stress (0·15% permanent extension), elongation, and reduction of area respectively are: for bars up to 2⅝ in. diameter 25, 15, 15, 20; for bars above 2⅝ in. to 4 in. in diameter 22, 12, 15, 20; and for bars above 4 in. to 6 in. 20, 10, 15, 20. Tables are appended showing permitted margins of manufacture in dimensions and notes on the heat-treatment of the alloys are given.—R. G.

British Standard Specification for Wrought "Y"-Alloy Bars for General Engineering Purposes. —— (*Brit. Stand. Inst.*, No. **478**, 1933, 1–13).—The aluminium used is to be in accordance with British Standard Specifications No. 359 or 360, and the copper electrolytic with only maker's scrap. The alloy is required to contain: copper 3·5–4·5, nickel 1·8–2·3, magnesium 1·2–1·7%, with aluminium the remainder and maximum impurities iron 0·5 and silicon 0·6%. The bars may be extruded, rolled, or forged as required. The minimum specified tensile strength (tons/in.^{2}), proof stress (0·15% permanent extension), elongation and reduction of area respectively are: for bars up to 2⅝ in. diameter 23·5, 14, 15, 25; for bars above 2⅝ in. to 4 in. diameter 21·5, 11, 15, 25; and for bars above 4 in. to 6 in. diameter 18, 10, 15, 25. Other clauses deal with freedom from defects, test samples, and re-tests. Tables are appended showing permitted margins of manufacture in dimensions, and notes on the melting preparation of the alloy and its heat-treatment are added.—R. G.

S.A.E. Specifications for Sheet Duralumin (Alloy No. 26). Anon. (*Machinery (N.Y.)*, 1932, **39**, (Data Sheet 238), 200A).—Specifies physical properties and thickness tolerances for aluminium alloy S.A.E. No. 26, commonly known as "Dural" or "17S."—J. C. C.

Report of Committee B-7 [of A.S.T.M.] on Light Metals and Alloys, Cast and Wrought. J. B. Johnson and J. A. Gann (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 292–293).—See this *J.*, 1932, **50**, 495.—S. G.

Removal of Beer Scale from Aluminium, V2A Steel and Other Metals. A. Freymann (*Schw. Brau.-Runds.*, 1933, **44**, 13; *J. Inst. Brewing*, 1933, **39**, 128).—Tests have been made with "TST" for the removal of beer scale from the surface of aluminium and other metals. This preparation, which is obtained in the form of a paste, is an acid derivative of benzol, contains no nitric acid, and is non-poisonous. It does not require an asbestos brush for its application, as does nitric acid, which it replaces. In addition, no gas is evolved, and the danger from nitrous fumes, which is present with the use of nitric acid, is avoided. V2A steel, iron, and pitch are not attacked, whilst its effect on aluminium, copper, and brass is exceedingly slight. An aluminium surface coated with "TST" for 24 hrs. lost 0·018 grm. of metal per 100 cm.^{2}, compared with 0·0617 and 0·2823 grm., respectively, with 15% and 8% solutions of nitric acid. If the coating is allowed to remain for 2–3 hrs., only one application is usually necessary, but even in stubborn cases where the scale is relatively thick, a period of 24 hrs. is more than sufficient.—S. G.

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XXIV.—BOOK REVIEWS

(Continued from pp. 223–224.)

The Alloys of Iron and Molybdenum. By J. L. Gregg. (Alloys of Iron Research, Monograph Series.) Med. 8vo. Pp. xii + 507, with 154 illustrations. 1932. New York: McGraw-Hill Book Co., Inc. ($6.00.) London: McGraw-Hill Publishing Co., Ltd. (36*s.* net.)

The task of collecting data with reference to alloys of iron and molybdenum, distributed as it is so widely through the literature of the world, is indeed a formidable one. In the first place, excepting for the pure iron–molybdenum alloys, very little systematic work would appear to have been carried out. Much of the data obtainable is rather in the nature of various tests conducted for industrial purposes. The author of this book is heartily to be congratulated on the excellent manner in which he has collected together data on this subject.

The book is well arranged into separate chapters, beginning with a general survey of the work, processes of extraction, and other introductory paragraphs. Following on this is an exhaustive treatment of the iron–molybdenum alloys, molybdenum steels of every type, and molybdenum cast-irons. There does not appear to be any feature missed. At the end of each chapter the author gives a summary of that chapter, and one cannot help but remark on the impartial attitude he adopts. These summaries do, however, give one the impression of a certain paucity in the data referring to molybdenum alloys, and also that certain investigations carried out on them require considerable revision and experimental re-determination. One excellent feature of the book consists of tables of mechanical tests, which, when possible, are augmented by graphs. Other properties, such as machinability, electrical resistance, magnetic properties, are amply dealt with; in fact, very little appears to have been missed.

Although a book of this nature is essentially a reference book, it is eminently suited for students and those who wish to specialize in alloy steels. It is excellently written, and the printing and paper are good. Photomicrographs are given of the iron–molybdenum alloys and molybdenum cast-irons, but photographs of molybdenum steels, with the exception of high-speed steels, are not given so fully as is perhaps desirable. This may be because molybdenum steels in the correctly treated condition are composed largely of fine sorbite, and a mention of this in the text is perhaps all that is necessary.

After reading the book one's interest in molybdenum steels is certainly increased, and the metallurgical reader should be inspired to carry out further research on the effect of this valuable alloying element. The book is published under the auspices of the Iron Alloys Committee of the Engineering Foundation, and it is hoped that further publications by this Committee of an equally high standard will rapidly follow.—J. H. ANDREW.

Practical Microscopical Metallography. By Richard Henry Greaves and Harold Wrighton. Second edition, revised and enlarged. Med. 8vo. Pp. xi + 256, with 311 illustrations. 1933. London: Chapman and Hall, Ltd. (18*s.* net.)

The first edition of this book, which appeared in 1924, was a notable contribution to the literature of the subject, and the second, revised and enlarged edition, which is now published, is a very welcome sequel. An idea of the enlargement of this edition is given not only by the increase in the number of pages, now 256, but also by the greater number of photomicrographs and illustrations in the text; this edition contains 311 figures, of which 260 are photomicrographs, whilst the first edition had 184 figures, 141 being photomicrographs.

A new chapter on "Low Power Photomicrography and Macrography," and new sections on the macrographic examination of steel and of copper alloys are valuable additions. Other sections, such as those dealing with photomicrographic technique, the structure and constitution of alloys, alloy steels, aluminium alloys, &c., have been considerably expanded.

Dr. Greaves' and Mr. Wrighton's book is so admirably written and produced, and the extensive collection of photographs of micro- and macro-structures of ferrous and non-ferrous metals and alloys is so excellent, that there is little to criticize. Attention may, however, be directed to Fig. 308, which is given as the structure of "copper–tin–antimony bearing metal containing 3·5 per cent. copper, 3·5 per cent. antimony, and the remainder tin." The structure shown is scarcely typical of this tin-base bearing metal, which should have no cubic crystals of SbSn. Perhaps the 3·5 per cent. antimony is a misprint for 8·5 per cent.—O. F. HUDSON.

Einführung in die Metallographie. Von Paul Goerens. Med. 8vo. Sechste Auflage. Pp. xvi + 392, with 485 illustrations. 1932. Halle (Saale): Wilhelm Knapp. (Geh., R.M. 15.50; geb., R.M. 17.)

In this, the sixth edition, of this well-known work it has been found necessary to introduce a few important alterations in order to bring it into line with modern developments both in theoretical and in practical directions. A new chapter has been written embodying the principles of X-rays and their applications to the examination of metals and alloys. The discussion on the use of ternary diagrams has been developed, and other equilibrium diagrams have been amended in order to bring them up to date so that they embrace the results of the more important recent investigations. In the section devoted to practical considerations diagrams of apparatus designed and employed during the last few years have supplanted those of more ancient date. Emphasis may be again laid on the clarity of the text, the illustrations and diagrams. The high standard is maintained throughout.—W. A. C. NEWMAN.

Handbuch der Spritzgusstechnik der Metallegierungen einschliesslich des Warmpressgussverfahrens. Grundlagen des Spritzgussvorganges. Konstruktionsprinzipien der Spritzgussmaschinen und Formen nebst Ausführungsbeispielen. Werkstoffkunde. Werkstattspraxis. Von Leopold Frommer. Med. 8vo. Pp. xvii + 686, with 244 illustrations. 1933. Berlin: Julius Springer. (Geb., R.M. 66.)

This book deals thoroughly with pressure die-casting, a process now of great importance in mass production of metal parts. The author is to be congratulated on presenting the first treatise dealing adequately with this subject and on the practical way in which he has handled it. The book is very well printed and illustrated.

To indicate the scope of the book the main section headings are given, the numbers in brackets indicating the number of pages devoted to each. The flow of metal in the mould (63); mould design and construction (121); casting machines (148); arrangement of mould on machine (53); industrial die-casting machines (73); alloys (151); die-casting practice (48); mathematical calculations (12). Some account is given of the "press-casting" process which has extended practical machine die-casting to brass and other higher-melting-point alloys. In general, the book contains much of interest both to the producer and to the user of die-castings and all metallurgists should welcome it as a source of reference to a branch of practice which has developed so rapidly in recent years.

Gegossene Metalle und Legierungen. Grundlagen der Metallgiessereitechnischen Werkstoffkunde. Von Willi Claus und A. H. F. Goederitz. Herausgegeben im Auftrage des Vereins deutscher Giessereifachleute. Demy 4to. Pp. xii + 346, with 107 figures and 174 large tables. 1933. Berlin: M. Krayn Technischer Verlag, G.m.b.H. (Geb., R.M. 68.)

This volume is devoted entirely to the non-ferrous metals and alloys from the point of view of their melting and casting. It assembles a vast amount of information on the subject, and the publishers have presented this in a sumptuous form, perhaps somewhat regardless of the poverty of would-be purchasers in these times of economic stress.

The origin of the book is the interesting collection of diagrams shown at the Düsseldorf Foundry Exhibition in 1929, which many members will have visited during the Institute of Metals meeting. These tables summarized the properties of the materials and the basic principles of the methods used in casting, and many additions have been made to the series for the present publication. The author has, moreover, written a detailed account of the theoretical and practical aspects of metallurgy which are concerned with this branch of the industry. Each section contains a bibliography which shows a wide acquaintance with the German and foreign publications.

Amongst the subjects dealt with are: gases in metals, solidification, structures, shrinkage, segregation, mould materials, and temperature measurements. Whilst copper and its alloys are treated specially fully, as would be expected from the author's well-known investigations, the light metals, nickel, zinc, &c., are not neglected.

As a reference book this volume can be recommended to all who have a sufficient knowledge of German to be able to utilize it.

The Mechanics of Deformable Bodies. By Max Planck. Being Volume II of "Introduction to Theoretical Physics." Translated by Henry L. Brose. Med. 8vo. Pp. 234, with 12 illustrations. 1932. London: Macmillan & Co. (10*s*. 6*d*. net.)

It is, to say the least, refreshing to come across a book dealing with what, for want of a better name, is customarily called classical mechanics, written by the one who, more than any other, has brought down the edifice of classical physics in ruins about our ears. The din still persists, but is perhaps a little less pronounced than in the 1920's. One thing is certain. Anyone with an easily attained minimum knowledge of mathematics can understand and appreciate the magnificent generalizations of classical mechanics; the methods and results of quantum mechanics are for the elect only, and I very much doubt whether even the elect are always aware of the speciousness of their methods and conclusions. The foundations of classical mechanics are on solid rock; quantum mechanics is built—some would say jerry-built—on literally shifting sand. Well here are the foundations of classical theory set out in condensed form. The subjects discussed comprise the general laws of motion of a continuously extended body, infinitely small deformations, and finite deformations. Do I hear you say "Not much there for the metallurgist"? You are mistaken. Apart from the fact that the metallurgist, in the large-scale working of his metals and alloys, is concerned essentially with what Professor Planck and the theorists would call finite deformations (but which the practical man calls rolling, hammering, &c.), it will, I am sure, surprise him to find crystal symmetry treated in a book such as this (pp. 61–66). What can I say of the book as a whole? To compliment Professor Planck would be but to imitate the public schoolboy who commenced his Greek paper with the remark "Homer is to be congratulated upon his *Iliad*." Let me, however, congratulate Professor Brose upon his translation, and the publishers upon turning out a well printed book at a very reasonable price. I commend it especially to honours students of physics and mathematics.
—J. S. G. THOMAS.

Englisch–Deutsches und Deutsch–Englisches Wörterbuch der Chemie. Von Willy H. Thurow. Teil II.—Deutsch–Englisch. Cr. 8vo. Pp. x + 287. 1932. Berlin-Schöneberg: Arthur Tetzlaff. (Lw., R.M. 14.)

This is a handy little pocket dictionary designed primarily for chemists, but it is not nearly so complete, nor does it include such a wide variety of terms relating to subjects on the borderline of chemistry, as the well-known dictionary of A. M. Patterson. Metallurgical terms, especially those relating to metallography and the testing of metals, are relatively few, but practically all branches of pure chemistry are well represented. Like many other German–English dictionaries, published in Germany, it contains a number of rather quaint English words and some errors of spelling, but these should detract only slightly from its usefulness to the English reader of a German book. The type is clear, the printing and paper are good, and the arrangement of dictionary is excellent for ready reference.—A. R. POWELL.

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

1933 JUNE Part 6

I.—PROPERTIES OF METALS

(Continued from pp. 225–232.)

On the Mechanical Properties of Aluminium Conductors. W. W. Usov (*Elektrichestvo* (*Electricity*), 1932, (14), 727–731).—[In Russian.] The heating of aluminium strip to 80° C. lowers its mechanical strength in the hot state by about 10% but has no appreciable effect in the cold. Cables, owing to the greater degree of work-hardening, lose a greater degree of mechanical strength (25%). Heating to 200° C. causes a 30–50% loss in the hot state. Still greater heating of cables by short-circuit currents may lead to complete annealing.—N. A.

Thermal Expansion of Antimony. Peter Hidnert and H. S. Krider (*Phys. Rev.*, 1932, [ii], 42, 911).—Abstract of a paper read before the American Physical Society. Measurements were made of the linear thermal expansion of 3 samples of cast antimony between room temperature and 560° C. and the data were correlated with available results obtained by previous investigators to 300° C. The minimum and maximum values for the coeff. of expansion of the 3 samples are given below:

Temperature Range, ° C.	Average Coeff. of Expansion per ° C.
20– 60	8·5–10·8 × 10^{-6}
20–100	8·4–11·0
20–200	8·7–11·3
20–300	9·2–11·4
20–400	9·2–11·5
20–500	9·6–11·6
20–550	9·7–11·0

A report giving additional details and indicating the cause of the differences obtained in the expansion of different samples of antimony is being prepared for publication in *U.S. Bur. Stand. J. Research*.—S. G.

The Effect of Tension on the Electrical Resistance of Single Antimony Crystals. Mildred Allen (*Phys. Rev.*, 1933, [ii], 43, 569–576).—The adiabatic tension coeff. of resistance of single antimony crystals has been determined for various orientations by a modification of the method previously used for bismuth (Allen, *J.*, this volume, p. 225). The curves connecting the coeff. with the primary and secondary orientations are of the same general type as with bismuth, since the symmetry is of the same nature. The 6 coeff. necessary to describe the effect of tension on resistance were determined from the experiments, and equations then derived to correct for the change in dimensions of the specimen produced by the tension. The coeff. for antimony when the tension and current are parallel to the trigonal axis and perpendicular to it are different both in magnitude and sign, whereas with bismuth the two were negative and nearly equal in magnitude.—W. H.-R.

Cerium. B. S. Hopkins (*Foote-Prints*, 1931, 4, (2), 1–16).—The sources of supply, methods of extraction, and properties of the metal and its chief compounds are briefly described.—A. R. P.

A New Method for the Formation of Strain Figures on Copper Surfaces. Yogoro Kato and Nagao Hayami (*J. Electrochem. Soc., Japan*, **1932**, 90–97). —See this *J.*, 1932, **50**, 147.—S. G.

New Phenomena in the Change of [Electrical] Resistance of Bismuth Single Crystals in Magnetic Fields. O. Stierstadt (*Phys. Rev.*, 1933, [ii], **43**, 577–579).—The change of resistance of bismuth single crystals in magnetic fields has been studied in a new type of goniometer in which every desired configuration of current, field, and crystal axes could be obtained. Curves connecting the change of resistance $\frac{dW}{W}$ with ψ, the angle between current and magnetic field, are shown for a field of $H = 3000$ AW/cm. The curves are periodic, and are analyzed so as to give Fourier coeff., and it is claimed that one of these coeff. is due to a secondary structure of the crystal as distinct from the primary structure.—W. H.-R.

Chemistry of Indium. Alfred W. Downes and Louis Kahlenberg (*Electrochem. Soc. Preprint*, **1933**, May, 163–166).—The displacing power and electrode potentials indicate that indium is a little less noble than tin in the electrochemical series. The potential behaviour of indium resembles that of cadmium and is only very slightly affected by the presence of gases. Like tin indium acts as a hardener in alloys; it readily alloys with gallium, thallium, gold, lead, tin, cadmium, bismuth, mercury, and sodium. In hydrogen the metal becomes covered with a brown film of hydride which decomposes on heating above 330° C. and re-forms on cooling. Indium is very slightly oxidized by carbon dioxide above 560° C.—A. R. P.

Mesothorium. Herman Schlundt (*Foote-Prints*, 1931, **4**, (1), 1–16).—The method of extracting mesothorium from monazite sand is described and an account is given of its radioactive properties and degradation products.—A. P.

The Electrical Resistance between 160° and 310° C. of Palladium Wires Charged with Hydrogen. Hans Brüning and Adolf Sieverts (*Z. physikal. Chem.*, 1933, [A], **163**, 409–441).—The electrical resistance of palladium wires has been determined at 160°–310° C. in hydrogen under pressures up to 28 atm. With low hydrogen concentrations the lattice constant of the α-face-centred cubic phase increases from 3·880 to 3·92 A. at 100° C. with increase in hydrogen content. Further increase in hydrogen concentration results in the appearance of the β-phase, until finally the whole specimen is converted into β, which also has a face-centred cubic lattice $a = 3{\cdot}97$ A. (minimum) at 100° C. The lower concentration limit of β between 80° and 150° C. lies very close to 33·3 atomic-% hydrogen; between 160° and 200° C. it occurs at lower hydrogen concentrations. These facts do not provide sufficient grounds for presuming the existence of the compounds Pd$_2$H as a characteristic component of the palladium–hydrogen system.—B. Bl.

Tungsten–Thorium Problem. I.—Activation of Tungsten Containing Thorium. E. Chalfin (*Physikal. Z. Sowjetunion*, 1932, **2**, 59–76; *C. Abs.*, 1933, **27**, 225).—The number of thorium atoms evaporating from a tungsten surface is only 5–10% of the number of thorium atoms reaching the surface. The quantity log $(1 - \theta)$ depends on the previous handling of the wire; only in special cases is it a linear function of the time of activation. When a tungsten wire is activated and deactivated by heating, the work of activation is decreased, as is also a quantity proportional to the total length of the cracks along which the thorium atoms reach the surface. When a wire is heated to 3000° K. not only thorium, but also tungsten evaporates.—S. G.

Thermionic and Adsorption Characteristics of Thorium on Tungsten. Walter H. Brattain and Joseph A. Becker (*Phys. Rev.*, 1933, [ii], **43**, 428–450). —Thorium was deposited on tungsten ribbon by evaporation from a thorium filament, and the thermionic emission was then studied as a function of temperature, and of a quantity, proportional to the amount of thorium on the tungsten surface. As the amount of thorium increases, the emission at a given temperature rises to a maximum, then decreases, and approaches asymptotically to a constant value which agrees within a factor of 2 with the value for clean thorium. These results are compared with those from thoriated tungsten wire in which activation is caused by diffusion from the interior to the surface. If *i* is the emission current, the results indicate that log *i* does not vary linearly with the amount of adsorbed thorium. This is in contradiction to the formula of Langmuir (*Phys. Rev.*, 1914, [ii], 4, 544; 1923, [ii], 22, 357; *J. Amer. Chem. Soc.*, 1932, 54, 2798), whose assumption of induced evaporation is shown to be improbable. Additional experiments are described to illustrate the variation of emission with applied field, and the evaporation and migration of thorium atoms on a tungsten surface.—W. H.-R.

Creep Characteristics of Metals at Elevated Temperatures. A. E. White and C. L. Clark (*Trans. Amer. Soc. Steel Treat.*, 1933, **21**, 1–16; discussion, 16–21).—Experience has shown that even the short-time proportional limit modified with a conservative factor of safety is not sufficiently accurate for purposes of design, owing to the tendency to creep. This factor is more important at elevated temperatures. The type of equipment employed at Michigan University for the determination of creep at high temperatures is described. Attention is directed to the importance of using a proper scale to detect a change in the rate of creep. Logarithm plotting is customary. Creep testing methods are as yet unstandardized: the type of testing unit used makes a difference in the results. Comparisons are being made between single step, up-step, and down-step methods of loading. The lowest rate of creep is found in the last named. A hypothesis is put forward that the logarithmic plotting of stress versus rate of creep would, for the same metal at all temperatures below the recrystallization temperature, give lines that are essentially parallel to one another and that, at temperatures above that of recrystallization, the same condition would exist. A further hypothesis is that the rate of creep will be less for fine-grained metals than for coarse-grained metals when at temperatures below the recrystallization temperature, whilst at temperatures above the latter the reverse is the case. Composition and methods of manufacture are important in determining the creep properties of metals. In the discussion *J. J. B. Rutherford* points out that the rate of creep of 18 : 8 alloy, which is very low, is appreciably greater for cold-worked specimens than for similar specimens thoroughly annealed. W. and C. aver that for every metal and alloy of given composition there is a definite equicohesive temperature or lowest temperature of recrystallization and that the creep characteristics are closely related to it.—W. A. C. N.

On the Beltrami–Haigh Energy Theory of Rigidity. V. S. Svida (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1932**, (8), 2–5).—[In Russian.] The following points are discussed: sp. energy of deformation for simple and complex stresses; the Beltrami–Haigh conditions of equal rigidity; the determination of permissible stresses in displacement and stretching of the walls of metal vessels by internal pressure. An expression is deduced for selecting the cross-section of bending and the diameter of the roller undergoing a simultaneous bending and twisting stress on the basis of the Beltrami–Haigh theory of rigidity.—D. N. S.

X-Ray Methods of Measuring Internal Stresses. G. I. Aksenov (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1931**, (2–3), 101–105).—[In Russian.] The procedure previously described (cf. this *J.*, 1931, **47**, 422) for measuring internal stress in isotropic materials by the Debye–Scherrer method has been extended to take into account the anisotropy of individual crystals.—D. N. S.

The Use of X-Rays for the Investigation of Elastic Stresses in Crystalline Substances. A. P. Komar (*Zhurnal Tehnicheskoy Fiziki* (*Journal of Technical Physics*), 1932, **2**, (6), 519–528).—[In Russian.] The work of Aksenov, Sachs, Dehlinger, and Laue is reviewed.—N. A.

Small Impurities. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 18–19).—The considerable effects which may be produced by the presence of very small percentages of certain impurities in some metals are discussed, especially the case of tellurium in lead. By regarding the effect atomically, the remarkable effect of about 0·06% by weight of tellurium can be understood from the large number of lead atoms likely to be influenced by a stranger atom of widely different nature.—R. G.

On the Mechanism of the Exchange of Metal Atoms and Noble Ions. Otto Erbacher (*Z. physikal. Chem.*, 1933, [A], **163**, 196–214).—The electrochemical deposition of noble ions on a metal can take place in two ways: in the first local elements are formed, and large amounts of the more noble metal are consequently deposited, and in the second there is solely an exchange between the metal atoms and the more noble ions corresponding with a monatomic layer of the metal. The reason for this different behaviour is that in the first case the e.m.f. of the local elements is higher than the deposition potential of the more noble ions by an amount sufficient to cause them to deposit electrolytically, whereas in the second case it is below this potential. Examples of deposition in monatomic layers are: bismuth on nickel in 0·1*N*-hydrochloric acid at 79° C., lead on platinum saturated with hydrogen in 12% hydrochloric acid, polonium on platinum and gold in 0·1*N*-hydrochloric acid.—B. Bl.

A Method for the Determination of the Absolute Surface of Metals. Otto Erbacher (*Z. physikal. Chem.*, 1933, [A], **163**, 215–230).—Cf. *J.*, this volume, p. 68.—B. Bl.

A Method for the Absolute Determination of the Active Surface of Noble Metals. Otto Erbacher (*Z. physikal. Chem.*, 1933, [A], **163**, 231–239).—When platinum is charged with hydrogen, the latter becomes electro-chemically active only at the active places where it can be replaced by nobler ions in a monatomic layer; hence this method serves to determine the active surface of platinum. The results show that this surface is more than double the measured surface for emery-papered platinum and is about 85% of the true surface of the metal. After polishing, the active surface is only $\frac{1}{30}$–$\frac{1}{5}$ as great as, and after platinizing much greater than, that of the roughened metal.—B. Bl.

Behaviour of Activated Carbon with Metallic Water-Purification Equipment. A. S. Behrman and H. Gustafson (*Indust. and Eng. Chem.*, 1933, **25**, 59–60).—In all cases in which activated carbons were in contact with metals under water, a p.d. is set up, the activated carbon being cathodic to the metallic element of the couple. The results are tabulated for various carbons and the following metals, *viz.* steel, brass, Monel metal, cast iron, copper, zinc, aluminium, lead, and stainless steel.—F. J.

The Pressure Coefficient of Resistance of Fifteen Metals down to Liquid Oxygen Temperatures. P. W. Bridgman (*Proc. Amer. Acad. Arts Sci.*, 1932, **67**, 305–344).—(1) The pressure coeff. of electrical resistance of the following metals have been measured at 0°, − 78·4°, and − 182·9° C. with pressures up to 7000 kg./cm.^{2}: lead, magnesium, aluminium, silver, gold, copper, nickel, iron, palladium, columbium, platinum, rhodium, molybdenum, tantalum, and tungsten. The general tendency is for the pressure coeff. of resistance to increase numerically at low temperatures, although in some cases the change is very slight. Tantalum and columbium showed a decrease in the pressure coeff. at low temperatures, but the specimens were of inferior purity. Nickel behaved anomalously, and is abnormal in other respects. (2) The apparatus used is described fully. The pressure was applied to the specimen by means of gaseous helium. (3) The results are not in agreement with those obtained at low pressure by Fischer (*Z. physikal. Chem.*, 1930, [B], **8**, 207). This difference is due to the fact that consistent results can be obtained only after the specimens have been "seasoned" by several applications of a pressure of some thousand kg./cm.^{2}, and the low pressures used by Fischer would not enable stability to be reached. (4) Interesting details of the penetration of metals (steels) by gases under high pressure are given. The cylinders were made to resist the passage of helium by previous treatment with nitrogen, the larger atoms of which served to plug up the pores in the metal.—W. H.-R.

Compressibilities and Pressure Coefficients of Resistance of Elements, Compounds, and Alloys, Many of them Anomalous. P. W. Bridgman (*Proc. Amer. Acad. Arts Sci.*, 1932, **68**, 27–93).—Measurements of the compressibility and the pressure coeff. of electrical resistance have been made at 30° and 75° C. for the following elements: columbium, rhodium, ruthenium, chromium, arsenic, and beryllium. These involve in most cases determinations of specific resistance, and mean temperature coeff. of resistance for purer metals than those previously examined. Chromium behaves abnormally both as regards compressibility and change of resistance with temperature or pressure; this suggests some kind of internal change, and the curves show that this takes place without appreciable hysteresis. For arsenic, measurements were made on single crystals, and the results were abnormal and complex. Measurements were also made for the compound Cu_5Cd_8, gold–silver alloys containing 25, 50, and 75 atomic-% of silver, iron–tungsten alloys containing 10·05, 20·03, and 27·92% tungsten by weight, and some iron–cobalt–tungsten alloys. The results are very complex, and the curves show many breaks and changes in direction. The meaning of these abnormalities is discussed from the point of view of general thermodynamics, and it is concluded that the internal changes are spread over ranges of temperature and pressure, and are not abrupt as in ordinary polymorphic transformations or phase changes involving a change of lattice structure.—W. H.-R.

Mechanical Hardness Influenced by Magnetism. S. R. Williams (*Phys. Rev.*, 1932, [ii], **41**, 386).—Abstract of a paper read before the American Physical Society. In 1931, Herbert published a most interesting article on "magnetic hardening of metals" (*Amer. Machinist*, 1931, **74**, 967). Not only did he find that rotating a ferromagnetic substance in a magnetic field changes the hardness, but that the same thing occurred for substances which are not ferromagnetic. This work of Herbert's confirms some observations on steel rods made by W. in 1924 (this *J.*, 1924, **32**, 521). The work of 1924 has been repeated and confirmed on a series of high-carbon steel rods of different carbon content and hardness. The effect seems to be very clearly shown. Magnetostrictive effects have been the means for studying the changes in hardness due to magnetic fields.—S. G.

Establishment of the Absolute Scale for the Thermo-Electric Force. W. H. Keesom, C. H. Johansson, and J. O. Linde (*Proc. K. Akad. Wet. Amsterdam*, 1932, **35**, 10–14).—[In English.] The formula $e_{abs} = \int_0^T \frac{\sigma}{T} dT$, where $\sigma =$ Thomson heat, expresses the thermo-electric force per degree of a metal in the absolute thermo-electric scale. This quantity is calculated for tin, lead, and a silver alloy from measurements of thermo-electric force and Thomson heat, assuming that $\sigma = 0$ in the superconducting state.—E. S. H.

Third Report of the Committee on Atomic Weights of the International Union of Chemistry. G. P. Baxter, (Mme.) M. Curie, O. Hönigsmid, P. Lebeau, and R. J. Meyer (*J. Amer. Chem. Soc.*, 1933, **55**, 441–452).—Values from recent data are given for Se, Te, La, Tl, Li, B, Na, K, Cs, and Zn. Reference is made to the determination of atomic weights from isotope data, which method still seems inferior to the best chemical methods, although the concordance of the two methods is reassuring. A complete table of the atomic weights of the elements is given.—R. G.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 232–238.)

Occurrence of $CuAl_2$ in Duralumin. George L. Clark and Howard A. Smith (*Phys. Rev.*, 1933, [ii], **43**, 305).—A note. X-Ray and microscopic examination of an old Duralumin aircraft propeller blade showed that abnormal precipitation of $CuAl_2$ had occurred just outside the position of the steel hub clamp. The amount of $CuAl_2$ was much greater than that to be expected from any known type of heat-treatment for ordinary lengths of time. The abnormal precipitation may have been caused by a peculiar combination of lattice-strain, fatigue, and high-frequency vibration.—W. H.-R.

The Effect of Cold-Rolling Treatment on the Properties of Duralumin. A. F. Belov and I. S. Repkin (*Legkie Metally* (*Light Metals*), **1932**, (5–6), 46–53).—[In Russian.] The properties of cold-rolled sheets of Duralumin containing copper 4·23, magnesium 0·77, iron 1·5, and silicon 0·25% have been studied in the work-hardened, quenched, and aged conditions. In one series of tests the sheets were rolled from 3·5 mm. to 1·65 mm. (a reduction of 47%) in one pass and in another series of tests from 3·5 to 0·8 mm. (a reduction of 77%) in several passes. The strengths of work-hardened sheets in both tests were nearly the same whereas both strength and elongation of quenched sheets were lower in the first than in the second series. With increasing reduction above 55% the hardness of the quenched sheets decreased. The number of passes has no effect on the quality of aged sheets although their hardness tends to rise with more than 45% reduction.—D. N. S.

Suitability of Light Alloys for Machinery Construction. W. M. Krylov (*Legkie Metally* (*Light Metals*), **1932**, (5–6), 53–56).—[In Russian.] The properties of steel and Duralumin are compared. With equal volumes and external loads it is calculated that Duralumin can, within the limits of elastic deformation, perform three times as much work as steel. The impact strength of 2 steel specimens was found to be three times that of similar Duralumin specimens. The additional strains in compound structures of steel and Duralumin due to the different moduli of elasticity and coeff. of expansion of the two metals are calculated.—D. N. S.

A Study of the Aluminium-Rich Aluminium–Copper–Silicon Alloys. Chiuyō Hisatsune (*Suiyô-Kwaichi*, 1928, **5**, (7), 559–566; *Japanese J. Eng. Abs.*, 1932, **8**, 85).—[In Japanese.] The constitution of the aluminium–copper–silicon alloys containing up to 70% copper and 8% silicon was studied by thermal and microscopic analysis. Two reactions, Liq. $+ \eta \longrightarrow$ CuAl + Si, Liq. + CuAl $\longrightarrow CuAl_3$ + Si were found to take place at 611° C. and 573° C., respectively. The ternary eutectic composition and temperature are given as copper 23·8, silicon 5, aluminium 71·2%, and 522° C.—S. G.

The Influence of the Preliminary Treatment on the Mechanical Properties and Electrical Conductivity of Aluminium Containing Magnesium Silicide. G. Grube and F. Vaupel (*Z. Metallkunde*, 1933, **25**, 84–88).—The best thermal and mechanical treatment of Aldrey wires (containing silicon 0·61, iron 0·26 and magnesium 0·45%) to produce a high tensile strength combined with the maximum electrical conductivity has been determined. Wires of 12 mm. diam. were cold-drawn to 2·8 mm., annealed at 550°–560° C. for 1 hr., quenched and subsequently aged at (*a*) room temperature or (*b*) 155° C. Wires of 12 mm. were annealed at 550°–560° C., quenched, cold-drawn to 2·8 mm. and subsequently aged at (*c*) room temperature or (*d*) 155° C. The tensile strength, elongation, and electrical conductivity were determined at intervals during the ageing period (143–165 hours). Results are shown in tables and graphs. Method *d* in 8 hours gives tensile strength, 35 kg./mm.^{2}; elongation, 8·4%; electrical conductivity 32 m./ohm.mm.^{2}; the corresponding values with method *b* for 100 hrs. are 34·7 kg./mm.^{2}; 10·2%; 32·5 m./ohm.mm.^{2}.—M. H.

Recent Advances in the Field of Silumin [Alpax] Castings. G. Sachs (*Metallgesellschaft Periodic Rev.*, 1933, 7, 21–29; also (abridged) *Light Metals Research*, 1933, 2, (24), 6–7; and (abstract) *Found. Trade J.*, 1933, 48, 342).—[In English.] Silumin castings can now be obtained with almost the same degree of reliability as rolled material. In order to reduce pinholing, which frequently occurs in the modified alloy, treatment with certain salts has been adopted. The alloy is especially adapted for intricate chill-castings and for die-castings. In these the deleterious effect of absorbed iron may be avoided to a certain extent by the addition of manganese. Resistance to corrosion is high. The addition of 0·8% copper causes a pronounced increase in the fatigue strength, and this is used to advantage in the construction of aircraft motors and Diesel engines. A further addition of 0·3% manganese to the copper–Silumin increases the hardness and diminishes the harmful effect of iron. Cobalt and chromium have the same effect as manganese. The addition of magnesium makes it possible to give Silumin much greater strength and hardness by quenching from high temperatures and then tempering. Heat-treated Silumin is also marked by high fatigue strength and almost complete indifference to the abrupt changes of temperature involved in the heat-treatment. The alloy having these properties is known as "Silumin-gamma" and contains silicon 12, magnesium, up to 0·5 (according to the hardness required), and manganese 0·3–0·5%. [*Note*: A patent, it is understood, has been applied for in Great Britain in connection with this alloy; see British Patent Application No. 3527/32.]—W. N.

On the Equilibrium Diagram of the Aluminium–Silicon–Tin System. Tatsuo Matsukawa (*Suiyô-Kwaishi*, 1928, 5, (7), 567–570; *Jap. J. Eng. Abs.*, 1932, 8, 85).—[In Japanese.] The ternary diagram of the system aluminium–silicon–tin was determined by the method of differential thermal analysis.—S. G.

Mechanical and Metallographic Characteristics of Some Foundry Light Alloys. C. Panseri (*Alluminio*, 1933, 2, 59–86).—Cf. *J.*, this volume, p. 11. The shape and dimensions of sand- and chill-cast tensile test-pieces, the mechanical properties of some foundry alloys, particularly Duralite, and the effect thereon of casting conditions are discussed at some length and their influence on the structure, distribution of secondary constituents, presence of intercrystalline cracks, &c., is described. In the heat-treatment of Duralite the best quenching temperature is 530° C., and the best ageing temperatures are: 150° C. for 12 hrs., to obtain maximum ductility, or 190° C. for 4–6 hrs., to obtain the best tensile strength. The macrostructure of the castings has a great influence on the red-shortness, to which some alloys are especially subject. The tensile properties of die-cast light alloys are considerably influenced by the outer skin, removal of which reduces the tensile strength by 17·3%, and the elastic limit by 5·1%. The importance of this fact is emphasized.—G. G.

Mechanical Properties at − 40° C. of Metals used in Aircraft Construction. J. B. Johnson and Ture Oberg (*Metals and Alloys*, 1933, 4, 25–30).—Data for the tensile strength, yield-point, ductility, impact strength, fatigue resistance, hardness, and elastic properties of 9 aluminium-base alloys and 3 magnesium-base alloys at + 20° and at − 40° C. are tabulated. In all cases the properties at the lower temperatures are as good as, or better than, at room temperature, hence the ordinary tests suffice for ascertaining the value of a metal for use in aircraft designed to operate at high altitudes.—A. R. P.

Contributions to the Knowledge of the Wear-Resistance of Metals, Illustrated by Some Preliminary Researches on Aluminium Alloys. —— Irmann (*Aluminium Broadcast*, 1933, 4, (3), 17).—Abstract of *Neuhausen Research Report*, No. 525, 1932. Wear-resistance tests on various metals and alloys rubbing against cast iron showed the order of resistance to be roughly: (1) grey iron; (2) nickel–brass; (3) Alufont II; (4) chrome steel; (5) Bohnalite;

(6) Depal (nickel 1·9, copper 2, manganese 2%, aluminium balance); (7) brass; (8) Avional; (9) Silumin. Hardness is no criterion of wear-resistance.—J. C.

A New Piston Alloy. Anon. (*Met. Ind.* (*Lond.*), 1933, 42, 496).—The applications are given of an aluminium alloy containing copper 6–12, nickel 1–3, chromium 0·5–5, and magnesium 0·5–2·5%. This alloy depends on its composition, and not on heat-treatment for its hardness. The Brinell hardness of permanent mould castings is 140–150, and the alloy is suitable for pressure castings having a Brinell hardness of up to 170.—J. H. W.

Further Studies on Chromium–Nickel–Iron and Related Alloys. Vsevolod N. Krivobok, with E. L. Beardman, H. J. Hand, T. O. A. Holm; A. Reggiori and R. S. Rose (*Trans. Amer. Soc. Steel Treat.*, 1932, 21, 22–60; discussion, 60–72).—Two widely discussed limitations with these alloys are the intergranular attack by corroding gases at high temperatures and the grain boundary "decomposition" or disintegration which occurs after the sample has been heated for some time at 550° C. to 830° C. The theoretical considerations concerning the constitutional diagram of these alloys, and especially those factors which determine the existence of metastable phases, have been studied. Previously the so-called disintegration has been thought to be correlated with the precipitation of a constituent consisting of carbides. This may not necessarily be the case, as in low-carbon alloys this constituent is found to be magnetic nickel–chromium ferrite. Decomposition is accompanied by a phase change from non-magnetic to magnetic. Magnetic analysis, microscopic observations, and corrosion tests were undertaken. Alloys with very low carbon content are shown to be immune from decomposition. Above this it is practically independent of carbon content. The addition of certain other elements prevents phase change, but does not suppress precipitation of a constituent, presumably carbides. The larger these additions the lower is the upper limit of the decomposition range. Whilst the copper sulphate corrosion test shows that these alloys are susceptible to attack, the ordinary mechanical properties and resistance to corrosion in standard acid solutions are but little impaired. Changes in the relative quantities of nickel and chromium in the alloy do not improve it so far as decomposition is concerned. Generally it is found that the higher the carbon content the larger must be the additions of special elements to produce beneficial effects. Original quenching temperature has a definite influence on decomposition. In the discussion, *J. A. Mathews* considers that after these alloys have been subjected either locally or wholly to temperatures within the 550°–830° C. range they should be given a high temperature anneal whenever possible. *H. D. Newell* suggests that phase changing resulting from composition does not interfere with many commercial applications of such altered alloys, but carbide precipitation may make the alloy liable to disintegration under corrosive conditions. There are two fields of application for the alloys studied: (1) at temperatures below a point where carbide precipitation can cause damage; (2) at elevated temperatures where fine carbide precipitation may cause damage, and is best eliminated by lowering the carbon content. Fine-grained low-carbon alloys resist corrosion better than large-grained ones. *A. Sauveur* is of the opinion that to prevent decomposition one or more elements should be added capable of producing a solid solution which is stable until a temperature is reached too low to permit decomposition. *F. H. Allison* considers that attention should be paid to the influence of colloids (colloidal carbon) in the solid matrix.
—W. A. C. N.

Aluminium–Bronze. Frank Hudson (*Found. Trade J.*, 1933, 48, 86–89, 106–107, 121–123; and *Met. Ind.* (*Lond.*), 1933, 42, 297–299, 327–330, 349–352, 378–380).—Paper read before the Scottish Local Section of the Institute of Metals. The structures of "aluminium–bronzes" as shown by the equilibrium diagram are described and illustrated and the restrictions on composition dictated by the properties of the alloys are enumerated, particular attention being paid to the high solidification shrinkage of the alloys, the ease of formation of aluminium oxide, and the strong tendency to absorb gases. All the alloys from 5% aluminium upwards are readily forged. The use of the microscope in supplementing fracture tests and in detecting and identifying defects in the alloys is described. The main defects are oxide segregation, self-annealing, and badly balanced composition combined with unsuitable heat-treatment. The heat-treatment, physical properties, corrosion-resistance, and applications of the alloy are described.—J. H. W.

X-Ray Analysis of Cast Alloys.—III. Gunji Shinoda (*Suiyô-Kwaishi*, 1928, **5**, (8), 593–594; *Japanese J. Eng. Abs.*, 1932, **8**, 85).—[In Japanese.] Cf. this *J.*, 1929, **42**, 446; 1930, **43**, 525, 527. S. first determined the equilibrium diagram of the copper-rich copper–tin alloys and found a eutectoid reaction, $\gamma \longrightarrow \beta + Cu_3Sn$ at 637° C. He then studied the effect of quenching and tempering on the physical properties of Perkin's metals by means of thermal analysis and measurements of the electrical resistance and thermo-electromotive force of the alloys.—S. G.

Chemical Investigations of the Ancient Metallic Implements in the Orient. I.—Ancient Chinese Copper Implements. II.—Ancient Chinese Bronze Implements. Tsurumatsu Dōno (*Nippon Kwagaku Kwaishi* (*J. Chem. Soc. Japan*), 1932, **53**, 744–748, 748–753; *C. Abs.*, 1933, **27**, 5).—[In Japanese.] An analysis of copper implements revealed 2·90–26·78% lead; lead was probably added to make casting easy. Chemical tests for estimating the age of bronze implements by studying the ratio of copper and tin agreed well with archæological findings.—S. G.

" Oilite " : An Oil-Containing Bearing Bronze. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 430–431).—In the manufacture of Oilite, a loose mixture of powdered metals is pressed into the required shape and sintered at about 1500° F. (815° C.) in a special atmosphere. The hot shape is then quenched in a lubricating oil and left to soak. The resulting bronze is said to have an oil content of 30–40% by volume. The performance of these bearing bronzes is described.—J. H. W.

The Transformation of the β-Solid Solution of Brass. R. Ruer (*Z. anorg. Chem.*, 1932, **209**, 364–368).—Differential heating and cooling curves of 14 copper–zinc alloys with 65·6–44·7% copper have shown that, contrary to earlier suggestions (see this *J.*, 1930, **43**, 463–464), no double transformation occurs in the β-solid solution. The transformation temperature was found to be 453° C. in the $(\alpha + \beta)$-range and 465° C. in the $(\beta + \gamma)$-range. The thermal effect in the heating and cooling curves is similar to that of iron within the temperature interval of its magnetic transformation. From this and other relations R. concludes—in contrast with the general view—that the $\beta \rightleftarrows \beta'$-transformation does not take place in the homogeneous phase, but is a real change of phase (see also R. Ruer, *Z. anorg. Chem.*, 1932, **205**, 230–234).—M. H.

The Transformations of the β-Phase in the Copper–Zinc System. P. J. Saldau and I. Schmidt (*Izvestia Instituta Fiziko-Khimicheskago Analisa* (*Annales de l'Institut d'Analyse physico-chimique*), 1931, **5**, 201–222).—[In Russian.] Apparently the same paper as was published in *Z. anorg. Chem.*, 1928, **173**, 273–286; see this *J.*, 1928, **40**, 514.—M. Z.

I.—The Relation between Mean Atomic Volume and Composition in Copper–Zinc Alloys. II.—Variation of Mean Atomic Volume with Temperature in Copper–Zinc Alloys, with Observations on the β-Transformation. E. A. Owen and Llewelyn Pickup (*Proc. Roy. Soc.*, 1933, [A], **140**, 179–191, and 191–204).—I.—X-ray analysis indicates that in the Cu–Zn series of alloys the mean atomic volume of both phases present in mixed regions is constant. There is approximately a linear increase of mean atomic volume with increasing atomic-% composition in all pure phases. The rate of this increase is practically the same for the α-, β-, and γ-phases, but that for the ε- and η-phases is greater, whilst that for the η-phase is greater than that for the ε-phase. The change in atomic volume when a copper atom is replaced by a zinc atom can be explained by assuming that the zinc atom is not spherical, and that it packs differently in the various phases. The (β + γ) — (γ) boundary is not at the same composition for all temperatures. A detailed study of the ε- and η-phases shows that the base side of the hexagonal unit varies linearly with composition, but whereas in the ε-phase the base side increases, in the η-phase it decreases with decreasing copper content. The axial ratio, on the other hand, decreases in the ε-phase and increases in the η-phase as the copper content decreases. Pure zinc has the following parameter values at room temperature: $a = 2{\cdot}659_1$ A.; $c = 1{\cdot}856$. II.—Changes in mean atomic volume in the α-, β-, and γ-phases in both the pure and duplex regions of the copper–zinc alloys have been investigated by X-ray precision analysis between 350° C. and 800° C. In all pure phases the mean atomic volume is constant at all temperatures. Both the β- and the γ-phases in the (β + γ) region showed a definite *minimum* mean atomic volume at about 500° C.; the α-phase in the (α + β) region showed a *maximum* value at about the same temperature. Changes in mean atomic volume are not due to changes in composition. Of three possible explanations, one, based on a change of solubility, appears to fit the experimental facts most satisfactorily. The β-transformation occurring at about 470° C. is discussed in terms of this solubility theory.—J. S. G. T.

Some Investigations on High-Tensile Brass.—I. Tomojirō Tanabe (*J. Min. Inst. Japan*, 1928, (514), 125–140; *Japanese J. Eng. Abs.*, 1932, 8, 83).—[In Japanese.] T. carefully investigated the influence of various single elements, *i.e.*, nickel, aluminium, manganese, iron, and tin, on various mechanical properties and the corrosion-resistance to dilute sulphuric acid of rolled brass plate containing 50–60% copper. In order to examine the mechanical properties of the materials, hardness, tension, static impact, and repeated impact tests and hardening by quenching and age-hardening were carried out. The results showed that the elongation and tensile strength of nickel–brass, aluminium–brass, and manganese–brass are superior to those of the “ mother ” brass. Cf. following abstract.—S. G.

Some Investigations on High-Tensile Brass.—II. Tomojirō Tanabe (*J. Min. Inst. Japan*, 1928, (515), 219–231; *C. Abs.*, 1929, 23, 1093).—[In Japanese.] Cf. preceding abstract. T. made a detailed investigation of the structure and mechanical properties which result on adding several pairs of metals such as manganese+nickel, manganese+iron, manganese+aluminium, manganese+tin, nickel+iron, and nickel+tin to a brass containing 60% copper. The paper contains extensive experimental data, with a few plates of photomicrographs. Among the results, it is stated that (1) with the alloy containing nickel+aluminium, a suitable heat-treatment can give properties comparable to those of steel. Thus, alloys containing nickel 2, and aluminium 1%, attain a tensile strength of 81 kg./mm.^{2} by quenching at 800° C. and annealing at 350° C.; (2) the alloy containing nickel 4·7, and aluminium 4·0% attains a tensile strength of 70–75 kg./mm.^{2}, elastic limit 45–50 kg./mm.^{2}, elongation 19–14% and contraction of area 25–16%.—S. G.

Effect of Work-Hardening on the Properties of Brass. V. Bugakov and N. Davidenkov (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), 1931, (2–3), 105–114).—[In Russian.] The anomalies observed in the curves showing the relations between the degree of reduction of α-brass by cold-rolling and the mechanical properties and rate of dissolution in acids are attributed to a maximum accumulation of residual stress at a certain degree of reduction (about 30%). This assumption is confirmed (*a*) by the disappearance of the anomalies when the residual stress is removed by annealing, (*b*) by a study of the relation between the stress and the rate of dissolution of the alloy, and (*c*) by direct measurements of the stress.—D. N. S.

Residual Stresses in Brass Cartridges. N. Davidenkov and F. Vitman (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1931**, (7), 71–76).—[In Russian.] Season-cracking of brass stampings is accelerated by ammonia vapour corrosion and residual stress in the surface layers. The distribution of residual stress in brass cartridges and the removal of this stress by heat-treatment have been studied. Measurement of the residual tangential stresses showed the presence at the mouth, of extension stresses up to 20 kg./mm.^{2} and at the base of compression stresses not greater than 8 kg./mm.^{2}. Annealing at 290° C. for 2 hrs. removes 80–90% of residual stress without reducing the hardness by more than 10%. No reliable data for the magnitude of the residual stress could be obtained by the use of corrosive liquids.—D. N. S.

The Electrolytic Potential of Ternary Gold–Tin–Mercury Alloys. Franz Griengl and Robert Baum (*Monatsh.*, 1932, **61**, 330–344).—Diagrams have been constructed showing the isopotential lines in the ternary system gold–tin–mercury; the curves show no discontinuities corresponding with the compounds AuSn and $AuSn_2$, which are, however, shown by the potential curves of the gold–tin system. Hence it is concluded that in the presence of mercury these compounds are at least partly dissociated.—A. R. P.

On the Position of Gold in the Potential Series in the Electrolysis of Molten Metallic Alloys. Ludwig Lämmermayr, Jr., and Robert Kremann (*Monatsh.*, 1932–1933, **61**, 345–350).—Experiments on the migration of the constituents when molten alloys of gold with mercury, bismuth, antimony, lead, or aluminium are electrolyzed in capillary tubes indicates that these metals can be arranged in the following order in a potential series: bismuth, antimony, mercury, lead, gold, aluminium.—A. R. P.

The Shape and Structure of Lead Shot. G. Tammann and K. L. Dreyer (*Z. Metallkunde*, 1933, **25**, 64).—Shot made from lead free from arsenic is always elongated, whereas that made from lead with 0·5% arsenic is spherical. These effects are explained as follows: at the surface of the lead drop arsenic is oxidized to trioxide which converts the lead oxide film covering the lead drop into liquid lead arsenite which solidifies at 200° C. In the absence of arsenic, however, the lead drop is covered by a skin of solid lead oxide which thus effects the formation of elongated shot. The structure of the shot consists of several lead dendrites cemented with lead-rich lead–arsenic eutectic.—M. H.

Experiment on the Use of Alkaline Earth Babbitts for Filling Linings of Bearings of Rolling Installations at the Petrovsky Metallurgical Works.—E. Dukhan (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1931**, (8), 55–62; (9), 36–55).—[In Russian.] The stability of bronze linings of wire rolling-mills filled with a lead bearing metal containing calcium 1, sodium 0·8%, was found to be greater than when a tin Babbitt was used, and the consumption of electrical energy fell by 43–50%.—D. N. S.

On the Question of Bearing Alloys. N. F. Bolchovitinov (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1931**, (10), 51–60).—[In Russian.] The nature of bearing alloys and their characteristic properties are reviewed and the effects of additions of zinc, phosphorus, nickel, and antimony to bearing bronzes are described. Methods of testing, and standards for Babbitts are given.—D. N. S.

Arsenic in Lead-Base Bearing Metals. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 11–13).—See this *J.*, 1932, **50**, 685; this volume, p. 124. A brief review of recent published work on the subject.—R. G.

The Magnetic Susceptibilities of Lead, Silver, and Their Alloys. Carol G. Montgomery and William H. Ross (*Phys. Rev.*, 1933, [ii], **43**, 358–360).—The magnetic susceptibilities of lead, silver, and their alloys were determined by a modified Curie balance, and may be expressed by the relation $10^9\chi = (116{\cdot}44 \pm 0{\cdot}68) + (0{\cdot}764 \pm 0{\cdot}012)\,P$, where P is the weight per cent. of silver. The susceptibility thus varies linearly with the composition, in contrast to the work of Spencer and John (this *J.*, 1927, 38, 433), whose results may have been affected by ferromagnetic impurities.—W. H.-R.

Contribution to the Study of the Physical and Mechanical Properties of Magnesium–Aluminium–Copper Alloys Rich in Magnesium. A. Portevin and P. Bastien (*Compt. rend.*, 1933, 196, 693–696).—Thermal analysis and microscopic study show three distinct regions starting with magnesium and containing respectively 1, 2, and 3 constituents. The solid solution region, as indicated by the hardness and electrical resistance of the sand-cast alloys, is well-defined, but does not coincide exactly with the area shown by thermal analysis, indicating a susceptibility of the alloys to heat-treatment. The alloys containing aluminium + copper $\leq$ 15% have coeffs. of expansion of $25{\cdot}8$–$27{\cdot}8 \times 10^{-6}$. The binary magnesium alloys containing up to 15% copper and up to 7% magnesium (*i.e.*, corresponding with the saturated solid solutions) can be forged. The mechanical properties of these alloys have been studied. Under rotating tensile tests the magnesium–aluminium–copper alloys, 88 : 9 : 3 or 85 : 9 : 6, gave the same order of results as the Duralumin type alloys.—J. H. W.

Comparative Investigation of Two Magnesium Alloys. M. Sharov and A. Maurah (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), 1931, (11), 18–33; (12), 30–38).—[In Russian.] The mechanical properties of the following piston alloys: (A) magnesium 88·3, aluminium 10, silicon 1·5, and manganese 0·2%; (B) magnesium 91·8, aluminium 2, copper 4, cadmium 2, manganese 0·2%, have been compared with those of the usual 88 : 12 aluminium–copper alloy (C). The tensile strength, elongation, yield-point, Brinell hardness, and impact strength have been determined at 20°–350° C. for the alloys as cast and after annealing at 200°–350° C. for 5–100 hrs., and the behaviour of pistons of the alloys in a 48-hr. test in aero-engines has been examined. Their thermal conductivities are in the order C, B, A. The mechanical properties of A and B at 20° C. are better than those of C, and unlike the latter are practically unaltered by long periods of heating at high temperatures. With rise in temperature, the mechanical properties of A and B fall more rapidly than those of C. B casts better than A, and the weight of pistons made of A or B is only about 75–77% of that of pistons made of C. Magnesium alloy pistons have one fundamental defect, *viz.*, they tend to crack in the connecting-rod sockets; in this respect A is worse than B. Cracking can be obviated by making the structure more robust and by improving the quality of the casting. It is concluded that both magnesium alloys are suitable for the pistons of aero-engines.—D. N. S.

The Specific Heat of Monel Metal between − 183° and 25° C. W. F. Hampton and J. H. Mennie (*Canad. J. Research*, 1932, 7, 677–679).—The heat capacity of Monel metal over the range − 183° to 25° C. has been measured in an adiabatic calorimeter. By differentiation of the equation representing the heat capacity curve, an equation for the specific heat over this range is obtained and values at various temperatures calculated. The specific heat at 20° C. is found to be 0·0997.—S. G.

Magnetic Properties of the Iron–Nickel Alloys under Hydrostatic Pressure. R. L. Steinberger (*Physics*, 1933, 4, 153–161).—A series of well-annealed iron–nickel alloys in nominal steps of 10% nickel, including the pure metals, has been examined for the effect of pressures up to 12,500 kg./cm.^{2} on the magnetic flux density. The application of pressure causes a relatively large change of flux, producing usually a decrease followed by an incomplete recovery of flux on release of pressure. The recovery is reversible in the sense that the same curve of flux change is traced with each series of pressure applications, provided the pressure does not exceed that first applied. The 30% nickel alloy is rendered nearly non-magnetic by application of a pressure of 12,000 kg./cm.^{2}. Of the remainder, pure iron exhibits the greatest, and the 90% nickel alloy the smallest, change of flux due to pressure. At constant field, the different alloys exhibit various types of changes of flux under pressure, *viz.*, linear, non-linear, and types showing hysteresis.—J. S. G. T.

Illium. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 470).—A brief note. It is claimed that Illium a new alloy of nickel, copper, chromium, and tungsten, with small amounts of iron, carbon, manganese, and silicon, has: tensile strength 26·7 tons/in.^{2}; yield-point 22·2 tons/in.^{2}; Brinell hardness 170–200; melting point 1300° C.; sp. gr. 8·3, and that it is very resistant to heat and corrosion. Cf. *J.*, this volume, p. 125.—J. H. W.

The Alloys of Palladium with Iron. A. T. Grigoriev (*Izvestia Platinago Instituta* (*Annales de l'Institut de Platine*), **1931**, (8), 25–36).—[In Russian.] See abstract from *Z. anorg. Chem.*, 1932, **209**, 295–307; *J.*, this volume, p. 126. —N. A.

Thermoelectric Properties of Platinum–Rhodium Alloys. Frank R. Caldwell (*U.S. Bur. Stand. J. Research*, 1933, **10**, 373–380; and *U.S. Bur. Stand. Research Paper* No. 537).—The thermal electromotive forces and thermoelectric powers of a series of platinum–rhodium alloys against pure platinum have been determined from 0° to 1200° C. The results obtained are compared with those obtained by other investigators. The specimens used in this work contained the following percentages of rhodium: 0·100, 0·500, 1·000, 5·00, 21·6, 39·0, 51·6, 56·6, 61·2, 80·7, and 100·00.—S. G.

The Rôle of the Platinum Metals in Dental Alloys. III.—The Influence of Platinum and Palladium and Heat-Treatment upon the Microstructure and Constitution of Basic Alloys. E. M. Wise and J. T. Eash (*Amer. Inst. Min. Met. Eng. Preprint*, **1933**, Feb., 1–28).—The effect of substituting platinum or palladium for part of the gold in an alloy of gold, silver, copper, and zinc in the atomic ratios 50 : 20 : 29 : 1 has been studied by thermal analysis, micrographic examination, and X-ray methods. In the palladium series the solidus and liquidus rise almost linearly with increase of palladium from 850°–870° C. to 1020°–1080° C. with 0–30 atomic-% palladium; in the platinum series the liquidus rises sharply in a curve concave to the composition axis and reaches 1200° C. at 20 atomic-% platinum, whereas the solidus rises slowly to 948° C. at 14 atomic-% platinum and in alloys with more than 5 atomic-% platinum a peritectic reaction occurs at this temperature. The α-solid solution range in the platinum series extends from 0% platinum at 400° C. to 14 atomic-% platinum at the peritectic temperature; below this line a new θ-phase separates having apparently the composition $AuPt_2Cu_3$. The α-phase in the palladium series decomposes at 400°–500° C., with increase of palladium up to 15 atomic-% giving a mixture of $\alpha + \theta$; alloys with more than 5 atomic-% palladium yield a mixture of $\alpha + \theta + \kappa$ below 600° C., whereas those with more than 28 atomic-% palladium yield $\alpha + \lambda$ on annealing below 600°–700° C. Owing to these changes both series of alloys undergo age-hardening on quenching from above the transformation point and tempering below it. In the palladium series the θ-phase has a face-centred tetragonal structure, $c/a = 0·92$, the κ-phase a body-centred tetragonal structure, $c/a = 0·96$–$0·98$, and the λ-phase a body-centred cubic lattice; the θ-phase in the platinum series has a face-centred tetragonal structure, $c/a = 0·98$ for the 20 atomic-% platinum alloy. The phase transformations during ageing of several alloys in both series have been studied and the results correlated with the change in mechanical properties. —A. R. P.

Studies on the Ternary System Silver–Copper–Nickel. W. Guertler and A. Bergmann (*Z. Metallkunde*, 1933, **25**, 53–57).—The miscibility gap in the liquid state of the ternary system silver–copper–nickel has been determined by analysis of the layers in specimens quenched slightly above or below the liquidus temperature. The gap which lies between 1·5 and 96% nickel in the binary system silver–nickel extends up to about 42% copper in the ternary system. The critical point lies near 35% silver, 40% copper, 25% nickel. The results of thermal analysis and microscopical examination are in general in agreement with those of de Cesaris. Only two phases exist in the system : a copper–nickel–silver solid solution with a low silver content and a silver-rich silver–copper solid solution. A model of the ternary system is given. Nickel is an unsuitable alloying element for silver even in the presence of copper.—M. H.

Investigations on Age-Hardening Phenomena in Britannia Metal. M. von Schwarz and O. Summa (*Z. Metallkunde*, 1933, **25**, 95–97).—Cf. papers by Egeberg and Smith, this *J.*, 1928, **40**, 527; 1929, **42**, 464. The Brinell hardness of a tin–antimony alloy with 8% antimony changed from 10·5 to 11·5, 8·8, and 7·1, respectively, after cold-working to 24, 51, and 78% reduction and to 9·1–9·7 after subsequent annealing at 175° C. for 90 minutes. The increase of hardness on annealing is shown by X-ray investigation to be due to the precipitation of the compound SnSb which has a crystal lattice of the sodium chloride type.—M. H.

The Diffusion of Mercury on Rolled Tin Foils. F. W. Spiers (*Phil. Mag.*, 1933, [vii], **15**, 1048–1061).—Mercury drops placed on rolled tin foils diffuse into elliptical areas forming an amalgam containing approximately 11·8% of mercury. Features of the diffusion are described, an empirical interpretation of the curves of growth of the ellipses is given, and the elliptical diffusion explained in terms of the rolling effects. The crystal structure of the amalgam, is shown by X-ray analysis to be hexagonal, the unit cell containing one atom and having dimensions $a = 3{\cdot}23$ A, $c = 3{\cdot}00$ A. Density measurements indicate the existence of a liquid phase from 8% mercury onwards; measurements of electrical resistance show the hexagonal phase to be a secondary solid solution and give an indication of the solidus curve for the tin end of the mercury–tin system.—J. S. G. T.

Super-Hard Alloys of the Metallo-Ceramic Type (Sintered Powders). G. A. Meerson (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1932**, (2), 60–67; (3), 67–73; (5), 59–67).—[In Russian.] A detailed description of the production of super-hard alloys, containing tungsten carbide, and cobalt at the Electrozavod works in Moscow. A review of the literature and the characteristics of various super-hard alloys is given.—D. N. S.

The Sulphurization of Non-Ferrous Alloys. J. P. Podolsky and N. M. Zarubin (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1931**, (5), 57–62).—[In Russian.] The diffusion of molten sulphur into copper, nickel, and alloys of nickel with copper, iron, and tungsten, has been studied. Copper forms Cu_2S at 600° C., and nickel forms NiS below, and Ni_3S_2 above, 600° C. In the sulphurization of solid solution alloys sulphide layers are formed, the outer consisting of the sulphide of the metal having the greater affinity for sulphur; thus in copper–nickel alloys this layer is copper sulphide, and the inner layer nickel sulphide. This phenomenon is similar to that observed in the "kernel roasting" of copper ores. In the sulphurization of alloys the components of which form chemical compounds with one another no separation into layers can be detected.—D. N. S.

Temperature Coefficient of the Moduli of Metals and Alloys Used as Elastic Elements. G. H Keulegan and M. R. Houseman (*U.S. Bur. Stand. J. Research*, 1933, **10**, 289–320; and *U.S. Bur. Stand. Research Paper* No. **531**).—In continuation of the work of W. G. Brombacher and E. R. Melton (*N.A.C.A. Tech. Rep.* No. **358**, 1930) the temperature coeff. of the modulus of elasticity and of Young's modulus of elasticity of 31 alloys and metals (phosphor-bronze; Monel metal; brass; nickel–brasses; Duralumin, beryllium–bronze; tungsten, as well as Elinvar, Modulvar and various steels) have been determined in the temperature range — 50° C. to + 50° C. The materials were selected on the basis of their possible use as elastic elements for aircraft and other instruments. In most cases the temperature coeff. were determined with the metal in the condition of heat-treatment or cold-work most suitable for its use as an elastic element and also in the annealed condition. The coeff. of each modulus at 0° C., the ratio of the coeff. at + 25° to that at — 25° C., the composition and the heat-treatment or cold-work are given for each sample. The temperature coeff. of Poisson's ratio and the significance of the differences in the two coeff. for a given material are discussed.—S. G.

Internal Friction of Iron and Iron Alloys. R. H. Canfield (*Trans. Amer. Soc. Steel Treat.*, 1932, **20**, 549–574; discussion, 574–576).—Elastic hysteresis is first discussed. The assumption that internal friction in solids is exactly analogous to viscosity in liquids, and that hence the frictional stress is proportional to the rate of change of shear strain is erroneous. C. proceeds to give a mathematical interpretation of the loop in the hysteresis curve. Apparatus and technique are described for measuring the dissipation of energy in a tubular specimen of metal when carried through cycles of alternating torsional stress. The results in this instance apply principally to iron alloys. In plotting the results, the half width of the hysteresis loop is plotted against the stress amplitude, giving a curve showing friction stress–elastic stress. The slope represents a coefficient of internal friction.—W. A. C. N.

Magnetic Properties of Solid Solutions. S. S. Bhatnagar and Pyara Lal Kapur (*J. Indian Chem. Soc.*, 1932, **9**, 347–356).—The properties of solid solutions of salts and metals are briefly surveyed and an experimental study is described having as object the determination of the relationship between magnetic susceptibility and other properties of solid solutions. Three types of solid solutions of salts were used, and were prepared by crystallization or melting. The magnetic susceptibility was determined by a magnetic balance of the Wilson type. The correlation of the results with those for metallic systems is discussed. Heat of formation appears to be analogous to magnetic susceptibility. When the heat of formation of the system is zero, the susceptibility–concentration curve of the system follows a linear course.—R. G.

III.—STRUCTURE

(Metallography ; Macrography ; Crystal Structure.)

(Continued from pp. 238–241.)

Methods of Metallographic Testing of Tungsten and Molybdenum. N. M. Zarubin (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), 1931, (7), 54–70; (8), 48–54).—[In Russian.] The methods used in the metallographic examination of tungsten and molybdenum in the laboratory of the Electrozavod works in Moscow are described.—D. N. S.

On the Question of Metallographic Investigation of Bimetal. N. M. Zarubin (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), 1931, (10), 12–21).—[In Russian.] The methods used in the laboratory of the Electrozavod works in Moscow are described. The bimetals examined are : Platinite, Invar–brass, Invar–copper, Invar–nonmagnetic steel, iron–brass, iron–copper, iron–gunmetal. Reagents suitable for etching separately each of the components of the bimetal are given.—D. N. S.

On the Colour-Etching of Metal Surfaces. N. M. Zarubin and G. A. Meerson (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), 1930, (7–8), 167–176).—[In Russian.] Experiments on the colour-etching and colour-photography of polished surfaces of tungsten, molybdenum, ferro–

tungsten, iron, and steel are recorded. Tungsten is etched with 10% permanganate solution in acetic anhydride; molybdenum with 50% sulphuric acid containing 10% of permanganate, and ferro–tungsten with 10% ammonium persulphate solution which can also be used for all the other metals.
—D. N. S.

On the Changes in Texture and Mechanical Properties of Duralumin Due to Deformation and Subsequent Thermal Treatment. E. Bachmetev (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1930**, (9–10), 154–167).—[In Russian.] The changes in the crystal structure of Duralumin after rolling to various degrees up to 99·6% reduction followed by thermal treatment, have been investigated by X-ray analysis. After cold-rolling to 89% reduction, the crystallites are oriented about the [111] and the [112] axes and the hardness–% reduction curve shows a sharp point of inflection. On further rolling, the crystallites tend to orient themselves solely in the direction of the [111] axis and the work-hardness rises rapidly. On quenching and ageing Duralumin that has been reduced 89% or more by rolling, the so-called recrystallization texture appears and the mechanical properties are improved, reaching a maximum after a reduction of 89%. It is suggested that the ageing process in Duralumin is dependent on the distortion of the space-lattice produced by the cold-work prior to the heat-treatment.—D. N. S.

Structural Changes in Duralumin Due to Deformation by Extension. E. Bachmetev (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1931**, (1), 99–105).—[In Russian.] The structural changes which occur in stretching Duralumin in the annealed condition and at different stages of ageing have been studied metallographically. Fine lines marked on the specimens enabled the same crystal grains to be examined under the microscope and photographed at different stages of the deformation process, while the collation of such photographs gave a means of elucidating the structural changes. In this way bending of the crystal grains, displacements of one grain with respect to another, lines of slip and surface cracks, but no twin formation could be observed both in annealed Duralumin and in Duralumin in various stages of ageing.—D. N. S.

On the Study of Statistical Anisotropy in the Distribution of Microcrystallites. G. S. Zhanov (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1930**, (9–10), 149–154).—[In Russian.] In Z.'s new axial "X-Ray-Texture Camera" the axis of the cylindrical film lies parallel to the primary X-ray pencil. During the exposure the specimen is turned through 90° or 180° while the film advances along the axis of the cylinder, the path traversed by it forming the width of the X-ray photograph. The resulting X-ray photographs are the projection of polar figures from a spherical on to a cylindrical surface. Examples of such diagrams for rolled Duralumin are given.—D. N. S.

The Polishing of Specimens for Metallographic Examination. A. R. Matthis (*Ing. Chim.*, 1932, **16**, 188).—A description (illustrated) of a machine designed for the rapid polishing of specimens, in which the different grades of emery paper are carried on a revolving mandril and means provided for adjustment of the position of the specimen. The machine is stated to be capable of satisfactory use with soft metals not easily polishable by hand.—R. G.

Structure Analogies of Alloys. Arne Westgren (*Trans. Amer. Soc. Steel Treat.*, 1932, **20**, 507–528).—X-ray analyses of the copper–zinc, silver–zinc, and gold–zinc systems have shown that they are all built up in the same way and Carpenter's assumption that the crystal structures of these alloy systems are analogous has been corroborated. Certain typical structures recur frequently in other related alloys, *e.g.*, those of copper, silver, and gold with zinc, cadmium, aluminium, and tin. The phases having the same structure as β-brass and γ-brass appear to be formed when the ratio of the number of atoms assumes the values 3 : 2 and 21 : 13, respectively. Combinations of transitional elements such as iron, palladium, and platinum metals with zinc, cadmium or aluminium also induce the formation of phases analogous to β- or γ-brass. —W. A. C. N.

The Crystal Structure of the Precipitated Copper–Tin Alloys. H. Kersten and Joseph Maas (*J. Amer. Chem. Soc.*, 1933, 55, 1002–1004; and (abstract) *Met. Ind.* (*Lond.*), 1933, 42, 348).—Addition of tin to a neutral or slightly acid aqueous solution of copper sulphate produces a precipitate of composition approximately Cu_3Sn. Precipitates prepared with solutions of varying acidities varied in composition from nearly pure copper to an alloy containing about 40% tin. The X-ray spectra of the alloys showed them to correspond in crystal structure with the α alloys and the compound Cu_3Sn as prepared by fusion.—R. G.

Diffraction of Low-Speed Electrons by a Gold Crystal. H. E. Farnsworth (*Phys. Rev.*, 1932, [ii], 40, 1049).—Abstract of a paper read before the American Physical Society. A previous investigation of electron diffraction by a silver crystal, for normal incidence on a (100) face showed that, in general, each observed diffraction beam, between 0 and 325 v., is made up of several components of fine structure. As the angle of incidence was changed from normal in small steps, the relative intensities of the components of any one beam changed enormously. The components which are present for normal incidence may disappear and others appear at angles of incidence a few degrees from the normal. For each beam there is a certain angle of incidence at which the most intense component attains its maximum value. No exact correspondence between the characteristics of the various beams was found. Similar observations are now being obtained for a gold crystal. A fine structure is also observed for these beams. The intensities of the components are also very sensitive to a change in the angle of incidence, but the particular characteristics of any one beam differ considerably from those of the corresponding beam for silver. This is particularly significant since gold and silver have the same lattice structure and also the same lattice constant to within 0·4%. —S. G.

Electron Diffraction by a Silver Film on a Gold Crystal. H. E. Farnsworth (*Phys. Rev.*, 1932, [ii], 42, 588).—Abstract of a paper read before the American Physical Society. A thin film of silver (not visible) was deposited on the (100) face of a gold crystal by evaporation in a vacuum. The silver formed in a lattice structure having the same orientation as that of the underlying gold crystal. The diffraction beams obtained for the thin silver film have the same characteristic fine structure, which varies with the angle of incidence, as that previously found for a more massive silver crystal (this *J.*, 1932, 50, 616), except that the relative intensities of the components of one of the lowest voltage beams for the silver film are reversed. As previously observed (see preceding abstract) the fine structure of the diffraction beams for a gold crystal differs from that of the corresponding beams of a silver crystal. Deviations from the plane grating formula for normal incidence are the same for the beams from the thin film as for those from a more massive silver crystal. These results substantiate the previous evidence (this *J.*, 1932, 50, 616, and preceding abstract) that the fine structure characteristics are at least partly determined by the nature of the atoms composing the crystal rather than by the lattice itself.—S. G.

The Crystalline State of Thin Sputtered Films of Platinum. G. P. Thomson, Norman Stuart, and C. A. Murison (*Proc. Phys. Soc.*, 1933, 45, 381–387; discussion, 387–388).—Films of platinum sputtered in various gases have been examined by the method of electron diffraction. They often show patterns which indicate that the small crystals are oriented with one face parallel to the face of the specimen, the crystals being otherwise arranged at random. The width of the diffraction rings shows that in many cases the size of the crystals is of the order 5×10^{-7} cm. Some films of platinum dioxide indicated crystals of dimensions 2×10^{-7} cm.—J. S. G. T.

X-Ray Analysis of Iron–Tin Alloys. W. F. Ehret and A. F. Westgren (*J. Amer. Chem. Soc.*, 1933, 55, 1339–1351).—The alloys were made in a vacuum furnace and given various treatments in evacuated glass or quartz tubes. One case of non-uniformity was found, the 70% tin alloy separating into two layers, β and $FeSn_2$. The following results were obtained. α-phase—solid solution of tin in α-iron. Solubility at 680° C. 9·8% tin. Length of cube edge in body-centred α-iron lattice increases linearly with increase of tin. β-phase—hexagonal structure with narrow homogeneity range. Corresponds with 3FeSn. β′-phase—possibly a mixture of phases, appearing in alloys containing 27–59% tin. β″-phase—hexagonal, probably $2Fe_2Sn$. γ-phase—nickel arsenide structure. $FeSn_2$ phase—probably hexagonal with narrow range of homogeneity. Sn phase—where occurring in a number of alloys does not differ from pure tin. Iron and all the other phases in the system are therefore insoluble in tin. The discrepancies between the X-ray results and the previously published thermal diagram of Edwards and Preece are discussed. —R. G.

Diffraction of Low-Speed Electrons by a Tungsten Single Crystal. Wayne T. Sproull (*Phys. Rev.*, 1933, 43, [ii] 516–526).—Single crystals of tungsten were ground and polished so as to give plane surfaces parallel to the (1–1–2) and (1–0–0) planes of the crystal. After thorough outgassing, the diffraction of electrons was then studied, and the following characteristics were noted. (1) The diffracted beams on the whole are less intense, less sharp in co-latitude and azimuth, and have a slower rate of growth and decay than those observed by other workers for nickel, copper, and silver. (2) The volume interference condition plays a relatively greater rôle than in the other metals. These differences are probably due to the fact that in the body-centred cubic structure of tungsten, the planes studied are relatively closer together but more sparsely populated by atoms than those examined in other cases, with the result that the electrons can penetrate the first layer of atoms more easily. The opposite extreme in which the diffraction pattern is due almost entirely to surface interference is found in the case of mica, where the cleavage planes are very densely populated, but spaced at relatively great distances.—W. H.-R.

The Crystal Structure of Uranium. Thomas A. Wilson (*Physics*, 1933, 4, 148–152).—A method for the X-ray analysis of powders derived from crystals of low symmetry is described. Uranium is shown to crystallize in space-group C^3_{2h} of the monoclinic system, with 2 atoms in each crystallographic cell of dimensions $a = 2{\cdot}829$ A.; $b = 4{\cdot}887$ A.; $c = 3{\cdot}308$ A. Axial ratios are 0·5791 : 1 : 0·6771. The corresponding density is 19·05. Uranium atoms appear to be prolate spheroids with major axis of length 3·425 A. and minor axis 2·826 A.—J. S. G. T.

On Co-operative Phenomena [Secondary Structure of Crystals, and Ferromagnetism]. F. Zwicky (*Phys. Rev.*, 1933, [ii], 43, 270–278).—The term co-operative phenomena is used to describe phenomena due to the interaction of a large number of elementary particles (electrons, atoms, &c.), the interaction extending over distances which are much greater than the usual action radii involved in the effect of a particle on its immediate neighbours. Z. claims that this kind of phenomenon is effective in the recrystallization of metals, the secondary structure of crystals, and ferromagnetism. Secondary structures are suggested to account for the magnetic properties of single crystals of iron, nickel, and cobalt.—W. H.-R.

On the Magnetization of Ferromagnetic Crystals. Francis Bitter (*Phys. Rev.*, 1933, [ii], 43, 655–660).—The function E_θ was previously (Bitter, *J.*, this volume, p. 231) described, and gives the energy of a ferromagnetic crystal as a function of the direction of magnetization. Photographs are given of plaster models which represent E_0 for (*a*) undistorted crystals of nickel and iron in zero applied field; (*b*) undistorted crystals of iron in a field of 100 oersteds parallel to the [100], [110], and [111] axes, respectively; and (*c*) iron crystals distorted by compression and extension along the above axes. Magnetization curves for distorted crystals are calculated and illustrated.—W. H.-R.

IV.—CORROSION

(Continued from pp. 241-244.)

Corrosion Research on Light Metals. Freeman Horn (*Met. Ind.* (*Lond.*), 1933, **42**, 173–176, 197–199, 253–254; discussion, 281–282; also (report with discussion) *Chem. and Ind.*, 1933, **52**, 59–60; and (abstract) *Found. Trade J.*, 1933, **48**, 162).—Read before the Chemical Engineering Group of the Society of Chemical Industry. The nature and direction of research on the corrosion of light metals are indicated. Parallel with this research is an investigation into the methods of treating metal surfaces to prevent corrosion. The 3 main fields in this latter investigation are metallizing by spraying or rolling, plating with zinc on chromium and oxidizing chemically or electrolytically. These methods are described, especially the last, of which the Bengough anodic process is the most successful from the point of view of corrosion-resistance. Research is also being extended in the direction of magnesium alloys, but with less success at present, the best method so far being the addition of manganese as an alloying metal.—J. H. W.

Corrosion of Aluminium and Its Alloys. H. Sutton (*Met. Ind.* (*Lond.*), 1933, **42**, 332).—A letter commenting on a paper read by Freeman Horn (cf. preceding abstract). The superiority of the Panalumin or Jirotka process to the anodic system or any chromate dip, as claimed by C. J. Goodwin, is controverted.—J. H. W.

Corrosion of Copper by Coke. Anon. (*Architect and Builder*, 1931, **125**, 231–232; *Building Sci. Abs.*, 1931, [N.S.], **4**, 57).—It is reported that tests carried out by the City of Birmingham Gas Department have led to the conclusion that the use of coke fuel as compared with coal for copper flue-back boilers under the conditions usual in kitchen ranges does not cause any increase of external corrosion. Protective surface treatment of such boilers appears to be neither necessary nor desirable. Boilers of cold-rolled copper show no superiority over those of hot-rolled copper. The use of specially refined copper is advisable. In manufacturing the brazing should be smoothly finished, external projections due to overlaps should be avoided; welding is suggested. —S. G.

Mineralization, Electrolytic Treatment and Radiographic Examination of Copper and Bronze Objects from Nuzi. Rutherford J. Gettens (*Tech. Studies Field Fine Arts*, 1933, **1**, 119–142; *C. Abs.*, 1933, **27**, 1598).—The mineralization of nails found at Nuzi, Iraq, which had been buried about 3500 years under 130 cm. of stiff damp clay, was studied by cross-sectioning the nails along various axes so that all the interior zones would be exposed. Four major zones were observed in the spike portion of the nails: (1) a central core having all the properties of native metallic copper; (2) an inner, nearly colourless zone, translucent where pure, consisting chiefly of CuCl and corresponding with the rare mineral nantokite; the minor components of this layer are distributed in well-defined layers as follows: (*a*) nearest the centre a black opaque layer appearing to be a form of cerargyrite (AgCl); (*b*) a zone of nantokite which is nearly colourless and free from minor constituents; (*c*) a second blank opaque layer of cerargyrite apparently identical with (*a*) but much thinner;

(*d*) a reddish-brown translucent layer having the characteristics of an iron compound consisting probably of a hydrated ferric oxide of the limonite ($2Fe_2O_3.3H_2O$) type; (*e*) a colourless translucent layer apparently of pure nantokite which serves as a matrix and chief component of the whole zone; (3) a deep red opaque zone of cuprite (Cu_2O); (4) a thick outer zone of green oxychloride of copper corresponding to the atacamite, ($CuCl_2{\cdot}3Cu(OH)_2$). From the study of the corrosion products surrounding the copper core, it is evident that reactions have taken place which are similar to those observed under artificial conditions by Bengough *et al.* (this *J.*, 1920, **23**, 65–135), Lean and Whatmough (*J. Chem. Soc.*, 1898, **73**, 150) and Mellor ("Inorganic and Theoretical Chemistry," **1923**, (III), 157–168). This is apparently the first time that the actual presence of CuCl as an intermediate product of corrosion has been reported. The probable causes of the presence of the minor components of zone (2) are discussed. From the experience gained in the electrolytic treatment of the copper nails and also of bronze objects, it is concluded that the method will not bring back original outlines where mineralization has resulted in the almost complete transformation of the objects to the basic copper chloride; this product lacks uniformity and compactness, and is usually penetrated with earthy material. When the chief mineral product is cuprite, electrolysis is successful so far as the recovery of form is concerned, but if the object has been completely transformed to cuprite, even after electrolytic treatment it will be extremely brittle. Only when it has a metallic core surrounded by a layer of cuprite may one hope to restore the object so that it will have both form and rigidity. A study of radiographs of several copper nails and a subsequent sectioning and electrolytic treatment showed that diagnosis of the internal structure of badly mineralized copper and bronze objects (especially small ones) is much aided by the use of X-rays.—S. G.

Solubility of Lead in the Municipal Water of Leipzig. —— Stich (*Pharm. Zeit.*, 1930, **75**, 1262–1263; *Building Sci. Abs.*, 1931, [N.S.], **4**, 57).—The results of tests of the solubility of lead shavings and pipes in distilled and municipal drinking water emphasize the need for constant control of municipal water supplies in contact with lead conduits.—S. G.

Some Observations on the Corrosion of Lead. A. H. Loveless, T. A. S. Davie, and W. Wright (*J. Royal Tech. Coll.* (*Glasgow*), 1933, **3**, (1), 57–64).—Investigations on the corrosion of lead by sulphuric acid of concentrations 30 to 96·5% at 50° C. show that the resistance offered by lead to attack is due largely to the protective coating of lead sulphate formed by the initial attack, and that the sulphate film formed is less coherent with increasing concentrations of acid. The effect of temperature (0°–200° C.) on the rate of attack depends on the concentration of the acid. Below 93% the increase in the rate of attack is more marked at higher temperatures, whilst above this concentration the increase is greater at the lower temperature ranges. The application of stress (0–200 $lb./in.^2$) increases the rate of corrosion and is noticeable with quite low stresses, whilst there is a rapid increase in the rate of attack when the stress exceeds 100 $lb./in.^2$. The effect of the applied stress on the lead sulphate film is to produce numerous cracks and allow the acid to penetrate to the metal below. Corrosion by hydrochloric acid at concentrations from 0 to 40%, and at two temperatures 15° and 100° C. show that the rate of attack is connected with the solubility of lead chloride in the hydrochloric acids solutions.—J. W. D.

Atmospheric Corrosion of Non-Ferrous Metals and Alloys. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 490).—A brief report of atmospheric corrosion tests on 24 non-ferrous metals and alloys carried out under the auspices of the Sub-Committee on Atmospheric Corrosion of Committee B-3 on Non-Ferrous Metals and Alloys of the American Society for Testing Materials. See this *J.*, 1932, **50**, 548.—J. H. W.

Some Comparative Corrosion-Fatigue Tests Employing Two Types of Stressing Action. H. J. Gough and D. G. Sopwith (*Iron Steel Inst. Advance Copy*, **1933**, (May), 1–31).—Corrosion-fatigue tests employing 2 types of stressing have been made on a cold-drawn 0·5% carbon steel, 3 "non-corroding" steels, Duralumin and a magnesium alloy containing 2·5% aluminium. The 2 types of stressing were reversed direct stresses and reversed flexural stresses at a frequency of about 2,200 cycles/min. The corroding medium was a fine air-borne spray of a 3% salt solution. S/N curves were plotted on a 25-million basis. It was found that in no case did the curves in the spray tests show a tendency to become parallel to the N-axis, *i.e.* no "corrosion-fatigue limit" was observed. After a certain endurance, the curves became simple exponentials. The curves obtained were of 3 types: (1) uniform slope, 0·5% carbon steel, and 18 : 8 chromium–nickel steel (direct stress); (2) decreasing curvature merging into a uniform slope, 15% chromium and 17 : 1 chromium–nickel steels and Duralumin, and 18 : 8 chromium–nickel steel (bending stress); (3) increasing curvature merging into uniform slope, magnesium alloy.
—J. H. W.

Corrosion and Residual Current. F. Tödt (*Z. Elektrochem.*, 1933, **39**, 146–147).—Experimental results on corrosion and residual current provide conclusive evidence that the mechanism of oxygen depolarization corrosion can be reproduced and measured galvanometrically. The determination of the current strength gives a measure of the oxygen produced and diffused on the noble metal surfaces.—J. H. W.

Fixed Surface Film Reactions. Leif Tronstad (*Light Metals Research*, 1933, **2**, (23), 11–16).—Translated from *Z. Metallkunde*, 1932, **24**, 185–188. See this *J.*, 1932, **50**, 741.—J. C. C.

Other's Views on "Modern Metals." G. C. McCormick (*Chem. and Met. Eng.*, 1932, **39**, 679).—Letter to the Editor directing attention to the danger of an unguided use of the data sheets previously published, *ibid.*, 1932, **39**, 504, 567.—F. J.

V.—PROTECTION

(Other than Electrodeposition.)

(Continued from pp. 245–249.)

Formation of Aluminium Oxide Film and Its Colouring. Seiji Kaneko and Chûjiro Nemoto (*Kōgyō Kwagaku Zasshi* (*J. Soc. Chem. Ind., Japan*), 1933, **36**, (3)).—[In Japanese, with English abstract in supplemental binding, pp. 116–117B.] The following solutions are suitable for the formation of an oxide film on the aluminium anode by electrolysis: (*a*) $0{\cdot}8N\text{-}H_3PO_4$; (*b*) $0{\cdot}8N\text{-}H_2CrO_4$; (*c*) $1{\cdot}0N\text{-}C_2H_2O_4$; (*d*) $1{\cdot}0N\text{-}H_3PO_4 + 0{\cdot}2N\text{-}NaOH$; (*e*) $1{\cdot}0N\text{-}H_3BO_3 + 0{\cdot}35N\text{-}NaOH$; (*f*) $1{\cdot}0N\text{-}H_2CrO_4 + 0{\cdot}2N\text{-}NaOH$; (*g*) $1{\cdot}0N\text{-}C_2H_2O_4 + 0{\cdot}5N\text{-}NaOH$. An oxide film can be formed by electrolyzing one of the above solutions at 100 v. During electrolysis the temperature of the solution is kept at 25° C. Of these solutions, (*d*) is the most suitable for dyeing. Aluminium oxide can be dyed with direct, acid, mordant, and acid mordant colours; basic colours are not suitable. Some of the colours suitable for this purpose are: red—alizarine sicc; orange—alizarine orange SW pdr; yellow—azoflavine FFN; green—union green B; blue—water blue; violet—alkali violet ROO; black—alizarine black for silk pdr.—S. G.

X-Ray Investigations of Electrolytically-Oxidized Aluminium. E. Schmid and G. Wassermann (*Mitt. Material., Sonderheft* **21**, 1933, 83–87; and (abbreviated) *Automobiltech.-Z.*, 1932, **35**, 396–397).—Reprint from *Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1932, **4**, 79–94. See *J.*, this volume, p. 84.—J. W.

Coating and Colouring Aluminium by Alumilite Process. H. Bengston and R. E. Pettit (*Chem. and Met. Eng.*, 1933, **40**, 135).—Abstract of article in *Machinist* (*Eur. Edn.*), 1933, **77**, 76–79; see *J.*, this volume, p. 245.—F. J.

The Characteristics of Sprayed Metal Coatings.—II. H. Reininger (*Z. Metallkunde*, 1933, **25**, 71–73).—Cf. *J.*, this volume, p. 247. The structure of a sprayed metal coating is similar to that of a sand coating, *i.e.* it consists of a pile of irregularly shaped particles held together solely by mutual clamping and surface pressures and interspersed with pores and oxide inclusions. A closer packing of the particles can be effected by surface pressure by cold-rolling, by treatment with rotating steel wire brushes, by annealing in inert gases, or by the application of protective coatings.—M. H.

Metal Spraying—the Process and Devices and the Influence upon Welding of Some Recent Developments. H. B. Rice (*J. Amer. Welding Soc.*, 1932, **11**, (9), 26–30).—The principles of the process and the apparatus used are described in detail. The applications are divided into two general fields—thin impervious coatings over large areas for resisting corrosion, and heavy coatings over small areas for replacement of worn sections, or for resisting abrasion. Examples from both fields are illustrated and described. In the former, zinc, aluminium, lead, and tin are the most commonly used metals; in the latter, hard or high melting-point metals are employed. The limitations of the process are discussed, and it is compared with welding for the applications where both processes are possible.—H. W. G. H.

Combating Corrosion of Piping. C. E. Joos and V. A. Rohlin (*Heating, Piping, and Air Conditioning*, 1932, **4**, 606–607, 671–674; *C. Abs.*, 1933, **27**, 259).—The significance of the p_H reading as an index of the corrosive tendencies of a water is outlined. Deaeration raises the p_H value through the removal of carbon dioxide, but this method is ineffective if the low p_H is due to the presence of a mineral acid. Different types of deaerator are described. The return condensate from vacuum heating systems contains no hardness. It is normally high in oxygen and low in p_H because of carbon dioxide, this giving the water intensively corrosive qualities. The presence of oxygen is due to interleakage or to the return of the condensate to a surge tank. The low p_H is commonly due to the carbon dioxide generated by the break up of the carbonates in the boiler, when a portion of the gas redissolves.—S. G.

The Fight Against Rust. E. Maass and A. Seifert (*Automobiltech. Z.*, 1932, **35**, 287).—Report of addresses given before the (German) National Committee for Metal Protection, Berlin.—P. M. C. R.

VI.—ELECTRODEPOSITION

(Continued from pp. 249–256.)

Modern Chromium Plating Plant. —— Birett (*Oberflächentechnik*, 1933, **10**, 25–27).—Cf. *J.*, this volume, pp. 136, 251. Recent improvements introduced into chromium plating works in Germany include the use of iron tanks set in a hot-water bath to keep the temperature at 45°–50° C. The sides of the tanks are protected from stray currents by thick sheets of glass held loosely against them. Some new types of suspending hooks are also illustrated and a brief account of modern chromium-plating practice is given.—A. R. P.

A Chromium Plating Bath with the Fluoride Ion. Alfred Perlenfein (*Rensselaer Polytechnic Inst. Eng. Sci. Series, Bull.* No. 39, 1933, 1–36, and (short abstract) *Iron Age*, 1933, **131**, 539).—By substituting sodium fluoride for sulphuric acid in the ordinary chromium plating bath brighter plates can be obtained with a wider range of current density and temperature; at high current densities the efficiency is much improved, and hence plating is more rapid and the plate more impervious so that a nickel undercoat on iron is generally unnecessary. Optimum results are obtained with

10 grm. of sodium fluoride with 125–300 grm./litre of chromic acid; with 8 grm./litre of fluoride fairly good results are obtained, but with 15 grm./litre no plate is obtained at low current density and very poor plates at high current density. The throwing power of the bath increases with the current density and is best with 10 grm./litre of fluoride. At 46° C. the current efficiency increases from 15% at 15 amp./dm.^{2} to 27% at 65 amp./dm.^{2} and higher, whilst at 28° C. an efficiency of 26% is obtained at 25 amp./dm.^{2}. The current density range at which bright plates can be obtained extends from 3 to 7 amp./dm.^{2} at 20° C. to 5–18 amp./dm.^{2} at 35° C. and from 15 to more than 75 amp./dm.^{2} at 45° C.—A. R. P.

Grey Chromium Plating. Richard Justh (*Oberflächentechnik*, 1933, **10**, 27–28).—To produce a matt-grey finish the chromium bath is made up by dissolving in 1 litre of water 500–600 grm. of chromium trioxide which has previously been heated at 170°–200° C. to obtain a small proportion of lower oxides (about 20 grm.). The bath is operated at 15°–18° C. with a current density of 20 amp./dm.^{2} which produces a deposit 0·02 mm. thick in 1 hour. At 0° C. with 80 amp./dm.^{2} the bath gives good hard grey deposits with a current efficiency of 50–60%. The metal is deposited in minute cubic crystals and is extremely hard, but can be polished with chromic oxide paste.—A. R. P.

Chromium Plating Screw Gauges. Anon. (*Machinery* (*Lond.*), 1933, **41**, 573–574).—It is shown that the usual practice for making allowance for the thickness of the deposit on plated gauges which consists in finishing them with all their diameters reduced by twice the deposit thickness is incorrect. If a uniform deposit is applied to a standard Whitworth gauge made in this manner, the thread form will be distorted, and over half the deposit on the flanks must be ground away. The need for a modified thread form is suggested. —J. C. C.

Electro-Chromium and Tool Work. E. E. Halls (*Machinist* (*Eur. Edn.*), 1933, **77**, 189–190E).—The plating scheme recommended for tool work is: (1) degrease in trichlorethylene; (2) acid clean; (3) polish; (4) degrease in electrolytic alkali bath; (4) rinse in 10% sulphuric acid; (6) nickel plate in hot agitated filtered solution; (7) buff; (8) degrease as in (4); (9) rinse in sulphuric acid as in (5); (10) chromium plate in a solution of 40 aq. chromic acid and 4 oz. sulphuric acid per gall. at 40°–50° C. and 70–80 amp./ft.^{2} at 3½–4 v.; (11) lightly buff.—J. H. W.

Surface Hardening by Chromium Plating. K. Altmannsberger (*Oberflächentechnik*, 1933, **10**, 41–42).—The use of chromium in plating tools and precision instruments is discussed.—A. R. P.

The Economic Importance of Chromium Plate. Richard Justh (*Oberflächentechnik*, 1933, **10**, 42–43).—The use and value of chromium plate are described.—A. R. P.

Free Cyanide in Copper Electroplating. L. C. Pan (*Metal Cleaning and Finishing*, 1932, **4**, 585–588, 651–654, 658; *C. Abs.*, 1932, **27**, 1277).—The resistivity of a cyanide copper solution decreases rapidly with increasing amounts of free NaCN or Na_2CO_3, NaCN being the better conductor. The anode polarization is practically inversely proportional to the content of free NaCN, but only in the absence of Na_2CO_3. When the solution contains sufficient Na_2CO_3 (40 grm./litre), the latter acts as anode depolarizer, and any variation in the free NaCN content does not further affect the anode polarization appreciably. The cathode polarization is practically unaffected by any change in the free NaCN content either in the presence or absence of Na_2CO_3. In the absence of Na_2CO_3 the bath voltage decreases rapidly with increasing amounts of free NaCN, this relationship being hyperbolic. In the presence of Na_2CO_3 the effect of free NaCN on the bath voltage is negligible. Either in the presence or absence of Na_2CO_3 there is a sharp maximum throwing power at a molar ratio of approximately 0·27 between free NaCN and copper. In the presence of Na_2CO_3, however, the maximum throwing power is 65% higher than in the absence of Na_2CO_3. The anode efficiency is almost directly proportional to the free NaCN content and approaches 100% at a molar ratio of 2·5 between free NaCN and copper. The efficiency is generally higher in the absence of Na_2CO_3. By increasing the molar ratio of free NaCN to copper from 0 to 0·7, the cathode efficiency is decreased to one half. It is reduced to 0 when the molar ratio reaches 2·3. In the presence of Na_2CO_3 the anode film is blue and soluble, causing little polarization. When Na_2CO_3 is absent and the free NaCN low, the anode film is brown. No anode film is visible when the free NaCN amounts to 14 grm./litre or more. The character of the deposit is improved by increasing the content of free NaCN. The presence of Na_2CO_3 makes the deposit generally brighter than that obtained when Na_2CO_3 is absent.—S. G.

Gold as a Corrosion Protection. René Leonhardt and P. Steen (*Oberflächentechnik*, 1933, **10**, 83–85).—Very thin gold plate can be applied to nickel plated articles to protect them against corrosion and enhance their beauty. The plate is free from porosity after polishing, adheres well, and closes up any pores that may be present in the nickel. Suitable plating baths are described. —A. R. P.

Nickel Plating of Fabricated Zinc in a Barrel. Albert Hirsch (*Electrochem. Soc. Preprint*, 1933, May, 129–133).—Zinc-base die-castings are not improved by ball-burnishing and the burnished surface is unsatisfactory for plating, since copper or nickel deposits thereon readily peel when polished. Citrate nickel baths give poor results on burnished zinc, and baths containing magnesium sulphate produce black streaks. Satisfactory plates on zinc die-castings may be obtained by the following procedure: the articles as they come from the press are tumbled in a barrel containing maplewood sawdust and pumice to remove the grease; treatment for 5 hrs. at 30 r.p.m. is required, after which the articles are cleaned in a solution containing sodium carbonate 4, trisodium-phosphate 4, and sodium hydroxide 2 oz./gall. After rinsing, the articles are plated in a bath containing cuprous cyanide 3 and sodium cyanide 4·5 oz./gall. using 12 v. at 60°–77° C. for 30 minutes. The copper deposit (0·2 oz./ft.^{2}) is ball-burnished in a barrel for 20 minutes, again cleaned in the alkali cleaner, rinsed, and barrel-plated in a solution containing nickel sulphate crystals 14–28, nickel chloride crystals 3–6, boric acid 2, sodium metaborate 0·1 and ammonia 4·5–9 oz./gall.; 6–12 v. are used at 32°–60° C. for 1 hr.—A. R. P.

The Improvement of Sheet Zinc by Electroplating. T. Hausen (*Oberflächentechnik*, 1933, **10**, 55–56).—Methods of plating zinc sheet articles with nickel and other metals are described. Deeply recessed articles must first be cleaned in xylene. In all cases an electrolytic clean is recommended, after which the article is dipped in 1% hydrofluoric acid or in 5–10% hydrochloric acid for a few seconds to remove surface films. A preliminary nickel coating is essential; this should be produced in a bath containing only 70 grm./litre of nickel sulphate, together with sodium citrate or 100–200 grm./litre of sodium sulphate to prevent dissolution of the zinc during plating. A nickel deposit of 0·0075 mm. thickness is sufficient to protect the zinc in further plating operations and to prevent diffusion of any finishing coat into the metal. Chromium or copper are the usual finishing coatings applied.—A. R. P.

The Question of the Electrodeposition of Alloys. I. Nickel–Cobalt Alloys. S. A. Pletenew and W. W. Kuznetzova (*Z. Elektrochem.*, 1933, **39**, 201–204).—The influence of the current density, p_H of the solution, temperature, and rate of stirring on the deposition of cobalt–nickel alloys from sulphate solutions has been investigated, and the results of Fink and Lah were not generally confirmed. The amount of cobalt obtained by the deposition of a 40% cobalt alloy from a sulphate solution in which the ratio of nickel to cobalt was 15 was determined.—J. H. W.

On the Electrochemical Behaviour of Palladium. The Electrodeposition of Palladium and Palladium–Silver Alloys from Complex Salt Solutions. G. Grube and D. Beischer (*Z. Elektrochem.*, 1933, **39**, 131–133).—Joint electrodeposition of palladium and silver from potassium cyanide and potassium thiocyanate baths has been effected. Deposition of metal from a potassium palladium cyanide solution takes place with a current efficiency of less than 1%. With a mercury cathode, reduction products of the palladium salts, having similar properties, were formed. A silver deposit, with a colour and crystal size similar to those of a deposit from a potassium cyanide–silver bath, can be obtained from a potassium thiocyanate–silver bath at ordinary temperature. With low current densities, the deposits from the palladium, potassium thiocyanate baths are darker in colour and contain a larger amount of organic material.—J. H. W.

A Study of Cyanide Zinc Plating Baths Using the Aluminium–Mercury–Zinc Anode. A. Kenneth Graham (*Electrochem. Soc. Preprint*, **1933**, May, 135–146).—The behaviour of zinc anodes containing 0·5% aluminium, and 0·3% mercury in N-zinc cyanide baths at 20 amp./ft.^{2} and 120° F. (49° C.) has been investigated with various quantities of sodium cyanide and sodium hydroxide. Anode and cathode efficiencies are 100%, the anode polarization and bath voltage are low for values of R above 2 (R = normality of sodium cyanide + normality of sodium hydroxide divided by the normality of zinc cyanide), and 22-hr. cathodes are very smooth and of good texture and colour when the sodium hydroxide is 4·5–10 oz./gall. and the sodium cyanide 5–8·5 oz./gall. The best bath is that containing 7 oz./gall. each of sodium cyanide and sodium hydroxide; addition of sodium carbonate up to 4 oz./gall. produces no effect, but reduction of the zinc cyanide to 0·75N lowers the efficiency at both electrodes and gives less favourable values of anode polarization and bath voltage. A pure zinc anode gives too high an anode efficiency and a large amount of sludge.—A. R. P.

The Adsorption of Colloids by Metallic Surfaces and Its Influence on the Adherence of Electrolytic Deposits. P. Jacquet (*Compt. rend.*, 1933, **196**, 921–923; and (abstract) *Génie civil*, 1933, **102**, 334).—To test if the poor adherence of electrodeposits of metals from solutions containing colloids is due to the existence of a skin of colloid on the base metal, a copper sheet, carefully polished, degreased, tempered for 30 sec. in a given colloidal solution and washed, was placed in a solution containing 125 grm. copper sulphate and 50 grm. sulphuric acid per litre and electrolysed for 1 hr. at 2 amp./dm.^{2}. The resulting deposit was examined for adherence by various methods. The colloids arranged themselves in 2 groups: (*a*) those that affect the adherence, such as proteins, (*b*) those that do not, the hydroxyl colloids such as gums and dextrin. In the first group, the adherence varies with the concentration of the colloid solution; the time of tempering is practically immaterial, and the colloid film adheres strongly to the sheet and is not easily removed.—J. H. W.

The Requirements for Good Electroplating and the Characteristics of the Most Important Plates. Hugo Krause (*Oberflächentechnik*, 1933, **10**, 15–20).—The various faults which may occur in plating and methods for avoiding them are discussed, together with the structure and characteristics of nickel, iron, zinc, cadmium, tin, lead, copper, brass, silver, and gold deposited from several types of bath.—A. R. P.

Resistance in Electrotype Metals. Samuel Epstein (*Platers' Guide*, 1933, **29**, (3), 9–11).—A summary of the results of an examination of samples of copper and nickel electrotypes recorded in an address to the Ohio State Electroplaters' Association (U.S.A.).—J. H. W.

P_3 in Plating Technique. Richard Justh (*Oberflächentechnik*, 1933, **10**, 57; and *Metallwaren-Ind. u. Galvanotech.*, 1933, **31**, 127–128).—The use of trisodium phosphate solutions as alkaline cleaning baths in plating shops is discussed.—A. R. P.

Practical Plating. Preparation of Work. I.—Polishing. II.—Cleaning. E. A. Ollard (*Met. Ind.* (*Lond.*), 1933, 42, 403–405, 451–454).—(I.—) Polishing is distinguished by an abrasive and by a burnishing action, and an appreciation of the mechanism of these two effects will assist in the selection of suitable polishing materials and technique. Cleaning is largely concerned with the removal of grease by: (*a*) washing in an organic solvent; (*b*) treatment by organic vapours; (*c*) boiling in an alkaline solution; (*d*) electrolytic cleaning; (*e*) scouring; (*f*) scratch-brushing and (*g*) various other processes. These are all discussed in some detail. (II.—) Describes in detail cleaning with trichlorethylene, electrolysis, scouring, and scratch-brushing, and summarizes the various methods that have been described.—J. H. W.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-Refining.)

(Continued from pp. 256–257.)

Electrolysis of Silver-Bearing Thiosulphate Solutions. K. Hickman, W. Weyerts, and O. E. Goehler (*Indust. and Eng. Chem.*, 1933, 25, 202–212).—Much of the silver accumulating in motion picture fixing baths used to be reclaimed as silver sulphide. It is now recovered as metallic silver by electrolysis, the bath which used to be thrown to waste being replenished and re-circulated. The electrolytic regeneration involves the use of large cells containing 100 ft.^{2} of cathode surface through which a current of 300 amp. is passed at 1–1·5 v. At the anode, thiosulphate is oxidized to tetrathionate and trithionate sulphate; at the cathode, silver is deposited with small quantities of silver sulphide and gelatine; some of the tetrathionate is reduced to thiosulphate. Vigorous agitation, together with the presence of acid, sulphite, and certain promoting agents, is essential. The yield per million ft. of film is about 1200 oz. The consumption of fixing baths is reduced to 35% of the quantity previously used.—F. J.

VIII.—REFINING

(Including Electro-Refining.)

(Continued from p. 257.)

Description of Continuous Lead Refining at the Works of the Broken Hill Associated Smelters Proprietary Ltd., Port Pirie, South Australia. G. K. Williams (*Proc. Austral. Inst. Min. Met.*, 1932, (87), 75–133, and (abstract) *Chem. Met. & Min. Rev.*, 1932, 25, 8–12).—A theoretical and mathematical discussion with curves of the mechanism of the Parkes process of desilverizing lead is followed by descriptions of the old batch process of working and of the modifications introduced to convert this process into a continuous operation with, as far as possible, gravity flow of the lead through the various stages. The latter method effects considerable economy in fuel and labour cost and allows much higher rate of treatment; it gives a smaller quantity of by-products from which antimony and silver can be recovered, and yields a much purer lead. The procedure is as follows: the blast-furnace lead (A) from the storage kettle is pumped continuously into one end of a softening furnace where it is heated to 750° C. by two oil-burners, whilst a current of furnace gases with 6–8% of oxygen is passed counter-current to the flow of metal to oxidize the antimony and arsenic and drive the dross towards an overflow notch at the bullion intake end of the furnace. The softened lead (B) which flows continuously from a notch at the other end of the furnace runs into a degolding kettle while the dross passes through a dross-ing furnace where its lead content is reduced by treatment with fine coal, the reduced lead being returned intermittently to the softener. In the degolding kettle 8 lb. of zinc per ton of lead are added and the temperature is maintained at 500° C. at the top and 330° C. at the bottom; the dross containing the gold is skimmed off, liquated, and the lead returned to the kettle. The degolded bullion (C) is siphoned from the bottom of the kettle to a storage kettle, from which it runs continuously to the desilverizing kettle, which is operated in a similar way to the degolding kettle, except that more zinc is added to form a layer of zinc above the lead through which the new lead is added until the upper layer is 3 ft. thick and contains 6000 oz./ton of silver, when it is removed and fresh zinc added. The desilverized lead (D) passes through a second softening furnace similar to the first, and is then ready for the market (E). The products from the various stages in the purification have the composition given in the following table :—

	A	B	C	D	E
Copper, % . .	0·068	0·070	0·0098	0·004	0·0004
Arsenic, % . .	0·182	0·0005	...	trace	nil
Antimony, % .	0·410	0·03	...	0·028	0·0017
Zinc, % . .	nil	nil	0·16	0·560	0·0002
Gold, grm./ton .	3·105	3·2	0·35	nil	nil
Silver, oz./ton .	47·2 oz.	48·1	45·7	0·03	0·03

The first softener dross contains arsenic 8·6, antimony 20, and lead 56·3% ; the final dross, zinc 11 and antimony 0·5% ; the gold dross, copper 10, zinc 32%, 350 oz./ton silver and 15 oz./ton gold, and the silver dross, lead 15, copper 0·5, zinc 64, and silver 20%. The weights of these residues per ton of refined lead are approximately 37·5, 15, 18·2, and 120 lb., respectively.—A. R. P.

IX.—ANALYSIS

(Continued from pp. 257–260.)

The Case Against Standardization of Chemical Analysis. P. F. Thompson (*Chem. Eng. Mining Rev.*, 1932, 25, 31–32).—Abstract of a paper read before the Analytical Group of the Victorian Branch of the Australian Chemical Institute. It is claimed that it is not possible to standardize chemical analysis, since it is an art requiring skill and understanding and into which the personal element enters. The solution to the problem lies in the proper training of analytical chemists and in not reporting results so as to give a specious idea of their accuracy.—J. H. W.

The Case Against Standardization of Chemical Analysis. Clement Blazey. W. Rayner Hebblewhite. Edward S. Simpson. E. Holl. Miller. P. F. Thompson. G. R. Anderson. R. J. Craig (*Chem. Eng. Mining Rev.*, 1932–1933, 25, 64–65, 99–102, 137–138, 174–175). Correspondence : C. B. claimed that standardization is of assistance in routine work and for referee analyses. W. R. H. stated that standardization of routine work left greater freedom for original research and was necessary in judging of specifications. E. S. S. considered that standardization cramped initiative and tended to give concordant but not necessarily accurate results. E. H. M. thought standardization useful when routine work was carried out by other than qualified chemists. An anonymous contributor feared that standardizing a method of analysis might hinder improvements in the method being effected. G. R. R. thought that standardization was of assistance to the manufacturer. R. J. C. stated that there was a best procedure for every operation and standardization was the recording of that procedure. In his replies, P. F. T. restated his case and reviewed the evidence submitted against it.—J. H. W.

What Precautions Should be Observed in Sampling Alloys Containing Precious Metals. W. Stein (*Mitt. Forschungsinst. Edelmetalle*, 1932, **6**, 81–83).—Drillings should be made at intervals across the diagonals of the ingot; in thin ingots the drill should go right through, but in thick ingots both sides should be drilled to the centre of the ingot and the drillings from each side assayed separately to test for segregation. High-speed tool steel drills are best, as contamination of the sample with iron is avoided; in no case should lubricants be used.—A. R. P.

Determination of Various Metals in the Chromium Plating Bath. Darwin Harris (*Chemist-Analyst*, 1932, **21**, (5), 7).—For the determination of Cu, Fe, Ni, and Zn in the Cr plating bath the CrO_3 is removed with $Pb(NO_3)_2$ and the Fe, Ni, and Cu are precipitated by addition of Na_2O_2. The precipitate is dissolved in acid, and the Cu, Fe, and Ni are separated and determined in the usual way. Zn is determined as phosphate in the combined filtrates from the Ni glyoxime and the Na_2O_2 separation.—A. R. P.

A Systematic Analysis of "Widia" Metal. S. Zinberg (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1931**, (2–3), 119–121).—[In Russian.] The alloy is roasted in a Pt crucible to convert the W into WO_3, and the powder thus obtained is fused with 3 times its weight of $NaKCO_3$. The fusion is extracted with hot H_2O and the filtered solution treated with $HgNO_3$. The precipitate of Hg_2WO_4 is collected and ignited to WO_3 for weighing. The Co in the residue from the leaching is converted into a complex cobaltammine, the solution of which is electrolyzed for Co. Fe is determined iodometrically or gravimetrically as Fe_2O_3. C is determined in a separate sample by the usual combustion method.—D. N. S.

Tantalum and Columbium [Niobium] Cathodes versus Platinum Cathodes for Electro-Analysis. D. F. Calhane and C. Malcolm Alber (*Electrochem. Soc. Preprint*, **1933**, May, 61–67).—Ta and Nb cathodes give equally good results as Pt cathodes in the electrolytic determination of Cu from acid $CuSO_4$, Zn from Na_2ZnO_2, and Ni from ammoniacal $NiSO_4$ solutions. Good deposits of Ag can also be obtained on Ta and Nb cathodes from the usual electrolytes. In depositing Zn on Pt cathodes these must first be plated with Cu or Ag, but this is unnecessary when using Ta or Nb cathodes. Erratic results are obtained with Ta cathodes during repeated use, unless the surface is mechanically cleaned after every few depositions; Nb cathodes do not seem to suffer from this disadvantage.—A. R. P.

New Methods of Analysis of Materials Used in Aviation. J. Vásquez-Garriga (*Rev. Aeronautica*, 1932, **1**, 79–82; *C. Abs.*, 1933, **27**, 2119).—A brief description of quantitative X-ray spectroscopy as applied to metals and alloys.—S. G.

Electron Tube as Spark Producer in the Spectrum Analysis of Minute Quantities of Metals. —— Goroncy and —— Urban (*Z. anorg. Chem.*, 1933, **211**, 28–32).—The spark produced by the device described has the advantage of a very great constancy and protective action on the material with maximum efficiency. The spark is suitable for the spectrographic analysis of metals. Pb and Hg can be detected in amounts as small as 10^{-8} grm. in a drop.—M. H.

Chloramine as a Reagent in Volumetric Analysis. O. Tomíček and B. Sucharda (*Coll. Trav. chim. Tchécoslov*, 1932, **4**, 285–299).—$Sn^{\cdot\cdot}$ and $Sb^{\cdot\cdot\cdot}$ may be accurately determined by potentiometric titration in *N*-HCl at 55°–60° C. with a 0·1*N*-solution of chloramine (Na *p*-toluenesulphonechloramide). CO_2 should be passed into the flask during titration. Good results are also obtained by using methyl red as indicator. Standardization is best effected with As_2O_3. The titre of the solution remains unchanged for 3 months when stored in a dark-coloured glass bottle.—A. R. P.

The Use of Potassium Hydroxide as a Fusion Reagent. P. F. Thompson (*Soc. Chem. Ind. Victoria Proc.*, 1932, **32**, 699–702).—The use of KOH is advocated for a variety of fusions of ores, &c. Fusion is carried out in a nickel crucible. Oxidation may be hastened by addition of a very small amount of sodium peroxide.—R. G.

On the Solubility of Nickel Dimethylglyoxime. P. Nuker (*Z. anal. Chem.*, 1932, **91**, 29–32).—The Ni dimethylglyoxime precipitate is more soluble in hot H_2O than in cold, C_2H_5OH increases the solubility, and $CH_3{\cdot}COOH$ or $CH_3{\cdot}COONa$ reduce it. For correct results, therefore, the solution should always be cooled before filtration and the minimum of C_2H_5OH used.—A. R. P.

Three Indicators. P. F. Thompson (*Soc. Chem. Ind. Victoria Proc.*, 1931, **31**, 536–544).—The use is described of dimethylglyoxime in the dichromate–iron titration, of a modified indicator for Zn titration and of a molybdo-ferrocyanide p_H indicator.—R. G.

The Use of Metallic Electrodes as Indicators. Sidney J. French and John M. Hamilton (*Proc. Indiana Acad. Sci.*, 1930, **40**, 171–174).—The features of the known metallic electrode indicators are reviewed. Al used with Rose's alloy was found to have advantages for acid solutions, giving a large change in e.m.f. at the end-point.—R. G.

The Reduction of Ferric Salts by Mercury (Borar's Method). F. H. Campbell and R. H. Hook (*Soc. Chem. Ind. Victoria Proc.*, 1931, **31**, 544–547).—The method was simplified by omitting the filtration of the excess Hg and drawing off a portion of the reduced solution through a cotton-wool filter fixed to the end of a pipette, for titration. A quantity of Hg sufficient to render the method rapid can be used and the determination is accurate. Re-oxidation is desirably slow.—R. G.

Dimethylglyoxime as a Test Reagent for Metals. Irwin Stone (*Chemist-Analyst*, 1932, **21**, (6), 8).—The reactions of Ni, Co, Bi, Fe'', Pd, Pt'', and Au with dimethylglyoxime are described.—A. R. P.

Spectrographic Investigations. XII.—On the Detection of Antimony, Arsenic, and Tellurium. Else Riedl (*Z. anorg. Chem.*, 1932, **209**, 356–363).—"Kahlbaum" As was found to contain traces of Ag, Cu, Fe, Pb, Sb, Sn, but to be free from Al, Bi, Cd, Hg, Mn, Si, Zn. Methods are described for the spectrographic detection of As, Sb, and Te. $2{\cdot}10^{-8}$ grm. As in Pb–As and Zn–As alloys and 10^{-7} grm. Te in Pb–Te and Bi–Te alloys can be detected with certainty. In solutions free from heavy metals the limit of detection lies at 0·01% As and 0·002% Te if 2 c.c. are evaporated in the arc. To increase the sensitivity an electrolytic method of deposition has been developed by which it is possible to detect $0{\cdot}5 \times 10^{-6}$ grm. As, $0{\cdot}05 \times 10^{-6}$ grm. Te, and $0{\cdot}05 \times 10^{-6}$ grm. Sb in 1 c.c. of solution.—M. H.

A Sensitive Test for Bismuth. Lewis Bernstein (*Chemist-Analyst*, 1932, **21**, (5), 15).—The test depends on the colour of the PbI_2 precipitated from a CH_3COOH solution of Bi to which $(CH_3CO_2)_2Pb$ has been added. Traces of Bi colour the PbI_2 orange to crimson.—A. R. P.

A Composite Reagent for Calcium. Gerald J. Cox and Mary L. Dodds (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1932, **4**, 361).—The reagent is made by dissolving 200 grm. of $H_2C_2O_4{,}2H_2O$ and 500 grm. of NH_4Cl in 3500 c.c. of water, adding 1000 c.c. of glacial CH_3COOH and 10 c.c. of 0·04% methyl-red solution, and filtering. For a determination 50 c.c. of the reagent are added to the HCl solution of Ca, the mixture boiled, and treated with NH_4OH until alkaline to precipitate CaC_2O_4.—A. R. P.

A New Reagent for Magnesium. C. Franklin Miller (*Chemist-Analyst*, 1932, **21**, (5), 6–7).—The HCl solution is treated with a 0·05% solution in dilute NaOH of the brown dye made by coupling tetrazobenzidine with resorcinol; on addition of 10% NaOH to alkalinity a dark blue lake is formed if Mg is present. Ca gives a reddish precipitate in amounts exceeding the solubility of $Ca(OH)_2$ and Cd gives a light blue precipitate.—A. R. P.

Reactive Paper for Detecting Molybdenum; Application to the Detection and Rapid Determination of This Element in Steels. E. Bertrand (*Bull. Soc. Chim. Belg.*, 1932, **41**, 98–103).—A drop of the solution to be tested for Mo is placed on a piece of filter paper previously coated with a thin film of H_2WO_4, and one drop of an HCl solution of $SnCl_2$ is placed in the middle of the first drop. A grey-blue spot surrounded by a colourless halo appears when Mo is present; the intensity and rate of development of the colour are a function of the amount of Mo present.—A. R. P.

Characterization of the Chemical Nature of a Substance by its Catalytic Properties. The Case of Silver. Georges Denigès (*Bull. Soc. Pharm. Bordeaux*, 1932, **70**, 13–16; *Chem. Zentr.*, 1932, **103**, II, 747).—Traces of Ag may be detected by boiling the solution with $MnSO_4$ and $(NH_4)_2S_2O_8$ when $HMnO_4$ is formed if Ag is present in amounts exceeding 0·02 mg./litre. The method is suitable for the detection of traces of Ag on a metal surface.—A. R. P.

Some Reactions of Vanadium Carbide. S. E. Oldham and W. P. Fishel (*J. Amer. Chem. Soc.*, 1932, **54**, 3610–3612).—VC reacts with HCl at high temperatures to form CH_4, H_2, VCl_2, and VCl_3. It is insoluble in aqueous HCl, but is soluble in hot oxidizing acids, forming hydrated pentoxides.—R. G.

Studies of Various Methods for the Separation of the Common Elements into Groups. I.—The Precipitation by Ammonium Hydroxide. Ernest H. Swift and R. C. Barton (*J. Amer. Chem. Soc.*, 1932, **54**, 2219–2228).—The results are given of various modifications of the ammonia separation of Cr, Al, and Fe from Mn, Ni, Co, and Zn.—R. G.

On the Separation of Hafnium and Zirconium.—I. Wilhelm Prandtl (*Z. anorg. Chem.*, 1932, **208**, 420–426).—The separation is carried out by fractional precipitation with ferrocyanogen-ion which is based on the smaller solubility of hafnium ferrocyanide.—M. H.

Investigations into the Analytical Chemistry of Tantalum, Niobium and Their Mineral Associates. XXI.—A Reliable Method for the Quantitative Separation of Titanium from Tantalum and Niobium. W. R. Schoeller and C. Jahn (*Analyst*, 1932, **57**, 72–78).—The mixed oxides are fused with $K_2S_2O_7$, the melt is dissolved in hot water containing 2 grm. of $(NH_4)_2C_2O_4$; 5 grm. of sodium salicylate are added, and the boiling solution is treated with 20% $CaCl_2$ solution until no further precipitate forms. The precipitate is collected, washed with hot salicylate solution, and boiled with HCl and $KMnO_4$ to destroy oxalates; the Ta_2O_5 and Nb_2O_5 are then separated by boiling with tannin. The yellow Ti filtrate from the $CaCl_2$ treatment is boiled with $CH_3{\cdot}CO_2NH_4$, NH_4Cl, and tannin, and the red precipitate collected, washed with half-saturated NH_4Cl solution, ignited, and fused with $K_2S_2O_7$. The fusion is extracted with a 1% solution of tannin in 5% H_2SO_4 and the small quantity of earth acid precipitate collected, washed, and purified as usual. Ti is best determined by difference between the original weight and the weight of the Ta_2O_5 and Nb_2O_5.—A. R. P.

Investigations into the Analytical Chemistry of Tantalum, Niobium and Their Mineral Associates. XXII.—The Separation of the Earth Acids from Metals of the Hydrogen Sulphide Group. E. F. Waterhouse and W. R. Schoeller (*Analyst*, 1932, **57**, 284–289; discussion, 289–290).—Treatment with H_2S, of tartrate solutions containing the earth acids and Sb, Bi, and Cu yields a precipitate of Sb_2S_3, Bi_2S_3, and CuS which always contains small amounts of earth acids. The precipitate should be redissolved in H_2SO_4, HNO_3, and tartaric acid, the solution made ammoniacal and poured into $(NH_4)_2S$ solution to precipitate Bi_2S_3 and CuS, and the filtrate treated with CH_3COOH to recover Sb_2S_3. Directions are given for the recovery of the Ta and Nb from the filtrates.—A. R. P.

Investigations into the Analytical Chemistry of Tantalum, Niobium and Their Mineral Associates. XXIII.—The Quantitative Separation of Tantalum, Niobium, Titanium, and Zirconium and a New Analytical Grouping. W. R. Schoeller and A. R. Powell (*Analyst*, 1932, **57**, 550–559).—From a neutral oxalate solution half saturated with NH_4Cl, tannin precipitates Ta, Nb, and Ti, whereas Zr, Hf, Th, and Al remain in solution; the former group is referred to as the "acid tannin group" and the latter as the "basic tannin group."
—A. R. P.

Determination of Small Quantities of Antimony in Solder in the Presence of Iron. C. W. Anderson (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1933, **5**, 52).—Fe interferes in the usual bromate determination of Sb, but its effect may be overcome by adding 25–30 c.c. of H_3PO_4 (*d* 1·37) to the solution before reducing the $SbCl_5$ with Na_2SO_3. The $NaBrO_3$ solution should be standardized against pure Sb solution to which about as much Fe has been added as is present in the assay solution.—A. R. P.

Determination of Arsenic: Iodometric Acidimetric Method. R. C. Wiley, J. P. Bewley, and R. Irey (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1932, **4**, 396–397).—The solution (20 c.c.) of the sample containing the As as As_2O_3 is introduced into a distillation flask together with 10 grm. of 20-mesh Zn; 10 c.c. portions of 75% H_2SO_4 are then added at intervals of 10 minutes for 40 minutes, and the solution then boiled for 5 minutes. All the gases evolved, which contain the As as AsH_3, are passed through a Meyer bulb tube containing a measured amount of $0·1N$-I_2, whereby the AsH_3 is oxidized to As_2O_5. Excess of I_2 is then titrated with $0·1N$-$Na_2S_2O_3$; 1 c.c. of $0·1N$-I_2 consumed = 0·001237 grm. As_2O_3. As a check, the titrated solution may be titrated with $0·1N$-NaOH using phenolphthalein as indicator (1 c.c. $0·1N$-NaOH = 0·0009896 grm. As_2O_3). The reactions are $AsH_3 + 4I_2 + 4H_2O = H_3AsO_4 + 8HI$ and $H_3AsO_4 + 8HI + 10NaOH = Na_2HAsO_4 + 8NaI + 10H_2O$.—A. R. P.

Beryllium. IV.—Micro Qualitative Analysis of Beryllium. Harold Simmons Booth and Spencer Guildfrary (*J. Physical Chem.*, 1932, **36**, 2641–2649).—The micro-detection of Be either by the use of potassium malonate or by the production of beryllium basic acetate recrystallized from glacial acetic acid is considered to be superior to the ordinary macro-analysis methods, *viz.*, the potassium oxalate and chloroplatinic acid methods, both in simplicity and in accuracy. A bibliography of literature of the subject is appended.
—J. S. G. T.

Determination of Boron Spectroscopically. J. S. McHargue and R. K. Calfee (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1932, **4**, 385–386).—The B is separated as $(CH_3)_3BO_3$ by distilling the solution with CH_3OH and determined by burning the distillate in O_2 and observing the spectrum through a cell containing water to which $0·01N$-$KMnO_4$ is added until the green B lines are completely absorbed. The c.c. of $KMnO_4$ added are a measure of the B; the method is accurate to 0·01 mg. B.—A. R. P.

Determination of Cæsium in the Presence of Rubidium and Other Alkali Metals. N. A. Tananaev and E. P. Harmash (*Z. anal. Chem.*, 1932, **89**, 256–262).—The hot concentrated solution is treated with a hot solution containing a large excess of BiI_3 dissolved in HI, whereby, on cooling, $Cs_3Bi_2I_9$ separates. The precipitate is collected, washed with ice-water, dried at 140°–150° C. for 1½–2 hrs., and weighed. The results are about 1% low.—A. R. P.

Volumetric Determination of Calcium and Magnesium in the Presence of One Another. Emöd von Migray (*Chem.-Zeit.*, 1932, **56**, 924).—When only small quantities of the elements are present in a solution free from other metals (except K and Na) the solution is boiled with N-$(NH_4)_2C_2O_4$ and NH_4OH in slight excess, acidified with CH_3COOH, treated with Na_2HPO_4, again made ammoniacal, and boiled for 5 minutes. After cooling, the precipitate is collected in a Gooch crucible, washed with cold H_2O, and rinsed into a porcelain basin. The suspension is heated at 80°–90° C. and titrated with 0·1*N*-HCl until methyl-red indicator just becomes rose-coloured; this gives the Mg. H_2SO_4 is then added and the liberated $H_2C_2O_4$ corresponding with the Ca titrated with $KMnO_4$.—A. R. P.

Volumetric Determination of Cerium with Arsenious Acid. Rudolf Lang and Josef Zwerina (*Z. anal. Chem.*, 1932, **91**, 5–12).—In von Knorre's $K_2S_2O_8$ method for Ce the $Ce(SO_4)_2$ can be reduced with standard As_2O_3 if 10 c.c. of 1 : 1 HCl, 1 drop of 0·005*M*-KIO_3 solution and 5 grm. of $MnSO_4,5H_2O$ are added. Ce''' can be oxidized to Ce'''' in NaOH solution by boiling with $Ni(OH)_2$ and $K_2S_2O_8$.—A. R. P.

Determination and Separation of Cobalt as Cobaltic Nitroso-β-naphthol. C. Mayr and F. Feigl (*Z. anal. Chem.*, 1932, **90**, 15–19).—The precipitate of Co nitroso-β-naphthol obtained under the usual conditions cannot be weighed, as it invariably contains cobaltic salts. A compound of definite composition can be obtained, however, by treating the Co solution with H_2O_2, NaOH (to alkalinity), CH_3COOH (until the $Co(OH)_3$ precipitate is dissolved), and 2% α-nitroso-β-naphthol in 50% CH_3COOH; the substance after drying at 130° C. has the formula $(C_{10}H_6ONO)_3Co,2H_2O$ and contains 9·645% Co. The results are accurate to ± 2% for 1–30 mg. of Co.—A. R. P.

Rapid Method of Estimating Copper in Brass, Aluminium Alloys, &c. M. V. Churakov (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1932**, (2), 84–85; and (French abstract) *Chim. et Ind.*, 1932, **28**, 1344).—[In Russian.] The sample (1 grm. for Al alloys, or 0·3 grm. for brass) is dissolved in 10 c.c. of warm HNO_3 (*d* 1·2), 50 c.c. of H_2SO_4 (1 : 4) are added, and the mixture heated for 15 minutes on a sand-bath. After addition of 15 c.c. of KCNS solution, the liquid is cooled, 10 c.c. of KI solution are added and the I_2 titrated with 0·1*N*-$Na_2S_2O_3$.—D. N. S.

Electrolytic Zinc: The Determination of Small Amounts of Germanium. Harald Lundin (*Electrochem. Soc. Preprint*, **1933**, May, 191–195).—Minute amounts of Ge cause serious trouble in the production of electrolytic Zn. The following procedure is recommended for the determination of Ge in material containing SiO_2 which adsorbs Ge: the sample is dissolved in H_2SO_4 and the solution evaporated twice with HF in a Pb dish until the H_2SO_4 reaches about 300° C., and no test for HF can be obtained with a glass rod. The mixture is then distilled with a large volume of HCl, Cl_2 being bubbled through the liquid during distillation. The condensate is collected in an ice-cooled receiver, treated with $NaHSO_3$ until the yellow colour disappears, then with Br until yellow, and with $NH_2OH{\cdot}HCl$ until colourless, adjusted to 4–6*N*-HCl, and saturated with H_2S. The GeS_2 is collected, washed with 4*N*-H_2SO_4, saturated with H_2S until free from HCl, and heated gently at first, then at 500°–600° C., until converted into GeO_2 for weighing. —A. R. P.

A Physical Method of Estimating Ferrous and Ferric Iron Formed by the Actions of Potassium Dichromate and Potassium Permanganate upon Ferrous Salt. Mata Prasad and P. Y. Deshpande (*J. Indian Chem. Soc.*, 1932, **9**, 133–136).—The amounts of ferrous and ferric iron were determined by the use of absorption spectra.—R. G.

On the Problem of Determining Lead in Mixed Solder and White Metal Residues. Wolfgang Boehm (*Metall u. Erz*, 1933, **30**, 47–48).—The material is dissolved in HBr and Br and the solution evaporated to dryness twice with HBr to volatilize $SnBr_4$ and $SbBr_3$. The residue is evaporated with H_2SO_4 and the Pb determined as $PbSO_4$ in the usual way.—A. R. P.

Volumetric Determination of Lead. A. Travers and —— Lu (*Compt. rend.*, 1933, **196**, 548–549).—The usual determination of Pb as sulphate gives incorrect results in the presence of Bi and Ba, owing to the hydrolysis of salts of the former and to the formation of mixed crystals with Pb of the latter. The following method, however, can be used: A neutral solution of the Pb salt is boiled with excess Javelle water and the Pb precipitated as PbO_2, 1% KCl added and the whole shaken with the required quantity of KI + KCl. PbI_2 is precipitated and the clear, supernatant liquid titrated. In the case of Bi-alloys, the Bi is separated with excess $NaHCO_2$, filtered, and the filtrate evaporated to dryness. H_2CO_2 is destroyed by concentrated H_2SO_4 and the Pb determined as above. To separate Ba and Pb the latter is precipitated in a weak acid solution with H_2S under pressure. The Pb is precipitated after standing for 2 hrs. on a water bath and the sulphide converted to sulphate in the ordinary way.—J. H. W.

The Solubility of Lead Chromate in Ammonium Acetate and Acetic Acid Solutions and the Determination of Small Amounts of Lead. E. A. Goode (*Soc. Chem. Ind. Victoria Proc.*, 1932, 32, 686–693).—Conditions are described for the rapid and accurate precipitation of Pb as chromate in amounts of the order of 1 mg.—R. G.

Volumetric Determination of Large Percentages of Manganese. Frank W. Scott (*Chemist-Analyst*, 1932, 21, (6), 6–7).—The alloy (*e.g.*, 0·5 grm. of ferromanganese) is dissolved in 25 c.c. of HNO_3, the brown fumes are expelled, and the Mn is precipitated by boiling with $KClO_3$ until Cl_2 ceases to be evolved. The mixture is boiled down to 15 c.c., treated with 0·5 grm. of $KClO_3$, boiled for 1 minute, cooled, and diluted to 200 c.c.; the MnO_2 is then dissolved by addition of a known volume of H_2O_2, the excess of which is determined by titration with $KMnO_4$.—A. R. P.

Determination of Molybdenum and Lead by Fajans's Method.—I. Z. Raichinschten and N. Korobov (*Zhurnal Obschtchey Khimii* (*Journal of General Chemistry*), 1932, 2, (8), 661–665).—[In Russian.] In the titration of Pb salts with $(NH_4)_2MoO_4$ the recognition of the end-point is facilitated by addition of certain dyes, *e.g.*, alizarin red which are first adsorbed by the precipitate, then displaced therefrom by the slightest excess of MoO_4'', thereby producing a colour-change in the solution. Heavy metals intefere but Al salts are inert.
—M. Z.

A New Rapid Method for the Macro- and Microchemical Determination of Silver. G. Spacu and P. Spacu (*Z. anal. Chem.*, 1932, 90, 182–185).—The neutral or feebly ammoniacal Ag solution is treated with KI until the AgI first precipitated just redissolves, then with a hot concentrated solution of $[Cupn_2]SO_4$ (pn = propylenediamine), whereby $[Cupn_2][AgI_2]_2$ separates in bluish-violet crystals containing 23·07% Ag. The precipitate is collected in a filter crucible, washed with 1% KI solution containing 0·5% of $[Cupn_2]SO_4$, then with C_2H_5OH and $(C_2H_5)_2O$, dried for 10 minutes in a vacuum dessicator, and weighed. The sensitivity of the test is 1 in 200,000.—A. R. P.

Estimation of Small Amounts of Silver in the Presence of Both Copper and Chlorides. Naoto Kameyama and Shoji Makishima (*Kōgyō Kwagaku Zasshi* (*J. Soc. Chem. Ind. Japan*), 1932, 35, (8); *C. Abs.*, 1932, 26, 5274).—[In Japanese, with full English summary in supplemental binding, pp. 372–373B.] From 0·1 to 10 mg. of Ag can be determined in 100 c.c. of solution containing as much as 6·3 grm. of Cu^{++} and 15 grm. Cl^- by heating with an excess of NaOH to precipitate CuO, filtering and measuring the colour produced on adding rhodamine.—S. G.

Volumetric Determination of Tin. Application to the Separation of Antimony and Tin. P. Ed. Winkler (*Bull. Soc. chim. Belg.*, 1932, 41, 115–137).—The HCl solution of the Sn is reduced with Zn to obtain $SnCl_2$, which is determined by adding an excess of I_2 to reoxidize the Sn and then titrating the excess with $Na_2S_2O_3$. Sb is best separated from Sn by H_2S in $H_2C_2O_4$ solution.—A. R. P.

Analysis of Ferro–Tungsten : Determination of Tungsten Content. P. Sokolovsky (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1930**, (9–10), 128–129).—[In Russian.] The powdered metal (0·5 grm.) is roasted for 2 hrs. at 800°–850° C., the sintered product digested with 50 c.c. of hot HCl (*d* 1·19), the solution treated with 3–5 c.c. of HNO_3 (*d* 1·4), the mixture diluted and the precipitated WO_3 collected, washed with 1 : 10 HCl, ignited and weighed.—D. N. S.

On the Determination of Zinc in Aluminium and Aluminium Alloys. H. Wagner and H. Kolb (*Chem.-Zeit.*, 1932, **56**, 890–891).—In the electrolytic determination of Zn in solutions obtained by dissolving Al or its alloys in NaOH the deposited Zn always contains Fe derived from reduction of the suspended Fe_2O_3. The deposit, after weighing, should therefore be dissolved in HCl and the Fe determined as Fe_2O_3 after precipitation with NH_4OH. —A. R. P.

Notes on the Volumetric Determination of Zinc by Means of Potassium Ferrocyanide and on a Sensitive Reaction for Iron. J. Guéron (*Ann. chim. analyt.*, 1932, [ii], **15**, 393–396).—The feebly acid (H_2SO_4) sulphate solution of Zn is titrated at 60°–70° C. with $K_4Fe(CN)_6$ using 3 drops of 0·1% $Fe_2(SO_4)_3$ solution as indicator. The blue colour of the liquid disappears at the end-point.—A. R. P.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

(See also "Testing" and "Pyrometry.")

(Continued from p. 261.)

A Comparison Microscope for Reflected Light. E. Stach (*Z. wiss. Mikroskopie*, 1932, **49**, 361–366).—Light from the two objects to be compared passes through two objectives thence through two rhombic prisms into the comparison Ramsden eyepiece. For comparison of two sections absolutely even illumination is obtained by two opaque illuminators which are focussed for brightness on a barytes plate by the aid of a photo-cell fixed to the eye-piece. Polarized light can be used with the instrument.—B. Bl.

A New Illuminator for Stereo-Microscopes of the Greenough Type. O. Scheerpeltz (*Z. wiss. Mikroskopie*, 1932, **49**, 333–337).—The illuminator is mounted rotatably on a movable quadrant fixed to the tube of the microscope. The beam of light remains focussed on the object when the tube is moved, when the quadrant is swung round and when the lamp is moved along the quadrant. —B. Bl.

An Automatic Apparatus Assembly for Thermal Analysis. C. T. Eddy (*Rev. Sci. Instruments*, 1933, [N.S.], **4**, 200–205).—Apparatus is described for the determination of thermal critical temperatures, accurate to within 4° C. and for the investigation of other properties, *e.g.*, resistivity and thermal energy.—J. S. G. T.

The Physical Society's Exhibition. —— (*Engineering*, 1933, **135**, 49–79, 169).—Illustrated descriptions of a number of exhibits including instruments for hydrogen-ion determination, and for indicating, recording, and controlling temperatures.—W. P. R.

The Physical Society's Exhibition. —— (*Engineer*, 1933, **155**, 37–92).—Illustrated descriptions of exhibits.—W. P. R.

Withdrawable Embedded-Type Immersion Heaters. Anon. (*Mech. World*, 1932, **92**, 612).—The new embedded-type immersion heater for electrical water-heating equipment is illustrated and described. Each element consists of a pair of heating coils of nickel–chromium alloy accommodated in channels in a cast-iron former. After filling in the space round the coils with refractory material, and drying and baking, the element is placed in a mould and a special aluminium alloy cast round it. The aluminium alloy completely protects the refractory material and windings, whilst providing a path of high thermal conductivity for the transmission of the heat liberated in the windings.—F. J.

The Production of Homogeneous Magnetic Fields. A. Bühl and F. Coeterier (*Physikal. Z.*, 1932, **33**, 773–774).—The use of a cylindrical coil and two short coaxial coils to produce a homogeneous magnetic field is discussed mathematically. By the use of a principal coil 40 cm. long and 6 cm. diameter, it is possible to obtain a magnetic field 10 cm. long and of 5 cm. diameter, of constant strength to within less than 7/100,000th part of its strength at the middle point of the field.—J. S. G. T.

Progress in the Manufacture and Application of Mercury Interrupters. André Léauté (*Bull. Soc. franç. Élect.*, 1932, [v], **2**, 1178–1190).—Recent improvements in the Pyrex-tungsten interrupter are first described. Oxidation of the electrode tends to set up a high internal resistance. If a bead of platinum is welded on to the tungsten before insertion, a clean unoxidized surface is presented, and the sensitiveness of the part is much increased. Other modifications of interrupters for use with low and high tensions are described. Types of thermostat depending on the combination of bi-metallic spirals with mercury contact breakers are described and illustrated.—P. M. C. R.

Photo-Electric Cells. R. Jouauste (*Bull. Soc. franç. Élect.*, 1932, [v], **2**, 1024–1070).—The principles of photo-electric cell construction, and the working of evacuated and gas-filled cells, are described. Some applications of the cells are enumerated, notably their uses as transformers in radiotherapy (cadmium or uranium cell), in sound-films, and in photometry (the copper-oxide cell).—P. M. C. R.

Preparation of Collodion Filters for X-Rays. H. Kersten and Joseph Maas (*Rev. Sci. Instruments*, 1933, [N.S.], **4**, (1), 14).—The manufacture of thin collodion filters containing manganous oxide, having a K absorption edge between that of the $K\alpha$ and $K\beta$ lines of the anticathode element, is described.
—J. S. G. T.

Two Rulers for Use in Analyzing Rotating Crystal [X-Ray] Photographs. Maurice L. Huggins (*Rev. Sci. Instruments*, 1933, [N.S.], **4**, (1), 10–13).—Rulers for constructing a reciprocal crystal-lattice and for reading interplanar distances directly are described.—J. S. G. T.

XI.—PHYSICAL AND MECHANICAL TESTING AND RADIOLOGY

(Continued from pp. 262–265.)

The Theoretical Basis of Metal Testing at the Present Time. W. Engel (*Danmarks Naturvidenskabelige Samfund, Ingeniørvidenskabelige Skrifter A*, Nr. 65, 1931, 1–96; *Building Sci. Abs.*, 1931, [N.S.], **4**, 239).—The principles underlying the mechanical testing of metals and the phenomena observed under static and dynamic loading are discussed under the following heads: (1) internal structure; (2) crystal deformation-twinning, slip, strain-hardening, space lattice distortion, crystal orientation; (3) deformation of polycrystalline metal, effect of grain-size on the quasi-isotropic character of metal; elasticity and plasticity; (4) practical stresses; static loading, strain, yield-point, creep; dynamic loading, impact; (5) aim of mechanical testing.—S. G.

Vibrations of Structures and Materials. Walter M. Pohl (*Machinist (Eur. Edn.)*, 1933, **77**, 203–205E).—The importance and significance of vibration tests of structures and materials are discussed and the methods of carrying out such tests and their interpretation are described.—J. H. W.

New Developments in Photoelasticity. A Purely Optical Method of Stress Analysis. Arshag G. Solakian (*J. Opt. Soc. Amer.*, 1931, 21, 293–306).—A description of the experimental working of the method of H. Favre, which is based on Neumann's theory (accidental double refraction of a ray of circularly polarized monochromatic light in a strained isotropic transparent medium) and depends on the measurements of the absolute phase retardation of the two refracted rays. Close agreement between the experimental and theoretical results is shown.—R. G.

Notes on the Testing of Welded Joints. Anon. (*Elect. Welding*, 1932, 2, (7), 17–18).—Refers only to steel; tensile, torsion, bending, Izod, hardness, and fatigue tests are briefly discussed.—H. W. G. H.

Percentage Elongation. A. C. Vivian (*Welder*, 1932, 4, (33), 1–7).—Experiments with flat test-pieces of thin rubber, cut into various shapes, are described.—H. W. G. H.

Recommended Practice for Testing Bolts, Screws, Nuts, Studs, and Pins. Sub-Committee on Bolts, Recommended Practice Committee, American Society for Steel Treating (*Metal Progress*, 1933, 23, (3), 25–26, 58).—A list of permissible tests is followed by notes on certain individual tests, which in some respects apply only to the bolt industry. These include appearance and finish, mechanical inspection methods, hardness testing, tensile tests, and their evaluation in the case of threaded sections, elongation, bead test, bend testing on shank, inspection of shank fractures, impact tests, shear and thread-stripping tests, micro- and macro-examination, inspection of coatings, and distribution of results. Coating inspection includes exposure and salt-spray corrosion testing, estimation of the thickness of the coating, and porosity tests; among the latter the trichloracetic acid method is described in detail.—P. R.

Tests on Threaded Sections. E. M. Slaughter (*Metal Progress*, 1933, 23, (3), 18–20).—A series of tests is described with a view to establishing a reliable general method for calculating true tensile strength in threaded sections. The three methods in general use are: (1) the calculation of the net area from the root diameter; (2) the use of a mean area calculated from the average of root and pitch diameters; (3) the calculation of the pitch area, from the pitch diameter, Cap screws made from a single bar of standard material (steel was actually employed) were tested to destruction, together with plain tensile bars of the same material, and the results calculated by the above methods were correlated with those given by the plain bar. The results show that the second (mean area) method, whilst giving somewhat low results, is the most nearly accurate. The strengthening effect of the thread is briefly considered.—P. M. C. R.

A Rapid Method of Determining Endurance Limit by Means of Measuring Electrical Resistance. Shōji Ikeda (*J. Soc. Mech. Eng. Tokyo*, 1928, 31, (136), 447–466; *Japanese J. Eng. Abs.*, 1932, 8, 11).—[In Japanese.] Cf. this *J.*, 1929, 42, 563.—S. G.

Tensometer for Measuring Small Deformations. A. F. Lorenz (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), 1932, (1), 68–76).—[In Russian.] The results obtained with a simple new tensometer are compared with those obtained with the Martin apparatus and a Cambridge extensometer. The new instrument consists of a flexible steel strip, fixed between 2 bearings in such a way as to be "dead-beat." In the centre of the plate is attached a rod with a mirror, in which the image of the scale is observed through a telescope. During deformation of the specimen the strip bends and the resulting angle of turn of the mirror is determined by the displacement of the scale image. This apparatus is not sufficiently accurate for big deformations, but for small deformations it compares not unfavourably with the Martin instrument, while its stability is greater and fixing is very simple. It can be used for measuring the deformation of wire.—D. N. S.

"New" Indentation Hardness Tests. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1933, 9, 5–6).—The commonly used hardness tests are reviewed. A new development of the Brinell test by T. Matsumura (*Mem. Coll. Eng. Kyoto Imp. Univ.*, 1932, 7) is described. Although this test, in which the load producing a definite depth of impression by a 4 mm. ball is measured, has advantages, the values do not agree with the results of diameter of impression measurements. By taking the normal definition of indentation hardness, the Matsumura machine would give rational hardness values and would be almost identical with other available hardness testing methods. In all depth measurements, the exact diameter of the impression is not necessarily obtained.—R. G.

RADIOLOGY

On the X-Ray Determination of Stresses in Welds. John T. Norton (*J. Amer. Welding Soc.*, 1932, 11, (9), 5–7).—"Pinhole" radiographs indicate the state of perfection of the grains of a metal, since any deformation of the atomic planes produces asterism, *i.e.*, elongation of the spots of the radiograph. Usually asterism is apparent only when plastic deformation has taken place and, in the case of a weld, shows where stresses were large enough to require relief through deformation. "Stress-relief" annealing does not remove asterism, although the ductility of the material is improved, but annealing above the recrystallization point will remove the asterism, provided that no further deformation is produced by mutual interference of the grains during growth. Many secondary effects can produce small amounts of plastic deformation, and it is, consequently, often difficult to interpret the exact significance of the asterism. Its presence, however, is definite proof that the grains are not perfect and, therefore, have not their maximum capacity for deformation. Impact resistance and fatigue resistance of welds are undoubtedly very much influenced by small local deformation of the grains: correlation with the "pinhole" radiographs should, therefore, be valuable.—H. W. G. H.

Röntgenographic Examination of Large Chemical Apparatus. W. Busse (*Chem. Fabr.*, 1932, 11, 185–186).—Tables are given showing the voltage and optimum exposure time for various thicknesses of iron, copper, and aluminium which is being examined for flaws by X-rays. Prolonged exposure or too high a voltage tends to blur the contrast between sound and unsound places.
—A. R. P.

Making Radiographic Inspections of Chemical Equipment. Herbert R. Isenburger (*Chem. and Met. Eng.*, 1933, 40, 130–132).—The examination of pressure vessels and of welded seams by X-rays and by γ-rays is discussed. A double-exposure technique is described and its advantages over the stereoscopic method are discussed. For field-work in the chemical industry it is necessary to have a compact and rigidly-built outfit capable of penetrating 3 in. of steel in a 1-minute exposure. An outfit of this kind is described and by its use considerable economy is effected.—F. J.

Recent Developments in X-Ray and Gamma-Ray Inspection of Power-Plant Materials. Herbert R. Isenburger (*Steam Plant Eng.*, 1933, 11, January).—Both X-rays and γ-rays are now used for the examination of power-plant materials. The former are employed for steel up to 4 in. in thickness, but the latter do not give sufficient definition even up to a thickness of 2 in. Examples are quoted and illustrated by photographs. X-ray examination of welded seams is compulsory for most machine parts made in the U.S.A. Particulars are given of a 300,000 v. X-ray unit which will penetrate 3 in. of steel in a 1-minute exposure. The respective merits of X- and γ-rays are set out in tabular form.—W. A. C. N.

X-Ray Investigation of Metals. D. Faggiani (*Rivista di Fisica*, 1932, (1), 16–23).—The scientific, industrial, and technical importance of X-rays in metallurgy is discussed.—G. G.

XII.—PYROMETRY

(Continued from pp. 265–266.)

Experiments with a Registering Photo-Cell Pyrometer. G. Müller and H. J. Zetzmann (*Z. tech. Physik*, 1933, 14, 90–94).—The relation between black-body and true temperature and its practical utility is explained. Experiences with an almost inertia-free pyrometer for the control of the maximum temperature in point-welding are described; it is probably possible to control point welding automatically with the aid of additional apparatus.—J. W.

Some Observations of Automatic Temperature Control. C. E. Foster (*Metallurgia*, 1933, 7, 187–190).—The component parts of an automatic temperature control system and their interaction are considered, and also the application of automatic temperature control to various types of furnaces. Two types of control are referred to, the first known as the "hit or miss" system, because within predetermined limits the heat supply is quickly changed from low to high or *vice versa*, and the second known as the "step by step" system, which can lose or gain heat quickly, and the effect of a chain of time lags, which occurs with both systems, is dealt with diagramatically. A detailed description is also given of the working of a typical indicating pyrometer for automatic control and the methods adopted to achieve the closest and most accurate control are fully considered.—J. W. D.

A Pyrometer Controller. Anon. (*J. Sci. Instruments*, 1933, 10, 22).—A note. Describes very briefly a pyrometer controller which can be used in connection with either thermocouples or resistance thermometers. A photograph is shown, but no details are given.—W. H.-R.

On the Passage of Mercury through Narrow Capillaries. H. Ebert and W. Ende (*Z. tech. Physik*, 1933, 14, 64–67).—The irregular movement of mercury in locally constricted capillaries of maximum thermometers is attributed to the presence of impurities in the metal.—J. W.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 266–270.)

Metal Mixing by Analysis. Wesley Lambert (*Met. Ind.* (*Lond.*), 1933, 42, 441–442).—The method of calculating the constitution of the charge from a knowledge of the weight and composition of the material available, when using scrap or scrap and new metal is described and illustrated with an example.
—J. H. W.

Ferrous and Non-Ferrous Metals in the Foundry. W. Rosenhain (*Proc. Inst. Brit. Found.*, 1931–1932, 25, 183–201; discussion, 201–213).—See this *J.*, 1932, 50, 769.—S. G.

Gas Contents of Aluminium Casting Alloys. H. Nipper (*Z. Metallkunde*, 1933, 25, 65–67).—The influence of a large number of factors (such as quality of the metal, flux, melting temperature, mechanical and chemical treatment of the molten metal, casting temperature, kind of mould, casting method, &c.) on the gas content and mechanical properties of aluminium and Silumin castings has been investigated by density measurements, gas removal, and tensile tests. For the results, which are not given in detail, the original paper must be consulted.—M. H.

High-Strength Sand-Casting Aluminium Alloys. W. C. Devereux (*Proc. Inst. Brit. Found.*, 1931–1932, 25, 517–551; discussion, 551–559).—See this *J.*, 1932, 50, 124.—S. G.

Carbon and Nitrogen in Aluminium. Takayasu Harada (*Suiyô-Kwaishi*, 1928, 5, (7), 571–578; *Japanese J. Eng. Abs.*, 1932, 8, 85).—[In Japanese.]

H. carried out experiments on the determination of carbon and nitrogen in certain kinds of commercial aluminium, and on the behaviour of these non-metallic elements on melting aluminium. The product of carbon and nitrogen goes into slags and does not adversely affect or combine with the metal. Nitrogen does not affect the metal, if pure, when melted at temperatures up to 1400° C.—S. G.

Pressure Casting of Brass. P. Weiss and R. Wartena (*Rev. Fonderie moderne*, 1931, 25, 331–333, 345–346).—Discussion of a paper published in *De Gieterei* (*Den Haag*), 1931, March. The technique of pressure casting in chill moulds is described and its application to aluminium and brass discussed. Both these metals have relatively high melting points, and the former has the property of absorbing iron at high temperatures and of forming alloys with nearly all other metals. The moulds are therefore usually made of special chromium, vanadium, or chrome-nickel steel, made in one piece. The method of casting is based on a goose-neck delivery and a special melting crucible, which may be either tilting or fixed. The casting machine, which resembles a hydraulic press, and its mode of action are described.—J. H. W.

An Investigation of Core Oils. Carl H. Casberg and Carl E. Schubert (*Univ. Illinois Bull.*, *Eng. Exper. Sta.*, No. 221, 1931, 1–22).—Tests with numerous core oils show that the tensile strength of the cores has no definite relation to the sp. gr., percentage of ash, flash-point, or fire point of the oil. The initial tensile strength (L) of baked cores made by standard methods of mixing and ramming and with standard baking time and temperature is proportional to the saponification (S) and iodine (I) values of the core oil, thus $L/S=0{\cdot}77$ and $L/I=0{\cdot}90$. The water absorbed by the cores divided by the percentage loss in strength thereby produced in all cases gave a value of 0·00037.—A. R. P.

Pure Rubberized Oil as a Substitute for Linseed Oil in Foundry Core Binders. L. Wilson Greene and J. M. Faraday Leaper (*Oil and Soap*, 1933, 10, (1), 28–39; *C. Abs.*, 1933, 27, 1597).—Laboratory tests indicate that rubberized oil from *Hevea brasiliensis* may be used as a substitute for linseed oil in core binders. The high acidity of rubberized oil apparently has no deleterious effect on its core-binding properties.—S. G.

Introduction to the Study of Moulding and Casting. J. Pillon (*Proc. Inst. Brit. Found.*, 1931–1932, 25, 307–376; discussion, 376–381).—French exchange paper.—S. G.

Sand Testing in the Foundry. W. Y. Buchanan (*Proc. Inst. Brit. Found.* 1931–1932, 25, 560–600; discussion, 600–607).—See this *J.*, 1932, 50, 391.
—S. G.

Moulding Sands. G. Tarocchi (*Fonderia*, 1932, 9, 436–445).—A detailed study of the preparation and properties of foundry sands.—G. G.

XIV.—SECONDARY METALS, SCRAP, RESIDUES, &c.

(Continued from p. 270.)

The Buying and Selling of Old Gold. C. M. Hoke (*Met. Ind.* (*N.Y.*), 1933, 31, 55–57).—Hints on the best methods of disposal of precious metal scrap in the U.S.A.—A. R. P.

On the Production of Iron-Poor Remelted Zinc. Edmund R. Thews and W. E. Herrmann (*Met. Ind.* (*Lond.*), 1933, 42, 465–467).—Removing iron in remelting commercial scrap zinc presents practical difficulties. Previous to melting, mechanical ferrous impurities should be removed as far as economically possible. Reverberatory furnaces are recommended for remelting scrap comparatively poor in iron. Melting pot furnaces appear superior for handling large quantities of commercial zinc scrap containing 0·10–0·15% of iron. The reasons for these conclusions are discussed in detail.—J. H. W.

XV.—FURNACES AND FUELS

(Continued from pp. 271–273.)

1-Ton Crucible Melting Plant. Anon. (*Met. Ind.* (*Lond.*), 1933, 42, 429).—A description is given of the construction and performance of 2 brass and bronze oil-fired crucible furnaces, claimed to be the largest tilting furnaces ever constructed.—J. H. W.

Photo-Electric Control of Gas Furnaces. Anon. (*Machinery* (*Lond.*), 1933, 41, 463).—A note. In a recent furnace installation, a photo-cell operating through a relay shuts off the main gas supply if the flame becomes extinguished.—J. C. C.

A New Application of the Surface Combustion Principle. The "Degussa" High Temperature Furnace. Anon. (*Gas World* (*Indust. Gas Suppt.*), 1933, 5, (2), 15).—A gas-fired surface combustion furnace, operated with gas at ordinary pressure and capable of attaining temperatures up to 2000° C., is described. A model for laboratory work is also available.—J. S. G. T.

XVI.—REFRACTORIES AND FURNACE MATERIALS

(Continued from pp. 273–276.)

Inoculated Dinas Bricks. B. Pines (*Stal* (*Steel*), **1931**, (3–4), 75–83).—[In Russian.] X-ray examination of various quartz minerals used in the manufacture of dinas bricks leads to the conclusion that the different modifications of silica present in naturally occurring quartzes alter the direction of the transformations in the brick during firing, since they form centres of crystallization for these modifications. The best type of dinas brick is considered to be that with a tridymite–cristoballite structure obtained by firing in a manner which avoids the intermediate amorphous modification. Results of works' tests on the manufacture of bricks from charges inoculated with nuclei of the desired modification are given.—D. N. S.

Alumina as a Strong Fire-Resisting Material. H. Gerdien (*Z. Elektrochem.*, 1933, **39**, 13–20).—The refractory properties of alumina are described in the light of tests at various temperatures and in contact with various corrosive acids, metals, metallic oxides and salts, and it is shown that this material has a high resistance to corrosion under severe conditions of testing.—J. H. W.

Examination of Refractories. C. Meurice (*Ing. Chim.*, 1931, **15**, 97–114).—A review of the properties and constitution of refractories, dealing with the materials as regards structure, stability on heating, heat resistance, and resistance to the corroding action of products of combustion and molten materials. The properties and dilatation characteristics of the different forms of silica and alumino-silicates are described. From the dilatation curve the form in which the silica is present can be determined and useful practical indications obtained. Tests of heat resistance by determination of deformation under load are described; the appearance of a liquid phase can be clearly indicated.—R. G.

Further Contribution on the New Refractory "Siemensit." Hans Hirsch (*Tonind. Zeit.*, 1932, **56**, 1147–1149).—Characteristic results of the following tests are described: examination of structure, elastic properties, heat conductivity, refractoriness, softening under pressure, change of volume, resistance to sudden temperature changes, resistance to slags, especially basic and acid open-hearth steel slags, brown coal ash containing gypsum, crude glass mixtures rich in alkali, and fused sodium sulphate.—B. Bl.

On the New Refractory "Siemensit." Werner Hansen (*Tonind. Zeit.*, 1933, **57**, 209–210).—The stability of Siemensit in contact with lime and dolomite at 1200°–1400° C. has been investigated.—B. Bl.

"Sinterkorund" as a Refractory for Apparatus of High Chemical and Thermal Resistance. Hans Kohl (*Tonind. Zeit.*, 1932, **56**, 1266–1267, 1279–1280).—Sinterkorund consists of 99·8% alumina, 0·2% of silica, and traces of ferric oxide. After firing at 1800° C., it is completely crystalline, has *d* 8·78, and melts at 2050° C.; it is gas-tight up to 1720° C. and will withstand a load of 2 kg./cm.^{2} without deformation up to 1730° C. It has a high heat conductivity (at 17° C. 16·8 kg.-cal./m./hr./° C.) and is therefore very resistant to rapid temperature changes. The sp. electrical resistance at 800° C. is 0·35 × 10^9 ohm/cm., and the sp. heat 0·2796 (0°–1500° C.). Crucibles and dishes of sintered corundum are resistant to alkalis, high-pressure steam, chlorine, molten glass and slags, molten metals, fused litharge, and iron oxides. Many uses for the material in the chemical and motor industries are indicated.—B. Bl.

An Insulating Refractory for Heating Furnaces. Anon. (*Iron Age*, 1933, **131**, 433).—Describes a new insulating refractory said to combine low thermal conductivity and heat-storage capacity with refractoriness and light weight. —J. H. W.

Insulating Materials and Their Utility. C. Stanley Read (*Refractories J.*, 1933, **9**, 69–71).—The requirements for good insulation and the manner in which these requirements can be satisfied by insulating materials are discussed. —J. H. W.

XVII.—HEAT-TREATMENT

(Continued from p. 276.)

On a Rational Terminology in the Field of Heat-Treatment of Alloys. A. A. Botchvar (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), 1931, (9), 19–23).—[In Russian.] It is proposed that the terms used in describing certain heat-treatment processes should be reviewed, since many do not fully express the essential nature of the process. Examples of such terms are: "quenching," "annealing," "normalizing." Two variants of a new terminology are suggested.—D. N. S.

The Formation of Blisters during the Heat-Treatment of Age-Hardenable Aluminium Alloys. P. Brenner, F. Sauerwald, and W. Gatzek (*Z. Metallkunde*, 1933, **25**, 77–80).—The influence has been investigated of the composition, annealing medium (air, salt bath, vacuum), temperature and duration, and surface condition of the sheets on the formation of blisters in various aluminium alloys containing magnesium, copper, silicon, and manganese as well as the usual iron content. The results (illustrated by numerous photographs) indicate that the formation of blisters depends on exterior influence as well as the nature and amount of alloying elements. Hints are given for avoiding blisters, *e.g.* by annealing in an electric furnace instead of the usual salt-bath. Detailed results will be published in the Jahrbuch 1933 of the Deutsche Versuchsanstalt für Luftfahrt.—M. H.

Short-Time Annealing of Aluminium Sheet and Strip in Continuous Electric Annealing Furnaces. H. Masukowitz (*Met. Ind.* (*Lond.*), 1933, **42**, 425–427). —Abstract from *Z. Metallkunde*, 1932, **24**, 236–239; see *J.*, this volume, p. 47. —J. H. W.

Ageing of Zinc Die-Casting Alloys. Anon. (*Machinist* (*Eur. Edn.*), 1933, **77**, 213E).—The physical characteristics which must be known for the use of zinc-base alloys for die-castings are tabulated for the Zamak alloy No. 3. Ageing treatments are: (1) heat to 70° C. for 10 hrs., 85° C. for 8½ hrs., or 100° C. for 6 hrs. and cool in the furnace; (2) heat to 70° C. for 12 hrs., 85° C. for 8½ hrs., or 100° C. for 6 hrs., and cool in air.—J. H. W.

XVIII.—WORKING

(Continued from pp. 276–278.)

The Energy Absorbed in the Cold-Working of Metals. Walter Rosenhain and V. H. Stott (*Proc. Roy. Soc.*, 1933, [A], **140**, 9–25).—Apparatus for measuring the work done and the heat produced when a considerable length of wire is drawn through a die enclosed in a calorimeter is described. The process is continuous in operation and is characterized by a much larger expenditure of energy per unit mass of metal than has been the case with previous processes. In the case of annealed aluminium wire the energy absorbed by the wire amounted to 0·47 joule per grm. of metal, equivalent to 1·2% of the total work done, *viz.* 38 joules per grm., including friction in the die. The corresponding figures for annealed and hard copper were: annealed; 0·96 joule/grm.; 3·1%; 31 joules/grm.; hard, 0·12 joules/grm.; 0·5%; 24·5 joules/grm. These values are less than those obtained by Farren and Taylor (see this *J.*, 1925, **33**, 322), but confirm their results approximately.—J. S. G. T.

Machines for the Hot-Pressing of Non-Ferrous Metals. O. Kühner (*Z. Metallkunde*, 1933, **25**, 88–93).—A detailed description of the construction and operation of various types of hot-pressing machines (friction spindle press, eccentric press, knee lever press with pressure regulator) made by a German manufacturer.—M. H.

On the Problem of Working Magnesium Alloys under Pressure. R. Barbanel (*Legkie Metally* (*Light Metals*), **1932**, (2), 40–47).—[In Russian.] Works' practice in the drawing and extrusion of tubes of a magnesium alloy containing aluminium 4, manganese 0·3, and silicon 0·02% (introduced during casting) is described. The alloy was poured into tubular moulds, having an external diameter of 175 mm. and an internal diameter of 76 mm., with a length 350–400 mm. and a weight of 14 kg. The optimum conditions for extrusion were: temperature 350°–370° C., pressure 140 kg., rate 0·03–0·05 m./second, wax being used as lubricant. By extrusion matrices for drawing with an external diameter of 94 mm. and an internal diameter of 74 mm. were obtained. Wall thicknesses of 3–5 mm. could also be obtained. Drawing was carried out at 250° C. with a reduction of 5–7% at each pass, and a normalizing treatment at 350°–400° C. after each reduction.—D. N. S.

The Choice of Material for Stamps for Duralumin Stampings. S. I. Gubkin (*Niimash-Izvestia Nauchno-issledovatelskogo Instituta Mashinostroenia i Metalloobrabotki* (*Bulletin of the Scientific Research Institute of Machine Building and Metal Treatment*), **1932**, (3), 175–179).—[In Russian.] The adhesion of Duralumin stampings to the tool when stamping is carried out at above 400° C. is investigated. It is concluded that this is due to purely mechanical causes. The stamp should be constructed of alloy steel, which minimizes adhesion. The same result can be obtained by using a suitable lubricant.—N. A.

Striking a New Coinage. L. Golfier (*Aciers spéciaux*, 1933, **8**, 31–34).—The various processes in striking a new coinage from the casting of the bars to the final inspection are described and illustrated.—J. H. W.

Producing Aluminium Alloy Diaphragms. E. E. H. (*Machinery* (*Lond.*), 1932, **40**, 814–816).—Details are given of the methods of flattening, enamelling, forming, heat-treating, and cleaning aluminium alloy diaphragms used in sound-reproducing instruments. An alloy containing copper 0–0·05, manganese 1·25–2·0, iron 0–0·45, silicon 0·05–0·40% is used for simple flat diaphragms 0·02–0·03 in. thick, and Duralumin 0·001–0·003 in. thick for very light diaphragms of intricate contour. The thick diaphragms are flattened by heat-treatment at 225° C. ± 5° C. under pressure in a special fixture. Brief details are included of the use of nitro-fluoric acid solution for producing very thin Duralumin sheet by uniform chemical attack.—J. C. C.

XX.—JOINING

(Continued from pp. 280–281.)

Repairs of Aluminium Accessories by Means of a Patented Alloy. W. A. Lapidus (*Avtogenoe Delo* (*Autogenous Practice*), **1931**, (1), 16–17).—[In Russian.] The solder (composition not stated) melts at about 200° C. and is used by the American Fix Co. of Cleveland for repairing aluminium accessories.—D. S.

The Autogenous Welding of Aluminium and Its Alloys. H. Bohner. H. Buchholz (*Z. Metallkunde*, 1933, **25**, 50–52, 64).—Cf. this *J.*, 1932, **50**, 257. Chiefly polemical. H. Bohner states that fine-grained welded joints can be produced by the use of a welding rod containing 0·15% titanium. The welding method has little influence on the tensile strength (18–24 kg./mm.^{2}) and elongation (2·5–6%) of alloys of the Lautal type; the breadth of the softened zone is 4 times as great with autogenous welding as with electric welding, whatever the thickness of the sheet. The bending strength of welded wires of aluminium–copper alloys is higher if the welding rod contains more aluminium than the alloy welded.—M. H.

Electric Welding of Sheet Aluminium by Means of a Carbon Arc. A. P. Goriatchev and R. R. Syromiatnikov (*Avtogenoe Delo* (*Autogenous Practice*), **1931**, (6), 6–9).—[In Russian.] The welding of aluminium (containing silicon 0·21, iron 0·94, and copper 0·19%) with a positive carbon electrode, the metal forming the negative electrode, is described. The current used was 100–180 amp., the filler rod had the same composition as the metal and the flux was a mixture of sodium chloride 7·6, potassium chloride 66·1, and lithium chloride 27·3%. In the tensile test a work-hardened welded sheet fractures along or adjacent to the welded seam while a welded and normalized sheet fractures outside this zone. The hardness of the weld is 32·5 compared with 27 for the annealed sheet, but the weld is sufficiently elastic to bend double without fracture.—D. N. S.

XXI.—INDUSTRIAL USES AND APPLICATIONS

(Continued from p. 282.)

Aluminium in Denture Construction. Anon. (*Brit. J. Dental Sci., Prosthetics Section*, 1930, **75**, 33–36).—Extracts from various sources. Aluminium dental bridges are used in Germany and the U.S.S.R. A Russian committee found such bridges to be harmless, and to produce no after-taste or irritation. —J. C. C.

Dry Kiln Doors of Aluminium. Anon. (*Railway Eng.*, 1931, **52**, 394).—A very brief note. Cf. this *J.*, 1932, **50**, 688.—H. F. G.

The Design and Construction of Metal Hulls for Boat Seaplanes. R. J. Moffett (*Engineering J.*, 1931, **14**, 609–615).—Aluminium alloys, notably Duralumin, are generally used, but owing to their relatively low corrosion-resistance, especially to salt-water. the use of " stainless " steel is increasing. Anodic treatment and gum-base paints are employed with some success, the best anti-corrosion surface being that of anodically treated and painted Alclad. Methods of working aluminium alloys are briefly noted.—H. F. G.

Light Metals in Transport Engineering. Freeman Horn (*Met. Ind.* (*Lond.*), 1933, **42**, 39–42).—A review of the applications of light metals in the construction of ground and aerial transport machines.—J. H. W.

The Use of Aluminium and Aluminium Alloys in 1933 Automobile Design. W. Tyson (*Aluminium Broadcast*, 1933, **4**, (2), 11–14).—A review.—J. C. C.

Aluminium and the Car. Anon. (*Met. Ind.* (*Lond.*), 1932, 41, 400).—A brief description of the applications of special aluminium alloys for use in the manufacture of motor-car parts.—J. H. W.

An Aluminium Coating that is Useful in Electrical Engineering. R. E. Pettit (*Elect. Manufacturing*, 1932, 10, (3), 22–23; *C.Abs.*, 1933, 27, 353).—An artificially-formed coating of Al_2O_3 is an effective insulation material for electrical machinery and equipment. By the Alumilite process this is produced by making the aluminium article the anode in a bath of sulphuric acid with certain organic and inorganic modifiers (not described in this article). —S. G.

On the Use of Aluminium Windings in the Rotors of Turbo Generators. E. G. Komar (*Elektrichestvo* (*Electricity*), 1931, (15), 854–858).—[In Russian.] A review of the present-day aspects of the problem and an attempt to examine it theoretically.—N. A.

Characteristics of the General Electric Photoflash Lamp. W. E. Forsythe and M. A. Easley (*J. Opt. Soc. Amer.*, 1931, 21, 685–689).—Aluminium foil in slight excess of oxygen is flashed in a closed bulb by application of a suitable voltage. The light emitted is about 166,000 candles, or the equivalent of 470 five hundred watt incandescent lamps in maximum output, with an efficiency of about 32 lumens per watt.—R. G.

Aluminium Webs. L. R. (*Anzeiger Berg-, Hütten- u. Masch.*, 1932, 54, (11), 6).—The webs are made from strips of aluminium, 0·3 mm. wide, cemented together with a film of cellulose hydrate.—B. Bl.

Aluminium Paste. —— (*Drugs, Oils, Paints*, 1932, 47, 622; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (30), 306).—A heavy paste of very fine high-grade aluminium flake in neutral oils which will not under normal conditions dry out or harden when mixed with varnish is claimed to produce a smooth solid surface resembling a plated finish.—S. G.

Aluminium Paints as a Means of Excluding Damp and of Improving Damp Rooms. W. Stümer (*Bautenschutz*, 1931, 2, 95–96; *Building Sci. Abs.*, 1931, [N.S.], 4, 422).—The properties and uses of aluminium paints are discussed. Such paints are particularly suitable for painting bituminous coatings. Aluminium paints on wood are highly moisture-resistant, and surfaces so painted are little affected by frequent washing. The metallic constituent of such paints is non-poisonous. The metallic nature of the coating prevents the penetration of micro-organisms. The light-reflecting value is high—60 to 70% of incident light. A single coating is usually sufficient for maximum reflection and covering power. Their high reflectivity makes such paints of value in covering roofs in tropical countries, whilst the coatings are also little affected by smoke and are not discoloured by sulphuretted hydrogen. Practically all surfaces may be painted, provided that the most suitable vehicle is used, *e.g.* an oil for external walls, a quick-drying lacquer for interior walls, and the best stand oil for wooden walls or beams.—S. G.

Aluminium Paint on Creosoted Wood. Anon. (*Wood Preserving News*, 1930, Dec.; *Building Sci. Abs.*, 1931, [N.S.], 4, 92.)—A report is given of an investigation of the usefulness of certain paints when applied to creosoted wood. The paints studied were: (1) a white cellulose paint; (2) a green lead paint; (3) a green zinc paint; and (4) an aluminium paint. One coat of each was applied to creosoted poles set up in the ground and allowed to dry out for 3 weeks before painting. After exposure to the weather for 2 years it was found that whereas the cellulose, lead, and zinc coatings had failed as regards retention of their colours and had in the main assumed the colour of the creosote, the aluminium paint had fully retained its colour. The vehicle was a hard, dry, long oil varnish type containing 50% by weight of non-volatile oils and gums. The major portion of the vehicle consisted of heat-treated China wood oil and the remainder of heat-treated linseed oil. Aluminium powder was added in the proportion of 2½ lb. per gall. on the job as required. This paint dries hard in 12 hrs.—S. G.

The Relationship between Radiant Energy and Paint. F. C. Atwood (*Amer. Paint J. Convention Daily*, 1932, **16**, (53B), 8; *Amer. Paint Varnish Manuf. Circ.*, No. **423**, 1932; *Paint Varnish Prodn. Manager*, 1932, **8**, (6), Sect II, 10–13; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (30), 304).—The vehicle in an aluminium paint may reduce the value of aluminium powder as heat insulator by as much as 50%. White pigments reflect 90% of visible spectral energy and are, therefore, the most effective non-absorbers for solar radiation. Hence, white paints are better than aluminium paints for coating petrol tanks, &c., exposed to the sun. For hot-water radiators the colour of the pigment is unimportant, as all ordinary pigments are good absorbents and good radiators of long-wave heat energy. An aluminium or other polished metal coating would, however, be definitely unsuitable for use on a radiator, because such a surface has a low radiation coeff. for long-wave heat energy. —S. G.

The Compounding of Aluminium Powder with Rubber. W. D. Guppy (*India Rubber Inst. Trans.*, 1932, **8**, 131–135; *C. Abs.*, 1933, **27**, 440).—Experiments show that powdered aluminium does not influence the time of curing to obtain a maximum tensile product. With increasing proportions of aluminium, the elongation at rupture and the tensile strength diminish, and the stiffness increases progressively. The most marked effect of powdered aluminium (in proportions about 50% by weight of the rubber) is to reduce the elongation at small stresses. At higher stresses, the extensibility increases very rapidly, and the remaining part of the stress-strain curve runs almost parallel to that of the base mixture. Vulcanizates containing aluminium have a tendency to tear readily along a plane parallel to the surface formed by the plates of the mould used for vulcanization, because of orientation of the aluminium particles. Several accelerated base mixtures were used in the experiments. Judging by inorganic sulphide in the vulcanizates, there is no chemical reaction between aluminium and sulphur during vulcanization. The experimental results are tabulated.—S. G.

The Use of Beryllium in Industry. —— (*Totchnaia Industria*, **1931**, Oct., and *Technique moderne*, 1932, **24**, 594).—The production and properties of the metal and its effects when added in small amounts to copper, bronze, and steel are discussed. The prices and annual production of the metal for the years 1923–1929 are given.—H. W. G. H.

Report of Committee A–10 [of A.S.T.M.] on Iron–Chromium, Iron–Chromium–Nickel, and Related Alloys. Jerome Strauss and H. D. Newell (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 136–137).—A progress report. —S. G.

Report of Committee B–1 [of A.S.T.M.] on Copper Wire. J. A. Capp (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 193–197).—See this *J.*, 1932, **50**, 497. —S. G.

Report of Committee B–5 [of A.S.T.M.] on Copper and Copper Alloys, Cast and Wrought. C. H. Mathewson and D. K. Crampton (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 255–263).—See this *J.*, 1932, **50**, 497.—S. G.

Uses of Copper in Buildings. I.—Copper Roofs. H. N. Bassett (*Carpenter and Builder*, 1932, **110**, 508; *Building Sci. Abs.*, 1932, [N.S.], **5**, 129).—B. briefly considers the use and methods of laying copper roofs. Copper may be used for all sizes and shapes of roof, whether sloping, vertical or flat, and may be laid on all kinds of support, *e.g.* wood or concrete. It is essential that no other metal than copper be used for nails or rivets, in order to obviate the danger of electrolytic corrosion. Jointing by brazing or soldering is to be avoided; welding with copper may be used, but so far as possible joints should be made by folding or riveting. A sheet of tarred felt should be placed under the copper to prevent wear by friction with uneven surfaces below. Provision should be made for expansion under the heat of the sun in view of the relatively high coeff. of expansion of copper. Copper sheets or tiles should not be attached directly to the supports, but should be held in place by copper clips nailed or rivetted to the supports with copper nails or rivets. Joints should be so made that water will flow away. Holes made for fixing the sheets or clips should be covered by a fold either of the clip or of the sheet. Edges should be doubled to afford additional stiffness to prevent wind lifting a sheet or tile or causing it to whip. It is pointed out that no very special skill is required for the fixing of copper roofing. As regards cost, the first cost of the copper roof is higher than that of a tiled roof but its durability is also greater. —S. G.

Heat Emission from Iron and Copper Pipe. F. C. Houghten and C. Gutberlet (*Heating, Piping and Air Conditioning*, 1932, 4, (1), 47–52; *Building Sci. Abs.*, 1932, [N.S.], **5**, 71).—An illustrated description is given of an investigation carried out at the research laboratory of the American Society of Heating and Ventilating Engineers with a view to determine the heat emission from copper steam and hot-water pipes of the dimensions commonly used in heating systems. It was found that the heat loss from bare copper piping is about 54% of that from bare, black iron pipes of the same nominal size, and 203% of the loss from insulated iron piping. Heat loss is approximately equal for vertical and horizontal pipes of the same size and material.—S. G.

Adoption of Air-Conditioning by Many Leading Railroads Provides Added Incentive to Public for Increased Summer Passenger Travel. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1932, (71), 2–3).—The use of copper and brass in air-conditioning plant used on American trains is referred to.—J. S. G. T.

Artificially-Cooled Air, Major Factor in New American Liners' Challenge for Supremacy of Seas. Tons of Copper Alloys Used. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1932, (71), 4–5).—The use of copper, brass, and bronze for air-conditioning plant used in American liners recently constructed, is referred to.—J. S. G. T.

New Adler Planetarium Replete with Copper Alloys Inside and Out. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1932, (71), 7).—About 15,000 lb. of copper sheet in addition to brass and bronze has been used in the building of the Adler planetarium erected recently in Chicago.—J. S. G. T.

Metal Supplants Masonry in Modern Construction. T. E. Orr (*Daily Metal Reporter*, 1931, 31, (72), 3–4).—From an address on "Copper for Vertical Surfaces" before the New York States Sheet Metal Contractors' Association. The use of such rustproof materials as copper and its alloys for vertical surfaces in the U.S.A. and Germany is reviewed.—P. M. C. R.

Copper Alloys and Corrosion. —— Ballay (*Usine*, 1931, 40, (47), 25–27).—Abstract of a paper presented to the Salon Nautique. See this *J.*, 1932, **50**, 183.—H. W. G. H.

The Fischer Bow-Collector. Anon. (*Tram. and Rail. World*, 1931, 69, 14–15).—Many tramway systems now substitute the bow-collector for the trolley-pole and wheel. The collector consists of a steel plate, pivoted in gun-metal bearings, the wear on the trolley-wire being reduced by two long copper strips riveted to the edge of the plate. This combination has been found to give longer life of both plate and wire than if brass or copper plating is used. The plate, which maintains contact by a system of springs, provides lubrication by suitable grease-filler grooving.—P. M. C. R.

Tentative Specifications for Insulated Wire and Cable: 30 per Cent. Hevea Rubber (D 27–31 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 960–976).—See this *J.*, 1932, **50**, 105–106.—S. G.

Tentative Specifications for Magnesium-Base Alloy Castings (B 80–31 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 302–304).—See this *J.*, 1932, **50**, 106–107.—S. G.

XXIV.—BOOK REVIEWS

(Continued from pp. 286–288.)

Man and Metals. A History of Mining in Relation to the Development of Civilization. By T. A. Rickard. In two volumes. Med. 8vo. Pp. xiii + 1068, with 108 illustrations. 1932. New York: McGraw-Hill Book Co., Inc. ($10.00); London: McGraw-Hill Publishing Co., Ltd. (50*s*. net).

It has been known to many metallurgists for some time that Mr. Rickard had in preparation an extensive work on the history of mining and metallurgy, and those who were aware of his wide knowledge and literary skill have looked forward with interest to its appearance. They will not be disappointed, for this important work not only brings together a great mass of historical material, but also presents it in such a way as to be eminently readable and attractive. The author has not been content to collect facts concerning the mining, smelting, and exploitation of metals, but has delved deeply into the records of the social reactions of mining on society and government, so that his work has a sociological value above that of a mere technical record. The very large number of references collected at the end of each chapter shows how thoroughly the field has been surveyed, but the literary quality of the narrative prevents the dullness which so often characterizes learned historical treatises. Some space might have been saved, and incidentally the cost reduced, by shortening those chapters which deal with matters not metallurgical, such as that on man before metals, and the accounts of the general history of Egypt and other Eastern countries, which are readily available in other works. No doubt the author wished to present his picture of the relations between Man and Metals with as complete a background as possible, but the reader who has good general histories at hand would prefer to see some of the subjects on which Mr. Rickard has exceptional knowledge treated in a rather fuller manner.

On controversial questions, such as the origin of bronze, the early tin trade with Britain, and the date of the introduction of iron smelting, the author's careful discussion of the evidence is most valuable, and his views deserve every consideration. Bronze still remains a mystery, and although it seems natural to assume that it was preceded by a prolonged use of copper, it remains a remarkable fact that some of the earliest Sumerian objects are of bronze. A vivid account is given of the part that the search for precious metals played in the history of the classical peoples and again in Europe and America down to our own times, and the story is full of meaning for the moralist as well as for the social historian. The use of slave labour in the mines, and the persecution and even extermination of cultured races by conquerors thirsting for gold, form shameful chapters in the history of civilization, whilst the wild gambling of the nineteenth century " gold rushes " is scarcely more creditable.

It is with the mining and smelting of metals that the author is concerned, and the treatment of the metal after extraction is considered only incidentally; consequently, the great modern developments of metallurgy receive little attention, and it is essentially as a study of the part played by metals in the evolution of mankind that this work will have permanent value, although no metallurgist can glance at it without lighting on some matter of interest, however little he may formerly have considered the social aspect of his science.—C. H. DESCH.

Ternäre Systeme. Elementare Einführung in die Theorie der Dreistofflegierungen. Von G. Masing. Med. 8vo. Pp. viii + 164, with 166 illustrations. 1933. Leipzig: Akademische Verlagsgesellschaft m.b.H. (Brosch., M. 8.30; kart, M. 9.60.)

This book is intended to introduce the reader to the more simple kinds of equilibrium diagrams met with in the study of ternary alloys. After a brief introduction to the Phase Rule, the methods of representing the compositions and phase boundaries of ternary alloys are described. The reader is then led systematically through a series of hypothetical ternary systems of increasing complexity. These begin with the simple case in which the three components A, B, and C form neither solid solutions nor compounds, and proceed to the opposite extreme, in which all three components are completely miscible in the solid state, and then to more complex combinations involving partial solid solubility, peritectic reactions, intermetallic compounds, and the formation of two immiscible liquids. The necessity for continual reference from the text to the diagrams makes the reading far from easy, but the general arrangement of this part of the book is admirable, and the student who works patiently through the whole series of examples will acquire a very useful knowledge of ternary diagrams, and will learn to avoid some mistakes which are easily made.

The book is illustrated by numerous figures of isothermal and vertical sections through the three dimensional ternary diagrams, and these are very clear and satisfactory. Minor misprints occur in the titles or lettering of Figures 82, 124, 128, 129, 134, and 135. In Figures 83, 86, 116 and 119, English readers may be puzzled by the use of a German type of w which somewhat resembles an m and is different from the ordinary w used in the text. The author is less fortunate with the perspective drawings of the three-dimensional diagrams; in some cases these do not show the shapes clearly, and could be improved by better drawing, and methods of shading.

The concluding chapters deal with the diagrams for ternary alloys of aluminium, iron, and silicon, of copper, zinc, and tin, and with the different modifications of iron in ternary alloys. The change from hypothetical to actual ternary systems is very welcome, and prevents the book from being too abstract. Readers will probably criticize the choice of the particular diagrams which the author has selected from the different investigations, but actual examples are undoubtedly desirable, although in some parts the author has been compelled to " simplify " the complex binary diagrams considerably so that his description of the ternary diagram is in the nature of a preliminary sketch with many details to be filled in. The preliminary sketches must, however, be made sometime, and we are glad to see a beginning.

In the opinion of the reviewer, the great defect of the book is the entire absence of any real description of the underlying assumptions. In view of the fact that the whole book depends on an absolute acceptance of the Phase Rule, we had expected at least some indication of the assumptions and limitations involved. At the beginning, the author raises our hopes by showing how in the case of hydrogen, oxygen, and water, we may have a system of one, two, or three components according to the conditions, but he is silent as to how this is to help us in our study of alloys, particularly where the solid state is concerned; in fact, apart from a short description of crystal lattices on p. 121, the only reference to equilibrium between phases is ten lines in the proof of the Phase Rule on pp. 7–8, where it is stated that if two phases are in equilibrium, the concentrations of the components are not independent, but are connected by a distribution law. This method of proving the Phase Rule does not seem so satisfactory as that of Gibbs, and when presented so briefly may easily confuse the student, who may ask, for example, what kind of distribution law holds when a compound is formed in the solid but has no existence in the liquid or vapour states. The reviewer feels that the student reader may easily be left in a state of uncertain confusion. Thus at the beginning of the fourth chapter, dealing with binary compounds, the reader is told that it is " perhaps more correct not to speak of a compound, but of an intermediate crystal phase without a considerable range of solid solubility, since the laws of heterogeneous equilibria state nothing about the molecular condition of the phases." This is a very dangerous statement to leave without further amplification, for the truth is, of course, that whilst the fundamental laws of thermodynamics are universal, their application to chemical equilibria can be made only by introducing explicit assumptions. It may, of course, be argued that discussions of this nature lie outside an elementary book, but in this case the limitations involved should be stated frankly, and the examples confined to simple systems. If complex equilibria such as these between the α, β, γ, and δ phases in brass or bronze are to be considered, the student should not be left with the impression that the fundamental theory is necessarily as simple as in the elementary cases. We may hope therefore that, in later editions, the author will not shirk these difficulties, but will discuss the underlying assumptions of the theory just as clearly as he has explained the detailed application of the Phase Rule to the different systems.—W. HUME-ROTHERY.

Plastic Working of Metals and Power Press Operations. By E. V. Crane. Med. 8vo. Pp. xi + 326, with 254 illustrations. 1932. New York: John Wiley and Sons, Inc. ($4.00); London: Chapman and Hall, Ltd. (25*s.* net.)

In this book the author attempts to deal in some three hundred odd pages with a dozen branches of the subject, the chapter headings being: " Mass Production "; " Essential Metallurgy "; " Shearing Metal in Dies "; " The Shearing Group of Press Operations "; " Bending Operations "; " Expanding, Contracting, and Curling "; " Cold-Working of Plastic Metals "; " The Drawing Group of Press Operations "; " Drawing Speed, Lubrication, Annealing "; " Cold Operations of the Squeezing Group "; " Extrusion "; and " Hot-Press Forging." As a result it has been impossible to give more than a cursory review of some of the processes, extrusion for example being disposed of in a dozen pages. The mechanical and metallurgical problems involved in the various processes are frequently considered together in the same chapter, a feature which interferes to some extent with the pleasure of reading the book, and gives the impression of its being a compilation of a number of separately written articles instead of an orderly development of the subject inferred from the title. There are more than 250 figures, many being blocks of plant, but they are badly reproduced and do not add to the attractiveness of the book.

The book contains much useful information, but the contents are not likely to satisfy anyone specially interested in the subject, and for this reason one of the most valuable additions that might have been made would have been a bibliography of literature, including German and French, where fuller information on the various processes could be found.

—H. W. BROWNSDON.

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

1933 JULY Part 7

I.—PROPERTIES OF METALS

(Continued from pp. 289–293.)

Investigation of Damaged Cables of Overhead-Lines. Fractures Caused by Mechanical Vibrations. Committee for Aluminium Free-Transmission Cables of the Deutsche Gesellschaft für Metallkunde (*Z. Metallkunde*, 1932, **24**, 285–288).—An illustrated report on observations of vibration fractures of overhead lines of copper, aluminium, and Aldrey. Fractures of the cables occurred in nearly all cases in, or very near to, the supports where the static and dynamic stresses are greatest. In this connection determinations of the endurance bending strength were made; the results obtained have been published elsewhere (cf. this *J.*, 1931, **47**, 257). To study the behaviour of wires of copper, aluminium, and Aldrey in the endurance vibration test under conditions which more nearly resemble those in vibrating overhead lines experiments with a new testing machine have been carried out. With the same amplitude, the number of changes of load is smaller for aluminium than for copper; the difference decreases considerably with a decrease in the amplitude. The figures for Aldrey nearly coincide with those for copper. It is concluded that the factors which promote the vibration fractures of overhead lines are of such a diverse nature that the vibration strength of the materials is of minor importance.—M. H.

The Action of Aluminium on Solutions of Metallic Salts. J. Salauze (*Bull. Soc. chim. France*, 1932, [iv], **51**, 1346–1352).—When aluminium powder is placed in copper sulphate solution there is a period of induction of 1–2 hrs., after which a violent reaction occurs. This induction period disappears when the powder is activated by immersion in dilute hydrochloric acid, solutions of acid-reacting salts, boiling solutions of alkali or alkaline-earth chlorides, or solutions containing traces of a gold, platinum, or mercury salt. Activated aluminium reacts quantitatively with solutions of copper, nickel, or cadmium sulphates or lead acetate depositing the dissolved metal in a finely-divided form. With iron salts, only about 50% of the theoretical amount of iron is deposited, owing to the reaction $2Al + 3H_2O = Al_2O_3 + 3H_2$ which occurs since the overvoltage of hydrogen on iron is small.—A. R. P.

Ultra-Violet and Light Reflecting Properties of Aluminium. A. H. Taylor and Junius D. Edwards (*J. Opt. Soc. Amer.*, 1931, **21**, 677–684).—Aluminium reflects ultra-violet radiation more efficiently than any other metal. Tests were made to determine suitable methods of surface preparation for reflectors. Specimens were etched with hydrofluoric acid, sodium hydroxide–sodium fluoride, and a solution of sodium hydroxide and chloride with hydrofluoric acid. The best reflecting surfaces were produced on pure aluminium and aluminium–manganese alloy. The reflection factors for light ranged from 82 to 87% and for ultra-violet radiation from 81 to 82% (λ 2967). The increase in reflection given by etching suggested that the surface film on aluminium is capable of absorbing light and ultra-violet rays.—R. G.

The Magnetic Change of [Electrical] Resistance of a Bismuth Wire. E. Englert and K. Schuster (*Physikal. Z.*, 1933, **34**, 236).—The change of electrical resistance due to a magnetic field is found to be the same for high-frequency a.c. of frequency up to 3×10^8 Hertz as for d.c.—J. S. G. T.

On the Anodic Behaviour of Cobalt. Konrad Georgi (*Z. Elektrochem.*, 1933, **39**, 209–219).—Experiments on the anodic behaviour of cobalt in trichloracetic acid and sodium hydrogen phosphate are described, and the fall in potential when the metal is immersed in a number of salt solutions is plotted against the current density. The explanation put forward for the phenomena observed is comparable with that advocated by Erich Müller for the behaviour of chromium and with that assumed for nickel.—J. H. W.

The Corner Metals of Electrical Distribution: Copper, Aluminium, and Lead. F. J. Brislee (*Chem. and Ind.*, 1933, **52**, 447–451).—A lecture read before the Liverpool Section of the Society of Chemical Industry, discussing the physical and chemical properties, purification, and uses of these metals.—E. S. H.

Elasticity of Copper Sheets. J. Weerts (*Z. Metallkunde*, 1933, **25**, 101–103).—The modulus of elasticity (E) of (1) cold-rolled (96% reduction) and (2) recrystallized, electrolytic copper sheets has been determined in various directions in the rolling plane and the results are compared with values calculated from the modulus of elasticity of single crystals of copper and the crystal orientation of the sheets. In (1), E (in 10^4 kg./mm.^{2}) is 1·09 (minimum) at 45° to the direction of rolling ($E_{\text{calc.}} = 0{\cdot}95$) and 1·40 (maximum) in the rolling and transverse directions ($E_{\text{calc.}} = 1{\cdot}58$) corresponding with a maximum difference of 28 (60)%. In the recrystallized sheet, however, the maximum lies at 1·23 (1·33) at 45° to the direction of rolling, and the minimum at 0·69 (0·68) in the rolling and transverse directions, corresponding with a maximum difference of 80 (96)%.—M. H.

The Effects of Frost on Water-Charged Lead and Copper Pipes. C. E. Larard and F. A. W. Oliver (*Engineering*, 1932, **133**, 673–675).—Copper pipes and lead pipes filled with water and sealed at both ends were placed in a refrigerating tank and the number of refrigerations required to cause the pipes to burst was recorded. Since the damage to the pipe occurs only on freezing of the water the lowest temperature of the freezing tank was – 15° C. After the water has frozen, further reduction of temperature tends to relieve the strain on the walls of the pipe. The results show that no sealed copper pipe of commercial quality withstood more than 2 complete refrigerations of the water in it without bursting. Under similar conditions no lead pipe fractured until at least 5 refrigerations had taken place. It should be noted, however, that fully-annealed, soft copper pipes behaved similarly to the lead pipes, indicating the importance of ductility in determining the number of refrigerations necessary to cause fracture of the pipe. Cf. following abstract.
—W. P. R.

The Effects of Frost on Water-Charged Lead and Copper Pipes. F. Buckingham (*Engineering*, 1932, **133**, 749–750).—A letter to the Editor commenting on a paper by C. E. Larard and F. A. W. Oliver (see preceding abstract). Under service conditions pressures much less than those necessary to cause bulging of a copper pipe would be sufficient to push an ice plug along the pipe and so relieve the pressure. Actual experience indicates that burst copper pipes are not so common an occurrence as burst lead pipes.—W. P. R.

Self-Diffusion in Solid Lead.—II. W. Seith and A. Keil (*Z. Metallkunde*, 1933, **25**, 104–106).—Cf. this *J.*, 1932, **50**, 723. Determinations of the rate of self-diffusion in lead by 2 radioactive methods, gave $1{\cdot}45 \times 10^{-11}$ and $4{\cdot}78 \times 10^{-5}$ cm.^{2}/day, respectively, at 106° and 324° C. The effect of temperature on the diffusion constant is given by the expression: $D = 5{\cdot}76 \times 10^5 \times e^{-14{,}025/T}$. The self-diffusion is practically independent of the structure of the metal.—M. H.

The Physical and Mechanical Properties of Pure Nickel. R. Chavy (*Rev. Nickel*, 1931, **2**, 25–29).—A summary of the principal properties of the pure metal, illustrated by tables and curves. A brief *bibliography* is given.
—W. A. C. N.

Factors Affecting the Ratio of Adsorption of Radium-B and Radium-C on Nickel. J. A. Cranston and C. Benson (*J. Roy. Tech. Coll.* (*Glasgow*), 1933, **3**, (1), 52–56; and (short abstract) *Met. Ind.* (*Lond.*), 1933, **42**, 428).—The ratio of radium-C to radium-B adsorbed on nickel, when immersed in a solution containing both elements, increases progressively with the acidity. The electrode potential existing between the nickel and the solution is found to be a minor factor in determining the ratio of radium-B to radium-C adsorbed, whether the electrode potential is established in electrochemically indefinite or in electrochemically definite systems.—J. W. D.

Researches on Rhenium. O. Huppert (*Z.V.d.I.*, 1931, **75**, 666, and *Technique moderne*, 1031, **23**, 596).—Rhenium is somewhat like tungsten; it is not very ductile, but can be forged and rolled hot. In the form of wire it has an ultimate stress of 50·6 kg./mm.^{2} with an elongation of 24%. Rhenium has an atomic weight of 186·31 and forms hexagonal crystals having a sp. gr. of 20·53. The electrical resistivity is double that of tungsten. Rhenium compounds colour the flame green and give characteristic lines in the green of the spectrum.—H. W. G. H.

Some Observations on Selenium and Selenium Dioxide and the Oxides of Nitrogen. Edward Barnes (*J. Indian Chem. Soc.*, 1932, **9**, 329–333).—Pure selenium is not acted upon by nitric oxide gas; nitrogen peroxide is reduced slowly by selenium to nitric oxide. With nitric acid there is a vigorous reaction.—R. G.

Work-Functions and Thermionic [Constant] and Constant " A " Determined for Thoriated Tungsten. W. B. Nottingham (*Phys. Rev.*, 1930, [ii], **36**, 376).—An abstract of a paper read before the American Physical Society. The work-function of a type *T* thoriated tungsten filament was determined with a 3·5 v. accelerating potential by measuring the thermionic current as a function of temperature over the range 1045°–1340° K. With the filament activated to give the maximum emission at 1100° K. with a 20 v. accelerating potential, the effective work-function ϕ' with 3·5 v. was found to be 2·59 v. From measurements of the current–potential relationship at 1100° K., it was found that the 3·5 v. accelerating potential had reduced the work-function by $\Delta\phi =$ 0·56 v. The work-function at zero field is $\phi' + \Delta\phi = \phi_0 = 3{\cdot}15$ v. Using this value of ϕ_0 and the measured current, the thermionic constant is $A = 59{\cdot}0$. Measurements made with a thorium covering thicker than that required to give the maximum emission as above, gave $\phi' = 2{\cdot}8$ v. with 3·5 v. accelerating potential, $\Delta\phi = 0{\cdot}3$ v. and therefore $\phi_0 = 3{\cdot}1$ v. and $A = 56{\cdot}0$. These data indicate that abnormally low values of A previously reported can be accounted for by the fact that the work-functions were not measured at zero field. Langmuir found the contact potential between thoriated tungsten and clean tungsten to be 1·46 v. Accordingly, the work-function of thoriated tungsten should be $4{\cdot}53 - 1{\cdot}46 = 3{\cdot}07$ v. which agrees with the above.—S. G.

Studies in the Spontaneous Oxidation of Zinc and the Nature of Pyrophoric Zinc. W. S. Sebborn (*Trans. Faraday Soc.*, 1933, **29**, 659–663).—When zinc dust or finely-divided electrolytic zinc is moistened with 10% sodium or potassium hydroxide solution in the presence of air or oxygen and the excess moisture removed by pressing, a vigorous reaction occurs with incandescence, and the metal is completely converted into oxide. No such action occurs in an inert atmosphere or when other solvents for zinc oxide are used instead of the alkali hydroxides. A similar reaction occurs with cadmium under the same conditions, but is much less vigorous owing to the smaller affinity of cadmium for oxygen.—A. R. P.

Remarkable Optical Properties of the Alkali Metals. R. W. Wood (*Nature*, 1933, **131**, 582).—A film of potassium, a few wave-lengths of light in thickness, deposited in a completely out-gassed quartz bulb by condensing at the temperature of liquid air, appears to be completely opaque to sunlight. It is shown that about 25% of the light included in the spectrum range 3000–1860 A. is transmitted. The reflecting power from 3000 A. to 2700 A. is about 75%, indicating that practically no energy is absorbed. Below 2700 A. the reflecting power falls off very rapidly. Interference bands are found in the spectrum of the reflected light.—E. S. H.

Oxidation of Metals Under the Action of Friction. Max Fink and Ulrich Hofmann (*Z. anorg. Chem.*, 1933, **210**, 100–104).—Wear tests with rolls of iron, nickel, and copper in the Amsler machine in air and dry air have shown that friction and wear are due to the formation of dust which consists of iron oxides (Fe_3O_4, Fe_2O_3) and iron, nickel oxides (especially NiO) and nickel, copper oxide, cuprous oxide, and copper. No wear takes place in a nitrogen atmosphere. "Frictional oxidation" is not due to an increase in temperature during the wear test, because it also takes place if the tests are made in liquid air. It seems possible that "frictional oxidation" is due to a mechanical activation of the chemical reaction. For the practical importance of this phenomenon see *Arch. Eisenhüttenwesen*, 1932, **6**, 161.—M. H.

Relative Wear of Metals Due to Abrasion. C. R. Weiss (*Amer. Soc. Mech. Eng., Preprint*, **1932**; and (summary) *Automotive Ind.*, 1932, **67**, 231).—The wear of a large number of ferrous and non-ferrous alloys was determined by noting the loss in weight of blocks lapped by a rotating grey-iron disc. The abrasive used was 80-mesh crystolon and water used as lubricant. "Aluminium-bronzes," phosphor-bronze, and manganese-brass all showed a relatively smaller amount of wear than a large number of ferrous alloys. —W. P. R.

Metal Wear and the Ceramist's Problem. H. W. Gillett (*Ceramic Age*, 1933, **21**, 6–8).—The problem of the wear of metals by abrasion with non-metallic materials and the means of overcoming it is discussed. In some cases, as in the new Hadsel mill, the abrasive material is made to take the brunt of the wear; the metal parts are protected by a layer of the material being crushed, and this material is made to grind against itself instead of against the metal. In choosing metals for resistance to abrasion in the ceramic industries, the soft metals, which can acquire a protective coating of the abrasive, are often precluded because of their insufficient resistance to deformation. Chromium plate or nitrided cases have a limited applicability owing to the tendency to stripping. The practice recommended is to weld in considerable thickness a hard facing alloy to a tough material, which may not of itself be very wear-resistant. Promising materials for the hard facing are the carbides of tungsten, molybdenum, tantalum, vanadium, or chromium, with iron, nickel, or cobalt as the matrix. Cf. following abstracts.—E. S. H.

What Metal Wear Means to the Ceramic Industry. C. E. Bales (*Ceramic Age*, 1933, **21**, 8–9).—Cf. preceding abstract. The wearing of metals in the ceramic industry is a matter of considerable expense, whilst the presence of small abraded particles of metal in the product is undesirable. Illustrations of wear in dry and wet pans, screens, pug mills, brick machine dies, press dies, and auger machines are given.—E. S. H.

Metal Wear and What it Costs. W. C. Rueckel (*Ceramic Age*, 1933, **21**, 9, 25–26).—Cf. preceding abstracts. Data are given, which show the cost of metal wear (per thousand bricks produced) in the various operations of brick-making. An investigation has been commenced, which aims at establishing definite metal specifications for the various types of wear encountered in ceramic plants and comparing the behaviour of these in service. Some preliminary results with alloy steels are reported.—E. S. H.

Two Kinds of Elongation Discriminated in Plastic Deformation. Ryûzaburô Taguti (*Rikwagaku Kenkyû-jo Iho* (*Bull. Inst. Phys. Chem. Res., Tokyo*), 1932, **11**, 576–584; *Japanese J. Phys. Abs.*, 1933, **8**, (2), 24–25).—[In Japanese.] A method has been developed for revealing strain figures produced on tensile test-pieces of well-annealed copper. A resin film was baked on to the surface of the metal and groups of cracks grew in the film at the deformed part of the test-piece. Similar figures were also found in brass, aluminium, zinc, nickel, &c. When the test-piece is deformed within the limit of elasticity, cracks in the resin film show the principal stress lines of tension shown to exist from a photo-elastic study. In the plastic deformation range the film cracks in a similar way to what it does in the elastic range, but cracks in the neighbourhood of the strain figure of materials have an echelon formation. Some conclusions as to the formation of the strain figures, deduced from crack analysis, are given.

On the Theory of Visco-Elasticity : A Thermo-Dynamical Treatment of Visco-Elasticity, and some Problems of the Vibrations of Visco-Elastic Solids. J. H. C. Thompson (*Phil. Trans. Roy. Soc.*, 1933, [A], 231, 339–407).—The introduction to this paper gives a review of previous work on imperfectness of elasticity with numerous references to work on metallic wires. A distinction must be made between statical and dynamical perfectness of elasticity. The practically defined experimental limit of perfect statical elasticity is defined as the greatest limiting strain for which the residual strain (or set) does not exceed 0·03% of the limiting strain. If the true limit has a non-zero value, the classical theory describes accurately the behaviour of a strained solid in equilibrium, but may require modification to describe the dynamical behaviour of a straining solid. If the true limit is zero, plastic effects are always present, and the classical theory always needs modification, but a distinction exists between the behaviour of the solid within and without the practically determined limit as defined above. The paper contains a thermodynamic development of a general theory of imperfect elasticity, usually called visco-elasticity, within the practically defined and experimentally determined limit of perfect statical elasticity.—W. H.-R.

Creep of Metals in Shear at High Temperatures. Franklin L. Everett (*Physics*, 1933, 4, 119–121).—The nature and significance of " creep " of metals in shear at high temperatures are briefly discussed, and experimental determinations of " creep " in thin steel tubes subjected to torsion are discussed. The formula proposed by Bailey, *viz.*, $f = (8{\cdot}7 \times 10^6/e^{0{\cdot}0006}0)(\phi/2)^{0{\cdot}51}$, in which f is the shearing stress in lb./in.², ϕ the rate of creep in strain per hr. at temperature 0° F., and e the base of Napierian logs., is found to fit the results obtained.—J. S. G. T.

Mechanical Behaviour of Metals at Elevated Temperatures. D. Faggiani (*Ingegnere*, **1932**, (10), 702–705).—Formulæ are developed to express the changes which occur in the mechanical properties of metals and alloys, at high temperature.—G. G.

Determination of the Coefficient of Diffusion of Metals in the Solid State. Shinsuke Tanaka and Chujiro Matano (*Proc. Phys.-Math. Soc. Japan* (*Nippon Sûgaku-Buturigakkwai Kizi*), 1930, [iii], **12**, 279–284).—[In English.] See this *J.*, 1931, **47**, 71.—S. G.

Some Theoretical and Practical Aspects of Gases in Metals. J. H. Scaff and E. E. Schumacher (*Bell System Tech. J.*, 1933, **12**, 178–196, and *Bell Telephone System Tech. Publ. Monograph* **B 727**, 1933, 1–19).—See *J.*, this volume, p. 228.—S. G.

The Production of Thin, Free Metal Films. C. Müller (*Physikal. Z.*, 1933, **34**, 340–341).—A method of producing thin films of nickel and iron by the action of carbon dioxide on the gaseous carbonyl of nickel or iron, and of producing thin films of gold by initial deposition on nickel, is briefly described.
—J. S. G. T.

The Effect of Pressure on the Electrical Resistance of Single Metal Crystals at Low Temperature. [Effect of Pressure on Transformation in Cadmium.] P. W. Bridgman (*Proc. Amer. Acad. Arts. Sci.*, 1933, **68**, 95–123).—(1) The effect of hydrostatic pressure, up to 7000 kg./cm.² at − 78° C. and − 183° C., on the electrical resistance of single crystals of the non-cubic metals zinc, cadmium, tin, bismuth, antimony, arsenic, and tellurium has been investigated. Except for arsenic, two orientations were examined for each metal, and from these the fundamental constants were calculated for the directions parallel and perpendicular to the principal axes. As with the cubic metals previously examined (Bridgman, *ibid.*, 1932, **67**, (8)), the general effect is for the pressure coeff. for every orientation to increase numerically with falling temperature. Pressure tends to equalize the resistance in different directions for zinc, cadmium, and antimony, this effect becoming less marked at low temperatures, but, with bismuth and tin, pressure accentuates the differences in different directions, and this effect is greater at lower temperatures. (2) For tellurium measurements were also made up to 12,000 kg./cm.^{2} at 0° C. and 95° C. The effect of pressure is relatively far greater than for normal metals, the resistance at 95° C. and 12,000 kg./cm.^{2} being only about 1% of that at 0° C. and atmospheric pressure. (3) The polymorphic transformation of cadmium, which takes place at about 3000 kg./cm.^{2} at ordinary temperatures, is suppressed at − 78° C., and does not take place up to 7000 kg./cm.^{2}.—W. H.-R.

On the Electromotive Forces Generated by Friction between Two Metals. Daizô Nukiyama (*Proc. Phys.-Math. Soc. Japan* (*Nippon Sûgaku-Buturigakkwai Kizi*), 1932, [iii], **14**, 93–107; *Japanese J. Phys. Abs.*, 1932, **8**, (2), 38).—[In English.] N. studied the e.m.f. between two pieces of metal, in contact and in relative motion, but this paper deals with only a part of his experimental results. All the metals were tested against a steel disc, and it was found that the variation in e.m.f. was characteristic of the metals tested. In some cases the e.m.f. increased with the pressure at the point of contact, whilst in others the e.m.f. was a maximum at a definite value of the contact pressure. The relation between the e.m.f. and the relative velocity of two metals at the point of contact was studied. The experimental results showed that with some metals the e.m.f. increased with the relative velocity but with others attained a maximum value at a definite relative velocity.—Author.

Atomic Moments in Ferromagnetic Metals and Alloys with Non-Ferromagnetic Elements. Edmund C. Stoner (*Phil. Mag.*, 1933, [vii], **15**, 1018–1034).—A summary is given of experimental results for the magnetic moment per atom in ferromagnetic metals at low temperatures, and of the results of Sadron for the change in the average atomic moment due to the substitution of other elements. The view is advanced that the observed values of atomic moment in ferromagnetic elements correspond with an equilibrium resulting from the normal tendency to anti-parallel setting of the spins of interacting electrons being opposed by the tendency to parallel setting. In simple cases, the substitution of foreign elements usually reduces the total moment, the decrease in moment per substituted atom, in Bohr units, being equal to the valency of the atom. This holds closely for copper, zinc, aluminium, and tin in nickel.—J. S. G. T.

Discontinuities of Magneto-Resistance. C. W. Heaps (*Phys. Rev.*, 1933, [ii], **43**, 763–764).—A note. Modern theory suggests that a ferromagnetic body consists of small elements each magnetized to a saturation intensity J, the body as a whole being unmagnetized when the J-vectors are distributed at random. An external field may magnetize the body, (*a*) by reversing the J-vectors which oppose the applied field, and (*b*) by rotating the J-vectors into the direction of the applied field. Experiments are described which show that, when a strained nickel wire is magnetized, discontinuities in magnetization are accompanied by discontinuities in resistance. It is unlikely that the resistance or magnetostriction will be affected by a mere reversal of magnetization, and hence, since the Barkhausen discontinuities are associated with both resistance and magnetostrictive jumps, it is concluded that process (*a*) is not the main cause of the Barkhausen effect.—W. H.-R.

Theory of Energy Distribution of Photoelectrons [Sommerfeld Theory of Metals]. Lee A. Dubridge (*Phys. Rev.*, 1933, [ii], **43**, 727–741).—Photoelectrons emerge from metal surfaces with velocities varying from zero to a more or less sharply defined maximum of which the value varies with the incident light according to the Einstein equation. Theoretical expressions are deduced for the energy distribution of the photoelectrons by an extension of Fowler's (this *J.*, 1932, **50**, 219) development of the Sommerfeld theory. These expressions are examined critically in the neighbourhood of the " maximum energy," and it is concluded that a perfectly sharp maximum exists only at the absolute zero of temperature; even at room temperature there is an uncertainty of several hundredths of a volt in V_{max}. In Part I, D. considers only the energies normal to the emitting surface, and the results are in agreement with experiments on out-gassed molybdenum using parallel plate electrodes. In Part II, expressions are deduced for the total energy, and agree with results for molybdenum using a spherical collector. The experimental details are to be published later.—W. H.-R.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 291–303.)

Studies on the Ternary System Aluminium–Antimony–Magnesium.—I., –II. W. Guertler and A. Bergmann (*Z. Metallkunde*, 1933, **25**, 81–84, 111–116).—(I.—) The constitution of the binary system aluminium–antimony has been studied micrographically and by thermal analysis. The only compound, AlSb (melting point 1050° C.), forms a eutectic with aluminium at 657° C. and 1–2% antimony, and with antimony at 624° C., and about 99% antimony. (II.—) The miscibility gap around the quasi-binary system aluminium–Mg_3Sb_2 extends up to 41% magnesium towards the magnesium corner, to about 78% antimony towards the antimony corner, and nearly reaches the binary system aluminium–antimony between about 10 and 50% antimony. In the system aluminium–Mg_3Sb_2 the miscibility gap extends from about 9% to about 98% Mg_3Sb_2 at the liquidus temperature of 960° C. The phase equilibria in the ternary system have been elucidated by micrographical analysis of slowly-cooled alloys of the different ternary partial systems. Photomicrographs are given.—M. H.

The Structure of Some Ternary Alloys of Aluminium, Copper, and Iron. Keiji Yamaguchi and Isamu Nakamura (*Rikwagaku Kenkyō-jo Iho* (*Bull. Inst. Phys. Chem. Res., Tokyo*), 1932, **11**, 815–833; *Japanese J. Phys. Abs.*, 1933, **8**, (2), 35).—[In Japanese.] The authors determined the constitutional diagram (reproduced in the abstract) by thermal and microscopic analysis. The phase of the ternary system which Gwyer (*J. Inst. Metals*, 1928, **40**, 309) represented by the symbol " N," is an intermetallic compound corresponding with the formula Cu_2FeAl_7, which appears to form small range of solid solutions. This N-phase is formed by a peritectic reaction shown nearly by $2CuAl_2$ (liquid) + $FeAl_3$ (solid) $\longrightarrow Cu_2FeAl_7$ (solid). Another phase of the ternary system, provisionally called " X," more rich in copper than " N," has been recognized. Its form, as the primary constituent, is polygonal, and with an aqueous solution of ferric nitrate or nitric acid it changes to a beautiful brown colour.—S. G.

The Effects of Iron on the Electrical Conductivity and Tensile Strength of Aluminium. Masao Kuroda (*Rikwagaku Kenkyō-jo Iho* (*Bull. Inst. Phys. Chem. Res., Tokyo*), 1931, **10**, 751–753).—[In Japanese.] See abstract from English source, this *J.*, 1932, **50**, 66.—S. G.

The Influence of the Preliminary Treatment on the Mechanical Properties and the Electrical Conductivity of Aluminium Containing Magnesium Silicide. G. Grube and F. Vaupel (*Z. Metallkunde*, 1933, **25**, 106).—See *J.*, this volume, p. 294. A brief supplement.—M. H.

Nickel in Aluminium Alloys. F. Renaud (*Rev. Nickel*, 1931, 2, 67–76).—Generally speaking, the addition of nickel to aluminium alloys is advantageous in modifying certain mechanical properties without necessitating changes in foundry practice, in increasing the tensile strength, or in improving the properties at higher temperatures. R. reviews the most important of the nickel–aluminium bearing alloys—aluminium–copper–nickel; " Y " alloy; " R.R. " alloys, and certain other alloys which bear trade names—and adds tables and other particulars of their physical properties, methods of manufacture, and special features which have to be borne in mind in certain instances. The last section deals with the industrial uses of these alloys, especially for aviation and automobile work.—W. A. C. N.

Examination of Light Piston Alloys. Paul Sommer (*Light Metals Research*, 1933, 2, (25), 1–24, i–ix).—A full translation, accompanied by sketches, of a monograph in *Forschungsarb. Metallkunde u. Röntgenmetallographie*, 1932, (4), 1–47. See this *J.*, 1932, **50**, 726.—J. C. C.

On the Equilibrium Diagram of the Antimony–Manganese System. Takejiro Murakami and Atsuyoshi Hatta (*Sci. Rep. Tôhoku Imp. Univ.*, 1933, 22, 88–100).—[In English.] Thermal analysis, electric resistance measurement, and microscopic examination of this system reveals the existence of the intermetallic phases η(MnSb), ε(Mn_3Sb_2), and δ(Mn_2Sb). The η phase has practically no solubility range and forms a eutectic containing 9·5% manganese with antimony at 570° C. The ε phase is formed by the peritectic reaction, melt $+ \delta \rightleftharpoons \varepsilon$, at 872° C., and has an existing range of 32 to 41% of manganese. The δ phase occurs at 45–50% of manganese at high temperatures, but at 47–48% at the ordinary temperature. The δ phase and β phase (manganese) form a eutectic at 922° C. and 55% manganese. The β phase is the result of a peritectic reaction, melt $+ \gamma \rightleftharpoons \beta$, at 1202° C. At lower temperatures the β phase is resolved into α (manganese) and the δ phases at 677° C. and 94·5% manganese by the eutectoid reaction, $\beta(Mn) \rightleftharpoons \alpha(Mn) + \delta$.—E. S. H.

Beryllium in the Metallurgy of Copper. Anon. (*Cuivre et Laiton*, 1933, 6, 89–92).—Beryllium may be used as a deoxidant or as an actual constituent in beryllium–bronze. In the former case it is very energetic even when added only to the extent of 0·01–0·02%. The usual method of incorporating the beryllium is as a 10% alloy with copper obtained by direct electrolysis. As an alloying element the effect of beryllium is very marked after heat-treatment consisting of heating the alloy to 800° C. for 1 hr. followed by quenching in water or oil and a reheating to 350° C. for 30–45 minutes. Between the two latter operations the alloy may be cold-worked. An alloy containing 2–3% beryllium has, after treatment, a high elastic limit and considerable hardness. The industrial development of the metal is at present limited by its price.
—W. A. C. N.

Beryllium–Copper Wires at Low Temperatures. R. Walle (*Z. Metallkunde*, 1933, 25, 123).—The tensile strength, elongation, and reduction of area of untreated wires (2 mm. in diam.) of the copper alloy with 2% beryllium are 62 kg./mm.², 80·2%, and 58·3%, respectively at room temperature and 69·4 kg./mm.², 22%, and 68·7%, respectively at − 70° C. In the age-hardened state the respective figures are 108·5, 2·2, and 25·2 for room temperature and 118·5, 2·9, and 39·8 for − 70° C.—M. H.

Castings of Beryllium Alloys With Several Different Uses. H. J. Noble (*Iron Age*, 1933, 131, 786).—Abstract of a paper and discussion given before the Hartford Chapter of the American Society for Steel Treating. Beryllium–copper alloys containing 2·5% beryllium are annealed for 1 hr. at 1450°–1500° F. (790°–815° C.) and quenched in water, which puts the beryllium in solid solution. The alloy is then precipitation-hardened at 500°–600° F. (260°–315° C.) for various periods, giving tensile strengths of up to 150,000–

180,000 lb./in.^{2} and Brinell hardnesses of 350–400. The applications of this alloy are described.—J. H. W.

The Influence of Nickel and Silicon on the Miscibility Gap of the Iron–Copper System in the Solid State at Room-Temperature. F. Roll (*Z. anorg. Chem.*, 1933, **212**, 61–64).—The limit of solid solubility of copper in iron-rich iron–nickel and iron–silicon alloys containing about 1·5% carbon has been determined micrographically. The solid solubility of copper in iron is raised much more by addition of nickel than by addition of silicon.—M. H.

Straight Copper–Lead Alloys versus Leaded Solid-Solution Bronzes for Heavy-Duty Bearings. F. R. Hensel and L. M. Tichvinsky (*Trans. Amer. Soc. Mech. Eng.* (*Iron and Steel*), 1932, **54**, (8), 11–24; *C. Abs.*, 1932, **26**, 4574–4575).—A metallurgical investigation of various bronze bearing alloys and a comparative study of their bearing performance for use in heavy-duty bearings led to the following conclusions: The lead content and its distribution in straight copper–lead alloys depend primarily on the casting temperature; with lower temperatures quicker solidification takes place and a larger amount of lead is retained in suspension. Pure copper–lead alloys have a tendency to pronounced lead segregation if the lead content exceeds 25%. Small amounts of impurities have an appreciable effect in retaining a good suspension of the lead in the copper and reduce the influence of the casting temperature on the lead content and its distribution. The physical properties of straight copper–lead alloys are nearly independent of the casting temperature within the range 1050°–1150° C., and depend only slightly on the lead content within the limits of 12–25% lead. The Brinell hardness decreases with increasing lead content. The physical properties of straight copper–lead alloys have values about one-half of those of solid solution bronzes of the same lead content; the electrical conductivity is about six times as high, but is lowered considerably by small amounts of impurities, especially phosphorus and tin. In general, a much better performance was obtained in bearing tests, the temperatures being considerably lower with straight copper–lead alloys than with solid solution bronzes because of their higher heat conductivity and low friction coeff. Bearings with steel backing can be made by a centrifugal casting process. Any speed between 1000 and 2000 r.p.m. may be used for a straight copper–lead bearing, whilst a 2-in. to 3-in. diameter bearing of solid solution bronze should not run higher than 1500 r.p.m.—S. G.

The Copper–Magnesium Alloys Examined Thermodynamically. F. H. Jeffery (*Trans. Faraday Soc.*, 1933, **29**, 550–553).—The constitutions of the liquid and solid solution phases are the simplest possible; both consist of monatomic molecules of copper and magnesium. Thermodynamic consideration of the equilibria in the system leads to conclusions which are in accordance with the work of W. R. D. Jones (this *J.*, 1931, **46**, 395), *i.e.* the existence of $MgCu_2$ and Mg_2Cu is confirmed as well as the absence of a region of solid solution extending on both sides of $MgCu_2$ (cf. G. Grime and W. Morris-Jones, this *J.*, 1929, **41**, 507).—A. R. P.

High Phosphorus Copper Alloys. Anon. (*Metallurgist* (Suppt. to *Engineer*, 1933, **9**, 24–27).—Recent developments in the successful mechanical working of hard and brittle materials are briefly reviewed and a paper by Burkhardt, Linicus, and Sachs (this *J.*, 1932, **50**, 602), dealing with the production of wrought articles from 8% phosphorus–copper alloy is summarized.—R. G.

Copper–Tin Alloys. II.—Bell Metal, Gun-Metal, and Speculum Metal. Anon. (*Tin*, **1933**, April, 15–18).—Bell metal, gun-metal, and speculum metal are copper–tin alloys containing not less copper than a true bronze. The last two also contain varying amounts of zinc. The history, composition range, physical properties, and applications of each of these 3 types of alloy are discussed.—J. H. W.

Ordinary and Special Bronzes. L. Guillet (*Cuivre et Laiton*, 1932, 5, 223–225).—See also *J.*, 1932, 50, 426. A summary of the effects of heat-treatment on various bronzes containing tin between 5 and 21%.—W. A. C. N.

Ordinary and Special Bronzes. L. Guillet (*Cuivre et Laiton*, 1933, 6, 81–82).—Generally speaking, the special bronzes have been less studied than the special brasses, for no apparent reason. Frictional resistance of the bronzes is decreased by the addition of the majority of other metals. Resistance to corrosion is in the main greatest in the case of the α alloys; the presence of a second phase augments the corrodibility. Maximum mechanical properties are normally obtained also with α solid solutions. In the case of copper–tin–aluminium alloys their strength is inferior to that of the binary copper–tin or copper–aluminium alloys. Nickel plays a similar rôle to zinc.—W. A. C. N.

Ordinary and Special Bronzes—Lead–Bronzes. L. Guillet (*Cuivre et Laiton*, 1932, 5, 425–426).—Lead is usually best limited to small quantities in brass and bronze on account of its non-miscibility. For the production of bearing metals, however, where it assumes semi-lubricating properties, lead may be added in greater amounts, up to, say, 30%. The physical properties of some of these alloys are studied.—W. A. C. N.

Influence of Nickel on some Copper Alloys Employed in the Foundry. N. B. Pilling and T. E. Kihlgren (*Rev. Nickel*, 1933, 4, 29–35).—Summaries of two papers presented to the American Foundrymen's Association. (*Trans. Bull. Amer. Found. Assoc.*, 1931, 2, 93–110, and *ibid.*, 1932, 40, 289–305. See this *J.*, 1931, 47, 607; 1932, 50, 772.)—W. A. C. N.

Ordinary and Special Bronzes—Phosphor–Bronzes. L. Guillet (*Cuivre et Laiton*, 1932, 5, 529–530).—The physical and mechanical properties of phosphor-bronzes containing up to 1·17% phosphorus are discussed and tabulated. —W. A. C. N.

New Antifriction Alloys of High Copper Content and Lead Base. The Rôle of Copper in these Alloys. A. Ricard and H. Ackermann (*Cuivre et Laiton*, 1933, 5, 295–304).—A large number of alloys is reviewed—ranging from one containing tin 95·5, antimony 1·2, copper 1·5, and lead 1·43%, which is used in airship construction, through some that are employed in tramways, locomotives, wagons, &c., down to one for goods wagons containing antimony 17, copper 1·5, and lead 81·5%. They are all, in effect, cupriferous white metals. The new alloys, to which special reference is made, contain much higher percentages of copper and much smaller percentages of lead. The advantages of these, together with tables and curves showing their physical properties, are set out in detail. It is considered that the developments in this type of material have not yet reached a maximum.—W. A. C. N.

On the Reciprocal Miscibility of Copper and Lead and Its Influence on the Quality of the Lead-Base Anti-Friction Alloys Containing High Copper Content. A. Ricard and H. Ackermann (*Cuivre et Laiton*, 1933, 6, 83–87).—A micrographic study of these alloys and a comparison with the white-metal bearing materials.—W. A. C. N.

Zinc–Bronzes. L. Guillet (*Cuivre et Laiton*, 1932, 5, 305–306).—The substitution of zinc for small proportions of tin in high-tin bronzes results in a change in microstructure consistent only with the lowering of the tin content. The physical properties, however, change rapidly with increasing percentages of zinc. The influence of zinc on the general characteristics of the commercial bronzes is discussed.—W. A. C. N.

On the Testing of Tensile Strength of Heating Wires at High Temperature. Shinji Togō (*J. Illuminating Eng. Soc. Japan*, 1928, 12, (3), 178–191; *Japanese J. Eng. Abs.*, 1932, 8, 51).—[In Japanese.] The tensile strength of heating wires, imported and made in Japan, was investigated at various temperatures. Specimens made with B & S 23-gauge wires were heated in an electric furnace maintained at a constant temperature. After heating for 1, 3, and 5 hrs., respectively, the tensile strength was measured by means of a spring balance, the applied force being increased at a nearly constant rate. The temperature was measured by means of a platinum/platinum-rhodium thermocouple and a millivoltmeter. It was varied from room temperature up to 1180° C. in steps of 100° C. The tensile strength was also measured at 15-minute intervals, for 5 hrs. at a constant temperature of 1000° C.—AUTHOR.

On the Coefficient of Thermal Expansion of Heating Wires. Shinji Togō (*J. Illuminating Eng. Soc. Japan*, 1928, **12**, (4), 243–247; *Japanese J. Eng. Abs.*, 1932, **8**, 51).—[In Japanese.] The temperature coeff. of thermal expansion of various heating wires were measured by means of a high-temperature dilatometer from room temperature up to 1000° C. They are nearly constant at all temperatures investigated, and have values of from $1{\cdot}92 \times 10^{-5}$ to $2{\cdot}135 \times 10^{-5}$.—AUTHOR.

On the Oxidation Testing of Heating Wires at High Temperature. Shinji Togō (*J. Illuminating Eng. Soc. Japan*, 1928, **12**, (6), 354–362; *Japanese J. Eng. Abs.*, 1932, **8**, 52).—[In Japanese.] A preliminary report of experiments carried out in order to find the relation between the oxidation and the life of heating wires. The degree of oxidation is expressed by the increase in weight per unit area of the outer surface of the wire in mg./cm.^{2}, which is measured by the deflection method of the thermo-balance invented by K. Honda. Samples tested were the same wires which were used in the earlier tests on tensile strength and thermal expansion. After polishing and cleaning the outer surface of the wire the sample, in the form of a coil 0·5 cm. in diam., was put into a porcelain pot, suspended from one end of the balance arm in an electric furnace at a constant temperature of 1180° C. The deflection of the balance was read by a telescope and scale every 5 minutes for 5 hrs. The temperature of the furnace was measured by a platinum/platinum-rhodium thermocouple and a millivoltmeter. From this test it is concluded that: (1) the oxidation of the heating wire varies with the temperature and the time of heating, and the rate of oxidation is characteristic of the material, and it is therefore useless to base the relative values of heating wires on a comparison of the oxidation at a special temperature and time of heating; (2) Nichrome IV and Chromel C were found to have very high resistance to oxidation and the remaining samples have nearly equal values; (3) TA and TC which are made in Japan oxidize more rapidly than the other samples.—AUTHOR.

On the Forced Life Testing of Heating Wires. Shinji Togō (*J. Illuminating Eng. Soc. Japan*, 1928, **12**, (7), 386–399; *Japanese J. Eng. Abs.*, 1932, **8**, 53).—[In Japanese.] A report of part of a life test at 1200° C. on heating wires. The tests were carried out (1) at a constant temperature of 1200° C. and (2) at a constant voltage which gave an initial temperature of 1200° C. to each specimen. The temperature of the wires was measured by means of a Siemens optical pyrometer.—AUTHOR.

On the Electrical Resistance of Heating Wires. Shinji Togō (*J. Illuminating Eng. Soc. Japan*, 1928, **12**, (9), 590–605; *Japanese J. Eng. Abs.*, 1932, **8**, 54).—[In Japanese.] The electric resistances of some heating wires were measured by the potentiometer method. To protect the specimen from oxidation it was placed in a quartz tube filled with nitrogen gas and slowly heated by means of an electric furnace up to 1000° C. and then cooled to room temperature. This process was repeated twice for each specimen. The first heating curve differed from the first cooling curve, depending on the initial heat-treatment of the wire, but the second two curves coincided with the first cooling curve. The specific resistance and the temperature coeff. were calculated from the second curve.—AUTHOR.

The Properties of Monel Metal and Similar Copper-Nickel Alloys. O. Bauer, J. Weerts, and O. Vollenbruck (*Z. Metallkunde*, 1933, **25**, 121–123).—

An illustrated abstract from *Metallwirtschaft*, 1932, **11**, 629–633, 643–649; cf. *J.*, this volume, p. 125.—M. H.

History of Nickel Coinage in Japan. K. Komatsubara (*Japan Nickel Rev.*, 1933, **1**, 24–27).—[In English and Japanese.] Five-sen nickel coins were issued in 1888 to replace 10-sen and 5-sen copper pieces. The first coins consisted of a copper–nickel alloy containing 75% of the former metal. Pure nickel coins are to be substituted for these as from April 1, 1933.—W. A. C. N.

The Electrical Properties of Nickel–Iron Alloys. P. Chevenard (*Rev. Nickel*, 1932, **3**, 55–64).—An account of a long series of researches undertaken by C. on the resistivity, the temperature coeff. of resistivity, and the thermo-electric power of nickel and its alloys. The paper is essentially theoretical in character. It is profusely provided with curves. A long discussion of the experimental technique is first given, and is followed by an account of the polymorphic changes of iron–nickel alloys, and the correlated changes in resistivity and temperature coeff. Generally speaking, it is averred that the electrical properties of the iron–nickel alloys obey the laws of solid solutions and are greatly affected by the polymorphic transformations in the series.
—W. A. C. N.

On Super-Permalloy Invented by Dr. K. Honda and Mr. T. Masuko. T. Futiwara (*Japan Nickel Rev.*, 1933, **1**, 95–96).—[In English and Japanese.] Permalloy, discovered by P. W. Ellmen, is an alloy of iron 30% and nickel 70%, with a small amount of other elements and is heat-treated. Investigations into the properties of this and similar materials resulted in the production of two super-Permalloys—No. 1, consisting mainly of nickel and iron, with cobalt, silicon, and manganese, and No. 2 having the following composition: nickel 40–90%, iron 10–60%, tin 0·1–5·0%, chromium (max.) 5% and less than 2% of other elements, silicon, manganese, or aluminium. Special features of Permalloy are: extremely high magnetic permeability; large initial magnetic permeability by alternating current and small change of initial permeability due to change of frequency; very low coercive force and residual magnetism; small hysteresis and loss by slip; annealing and subsequent slow cooling give maximum magnetic permeability without warping; there is no change by ageing; No. 2 is especially machinable; electric resistance is high. Permalloy is used for loading coils for submarine cables, and for transformers, electricity meters, magnetic needles, and relays.
—W. A. C. N.

Studies of the Process of Precipitation of Age-Hardenable Silicon–Nickel Alloys. O. Dahl (*Z. Metallkunde*, 1932, **24**, 277–281).—Nickel–silicon alloys with 5·6 and 6·6% silicon were quenched at 950° C. and (1) aged at 450° C. for 49 hrs. and subsequently aged at 490°, 530°, 570°, 610°, and 650° C., (2) aged at 450° C. for different periods and then aged at 570° C. for 4 hrs., (3) aged at 525° C. for different periods and then aged at 625° C., (4) alternately aged at 450° and 570° C., (5) consecutively aged at different temperatures between 525° and 775° C. The change in Brinell hardness and electrical resistance was measured at intervals during all treatments. For the results which are rather involved the original paper must be consulted; they are in accordance with the "precipitation" theory of age-hardening in its most general form.—M. H.

On the Equilibrium Diagram of the Binary System Nickel–Zinc. Kanzi Tamaru (*Rikwagaku Kenkyō-jo Iho* (*Bull. Inst. Phys. Chem. Res., Tokyo*), 1932, **11**, 772–784).—[In Japanese.] See abstract from an English source, *J.*, this volume, p. 15.—S. G.

The Constitution of the Nickel–Zinc Alloys. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 19–21).—A critical discussion and summary of a paper by K. Tamaru, *Sci. Rep. Tôhoku Imp. Univ.*, 1932, **21**, 344; See *J.*, this volume, p. 15.—R. G.

The Alloys of Praseodymium and Aluminium. G. Canneri (*Alluminio*, 1933, **2**, 87–89).—The equilibrium diagram of this system has been thermally and microscopically investigated. There are 3 compounds: PrAl, $PrAl_2$, and $PrAl_4$, the last-named existing in two modifications. Chemical and physical properties denote a perfect analogy between praseodymium and lanthanum.—G. G.

The Relation between Mean Atomic Volume and Composition in Silver–Zinc Alloys. E. A. Owen and Llewelyn Pickup (*Proc. Roy. Soc.*, 1933, [A], **140**, 344–358).—The mean atomic volumes of the different phases in the silver–zinc alloy system have been determined for a temperature of 380° C. by means of X-ray precision analysis. To make alloys in the α-phase region it was necessary to make diffusing mixtures of silver and zinc particles at about 450° C. The "as cast" alloys in this region gave no reflection lines, owing to lattice distortion. Owing to transformation of the β-phase into $(\alpha + \gamma)$ at 264° C., no reflection lines of the β-phase could be obtained by quenching alloys from above this temperature. The mean atomic volume in pure phases, at a constant temperature, changes almost linearly with composition, becoming less in the α-, γ-, and δ-regions with increasing zinc content. In the mixed regions, it remains constant for both phases. Phase boundaries are in general agreement with those at present accepted for the silver–zinc system at 380° C. The analogy between the copper–zinc system and the silver–zinc system of alloys is discussed.—J. S. G. T.

Corrigenda to "Investigations on Age-Hardening Phenomena in Britannia Metal." M. von Schwarz and O. Summa (*Z. Metallkunde*, 1933, **25**, 123).—Cf. *J.*, this volume, p. 302.—M. H.

Properties of Zinc-Base Die-Castings. Anon. (*Met. Ind.* (*N.Y.*), 1932, **30**, 470–472).—See *J.*, this volume, p. 73.—A. R. P.

The Physical Properties of Refractory Compounds. Karl Becker (*Physikal. Z.*, 1933, **34**, 185–198).—The production of refractory carbides, nitrides, and borides, their lattice structure and density, hardness, tensile strength, melting point, rate of evaporation, and coeff. of expansion, electrical conductivity, superconductivity, electronic emission, magnetic and optical properties, binary and ternary systems, are discussed. In addition, similar data relating to alloys of tungsten carbide and tantalum carbide with cobalt and metals of the iron group, respectively, are briefly discussed. A *bibliography* comprising 99 references to literature on the subject is appended.—J. S. G. T.

Bullet-Resisting Alloys. Kôtarô Honda (*Japan Nickel Rev.*, 1933, **1**, 17–23).—[In English and Japanese.] The efficiency of a shield plate in resisting penetration by a rifle bullet was measured by determining the energy absorbed when the bullet passed through such a plate. The change in velocity undergone by the bullet on penetration is directly related to the energy absorbed. The apparatus used is described and illustrated. Data for shields of 0·2% carbon steel and of a laminated shield having plates of similar composition are given. The latter is inferior to the former when of equivalent thickness. In addition, shields of various non-ferrous alloys were tested. A good shield plate must have great hardness combined with toughness.—W. A. C. N.

The Age-Hardening of Metals. Paul D. Merica (*Aciers spéciaux*, 1933, **8**, 50–61).—Conclusion of a paper read before the American Institute of Mining and Metallurgical Engineers. See *J.*, this volume, pp. 74, 238.—J. H. W.

Ageing and Age-Hardening in Metals. C. H. Desch (*Met. Ind.* (*Lond.*), 1933, **42**, 3–5, 10).—Address to a Joint Meeting of the Scottish Local Section of the Institute of Metals and the Institution of Engineers and Shipbuilders in Scotland. The general mechanism of age-hardening in metals due to the precipitation of a constituent is explained and the phenomenon in the case of

Duralumin, the copper–beryllium alloys, nitrogen-hardening of iron and blue-brittleness of iron is described.—J. H. W.

Inverse Segregation.—I. H. Sutton (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 22–24).—A review of published work on the subject, including recent papers by Woronoff and by Bohner.—R. G.

Contribution to the Study of the Castability of Ternary Alloys. Albert Portevin and Paul Bastien (*Compt. rend.*, 1933, **196**, 1396–1398).—If Θ and F are the temperatures of pouring and of the beginning of primary crystallization, respectively, the castability, A, is proportional to $\Theta - F$. The tin–bismuth, bismuth–lead, and lead–tin alloys follow the laws previously enunciated (*ibid.*, 1932, **194**, 850). Investigations on the ternary alloy, tin–bismuth–lead support the conclusions that: (*a*) the castability of the ternary eutectic is an absolute maximum by comparison with the castabilities of the binary eutectics; (*b*) the castability of the ternary eutectic varies inversely as the interval of primary crystallization, the interval of secondary crystallization only having a subsidiary effect. These conclusions suggest corrections to be made to the solid solution region of the equilibrium diagram, as was indicated by Shepherd (*J. Phys. Chem.*, 1902, **6**, 519).—J. H. W.

The Effect of Cold-Working on the Magnetic Susceptibility of Metals. Kôtarô Honda and Yosomatsu Shimizu (*Rikwagaku Kenkyō-jo Iho* (*Bull. Inst. Phys. Chem. Res. Japan*), 1931, **10**, 442–462).—[In Japanese.] See this *J.*, 1932, **50**, 116, 150.—S. G.

Permeability and Hysteresis in Magnetization in the Preferred Energy Direction. F. Preisach (*Z. tech. Physik*, 1932, **13**, 514–516).—An abstract of a paper published in *Physikal. Z.* (see *J.*, this volume, p. 74).—J. W.

On the Relationship between Solid Solutions and Mixtures of Crystals, and the Conditions under which True Equilibrium between Mixtures of Crystals and Solutions can be Experimentally Realized. Vitalius Chlopin (Experimental portion with A. Polessitsky, A. Ratner, and P. Tolmatscheff) (*Ber.*, 1931, [B], **64**, 2653–2666).—An investigation of the applicability of the Nernst–Berthelot law of partition in certain solution systems, especially of barium and radium salts. Two types of "mixed crystal" are distinguished; the stable type is regarded as a special case of the solid solution. A generally applicable process for conveniently and rapidly establishing equilibrium between mixtures of crystals and their parent solutions is described.—P. R.

Phase Transformations. J. Weerts (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 15–16).—A summary of a paper by W. in *Z. Metallkunde*, 1932, **24**, 265; see *J.*, this volume, p. 12.—R. G.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 303–307.)

[Contribution] to the Knowledge of the Grinding and Polishing Process. L. Hamburger (*Z. Metallkunde*, 1933, **25**, 29–32, 58–62).—Earlier work on the problem of the change of the nature of metallic surfaces by polishing is critically discussed; a large number of references are given. Polishing is primarily and essentially a process of abrasion which is combined with effects of adsorption. Delicate polishing of medium hard metals results in the removal of very minute particles having a size of 3–30 atoms. In a later phase of the process some of the separated particles fill up the pits existing in the surface. In the resulting brilliantly polished film the average particle size is small in comparison with the wave-length of visible light, but large in relation to atomic dimensions. The carefully polished surface layer of a crystalline substance consists of lamellæ of similarly arranged crystallites of amicroscopic size. The polish passes over into the interior of the metals through a transition layer of relatively great thickness, whereby the structure shows a gradual change. The nature of polished layers is complicated, partly by adsorption and inclusions of foreign substances, partly by the presence of more or less disturbed transition spots between the very numerous crystallites and more generally by a physical metastability.—M. H.

A Type of Fracture of Cast Metals and Alloys. Ichirô Iitaka (*Proc. Imp. Acad.* (*Tokyo*), 1931, 7, 337–340; *Japanese J. Phys. Abs.*, 1933, 8, (1), 5).—[In English.] The fractures of many metals and alloys, both ferrous and non-ferrous, were investigated. They were classified into 4 types: (1) Transgranular. Separation occurs along cleavage planes or "Spaltfläche"; fineness of fracture coincides with grain-size. (2) Transgranular. Slipping occurs along slip planes; fracture is finer than grain-size; fineness is equal to the width of one to three slip bands. (3) Transgranular. Breaking occurs along dendrite stems and their big branches; fineness is quite independent of grain-size and coincides with dendrite size. (4) Intergranular. Breaking occurs along grain boundaries; fineness coincides with grain-size. Type (3) was discovered by the present author, and the relation between fineness and width of slip band in Type (2) was also found by him.—AUTHOR.

Etched Figures of α-Brass. Keiji Yamaguchi (*Rikwagaku Kenkyô-jo Ihô* (*Bull. Inst. Phys. Chem. Res., Tokyo*), 1930, 9, (3), 203–210).—[In Japanese.]—S. G.

Microstructure of Some Magnetic Alloys of High Platinum Concentration. F. W. Constant (*Phys. Rev.*, 1930, [ii], 35, 116; *Bur. Chem. Abs.*, 1931, [A], 1364).—Alloys containing 5 and 10% cobalt are solid solutions; no evidence of eutectic structure is obtained. Cubic formations are shown by many of the crystals.—S. G.

Photomicrography with the 365 mμ Mercury Arc Line. A. P. H. Trivelli and L. V. Foster (*J. Opt. Soc. Amer.*, 1931, 21, 124–131).—Experimental work was carried out with a quartz mercury vapour lamp of atmospheric pressure type, and a non-spherical aplanat of aperture *f*/1 in place of the condenser. Two special objectives were worked out of 16 mm. and 1·7 mm. focal length which could be focussed definitely for λ 365 mμ, the visual examination being done with a mercury green filter, and the 365 filter substituted without change of focus. It was found that sandalwood oil was superior to cedar oil for immersion work in view of the high absorption of λ 365 mμ by the latter. With the apparatus and light used a considerable increase in resolution was obtained. The system has the advantages of not requiring quartz lenses and of simple focussing, providing an approach to those of ultra-violet photomicrography. The examples illustrated are by transmitted illumination.—R. G.

The Investigation of Thin Surface Films by Means of Reflected Polarized Light. Leif Tronstadt (*Trans. Faraday Soc.*, 1933, 29, 502–514).—An optical system is described and illustrated for the examination of surface films on metals by reflected polarized light, the theory of the method is discussed, and some of its applications are described. Alternating activation and passivation of iron and nickel results in the development of a film which is rendered visible through interference colours and is the cause of the passivity, thus confirming the oxide film theory of passivity. This optical method also affords evidence for the adsorption of gases on metal surfaces, and is therefore of importance in studying catalysis.—A. R. P.

Note on the Broadening of X-ray Lines of Cold-Worked Aluminium. L. Thomassen and J. E. Wilson (*Phys. Rev.*, 1933, [ii], 43, 763).—A Note. Samples of 99·97% pure aluminium were severely cold-worked by compression at room temperature, and at − 75° C., and X-ray diffraction photographs were then taken. The specimens worked at room temperature gave lines as sharp as those from annealed aluminium, but a distinct broadening of the lines was found for the specimens worked at − 75° C.—W. H.-R.

On the Arrangement of Microcrystals in a Fractured Single-Crystal Aluminium Wire. Kanekoto Fujii (*Mem. Coll. Sci. Kyoto Imp. Univ.*, 1930, **13**, 101–108; *C. Abs.*, 1930, **24**, 5195).—[In German.] The arrangement of the microcrystals formed when a single-crystal aluminium wire is broken in tension was determined by means of X-rays. The crystal fragments form an imperfect fibre structure on that plane perpendicular to the (221) plane which makes the smallest angle with the wire cross-section. Near the point of fracture the wire extends 120–130%, and the crystal fragments on either side have suffered rotation of about 95° at this point.—S. G.

Grain Boundary Effects as a Factor in Heterogeneous Equilibrium of Alloy Systems. Arthur Phillips and R. M. Brick (*J. Franklin Inst.*, 1933, **215**, 557–577).—An X-ray examination of aluminium-rich copper alloys has been undertaken in order to investigate whether, in alloys showing limited solid solubility, it might be possible to demonstrate an appreciable difference in concentration of the solute atoms in the two regions. Assuming a different solubility limit in the granular and boundary material, the solubility limits of any polycrystalline material should depend not only on the temperature, but also on the grain-size. The results obtained indicate a difference in parameter values between single crystals, and coarse and fine polycrystalline materials, at all temperatures. These results are confirmed by measurements of electrical conductivity.—E. S. H.

Notes on the Crystal Structure and Lattice Constant of Mercury. M. C. Neuburger (*Z. anorg. Chem.*, 1933, **212**, 40–44).—According to repeated determinations of a number of investigators the crystal lattice of mercury must be considered to be rhombic with one atom in the elementary cell. The best figure for the lattice constant is that of Mehl and Barrett: $a = 2{\cdot}999$ A. at − 46° C., $d_{\text{calc.}} = 14{\cdot}24$ at − 46° C. The smallest atomic distances are $d = 2{\cdot}999$ A., $e = 3{\cdot}463$ A., $f = 4{\cdot}581$ A. The atomic radius is $r = 1{\cdot}500$ A. —M. H.

Osmiridium.—I.; II.—X-Ray Investigation. (I.) O. E. Zviagintzev. (II.) O. E. Zviagintzev and B. K. Brunovskii (*Z. Krist.*, 1932, **83**, 172–186, 187–192; *C. Abs.*, 1932, **26**, 5877).—The earlier work on osmiridium is reviewed. The wide range of analyses indicates solid solution rather than definite compounds. Ruthenium may be present up to 19·1%. Determinations of sp. gr. are low because of gas bubbles. Variations in composition cause practically no change in axial ratio, and only slight changes in cell dimensions. For pure osmium $a = 2{\cdot}716$ and $c = 4{\cdot}331$ A.—S. G.

On the Constitution of Metallic Sodium. E. Wigner and F. Seitz (*Phys. Rev.*, 1933, [ii], **43**, 804–810).—Theoretical. The lattice constant, heat of vaporization, and compressibility are calculated approximately for crystalline sodium by an application of the quantum mechanics. It is assumed that the K and L electrons are not affected by the metallic bond, and that their wave functions are the same as in the free atoms. The free valency electrons are treated by a method similar to that proposed by Hund (*Z. Physik*, 1927, **40**, 742; 1932, **74**, 1), and more lately applied by Lenz (*Z. Physik*, 1932, **77**, 713) and Yensen (*ibid.*, 1932, **77**, 722) to ionic lattices, and by Lennard-Jones and Woods (*Proc. Roy. Soc.*, 1928, [A], **120**, 727) to two-dimensional metallic lattices. For the free electrons the wave function continues periodically through the crystal, and the electron has a smaller kinetic but a larger negative potential energy in the lattice than in the corresponding state in the free atom. It is concluded that even when the Pauli principle is taken into account the binding energy remains positive. The calculated values are in satisfactory agreement with the experimental determinations.—W. H.-R.

The Crystals of Zinc Coating the Surface of Iron Plate. Yoshiaki Matsunaga (*Mem. Coll. Sci. Kyoto Imp. Univ.*, 1931, [A], **14**, 263–266; *C. Abs.*, 1932, **26**, 4284).—[In English.] Zinc crystals deposited on the surface of an iron plate by hot-dipping were examined by means of X-rays, and Laue photographs were made. Single zinc crystals are oriented in such a way that their basal plane is inclined to the surface of the iron plate at an angle of about 18°.—S. G.

Fibrous Structure of Cold-Worked Metals. Keiji Yamaguchi (*Rikwagaku Kenkyō-jo Ihō* (*Bull. Inst. Phys. Chem. Res., Tokyo*), 1932, **11**, 741–760; *Japanese J. Phys. Abs.*, 1933, **8**, (2), 35).—[In Japanese.] Assuming that each of the crystalline grains constituting a metal deforms by the same mechanism as a single crystal, the fibrous structure determined by experiments corresponds to the case in which the outward deformation is similar to the deformation of the individual grain or to the compound deformation of 2 grains. In other words, each grain is so oriented as to deform simply without receiving the effect of slip interference of the adjacent grains. In such a metal as α-iron, having the crystalline structure of a body-centred lattice, the mechanism of deformation becomes rather complex owing to mechanical twinning, but the result is similar. When 2 crystalline grains lie side by side, the deformation of the contact plane must be the same for each grain if they deform simply without slip interference of the contact plane. From this point of view was conjectured the restriction that the normal to the contact plane must be equally inclined to the slip directions and slip planes of 2 crystals respectively. Again, in order that the contact plane should always be parallel to a certain crystallographic plane, this may possibly be a plane containing 2 slip directions, but this may not necessarily be compatible with the condition stated above. As one example, Y. mentioned that when an aluminium single crystal is stretched towards [110], a certain part deforms by slip plane (111) and slip direction $[01\bar{1}]$ and another by $(11\bar{1})$ [011], and the contact plane of the 2 parts is (100), satisfying the above two conditions, whilst the former crystal changes into the alternate lamellæ of two kinds of orientation by way of the deformation.—AUTHOR.

Selective Lattice Distortion in Wires under Torsion. W. A. Wood (*Nature*, 1933, **131**, 842).—X-ray investigation of wires of copper or nickel under torsion shows that distortion of the lattice is produced. As the torsional stress is increased gradually, the rate of broadening of the lines indicates that the (420) planes are distorted more rapidly than the (331) planes. Further, the lines do not broaden continuously, but in alternating periods in which their definition is partly recovered. It is probable that with increasing stress the distortion grows to the maximum characteristic of the metal, and that the more highly distorted grains disrupt and tend to recrystallize.—E. S. H.

Diffraction of Electrons by Metal Surfaces [Evidence for Amorphous Metal]. L. H. Germer (*Phys. Rev.*, 1933, [ii], **43**, 724–726).—(1) A beam of fast electrons directed on polished surfaces of nickel and tungsten formed no diffraction patterns in agreement with the work of Thomson (*Proc. Roy. Soc.*, 1930, [A], **128**, 658). When the polished surfaces were scratched with emery paper, a strong diffraction pattern was produced when the scratches were normal to the plane of incidence, and a very much weaker pattern when they were parallel to this plane. (2) No diffraction patterns were formed by electron beams grazing the surfaces of copper and nickel wires drawn through perfect dies, but strong diffraction patterns were produced from wires drawn through a broken die so that the surfaces contained minute projecting fins. (3) Diffraction patterns were obtained from etched surfaces which appeared matte or frosted, but not from those with smooth, metallic lustre. (4) G. concludes that diffraction patterns are formed only by transmitted electrons, and that there is no considerable layer of amorphous material (Beilby layer) on polished or highly worked surfaces.—W. H.-R.

The Mosaic Structure of Crystals. F. Blank (*Physikal. Z.*, 1933, **34**, 353–368).—Literature relating to the effect of the mosaic structure of crystals on the physical properties of crystals is reviewed. The basis of the subject is the suggestion put forward by Zwicky that lines of juncture between crystal units constitute a different structure from the units themselves. Microscopic, magnetic, electrical, and thermal investigations are briefly reviewed and a bibliography comprising references to 55 papers referred to in the text is appended.—J. S. G. T.

Energy Changes Related to the Secondary Structure of Crystals. F. Zwicky (*Phys. Rev.*, 1930, [ii], **36**, 378).—An abstract of a paper read before the American Physical Society. Theoretical considerations have led Z. to the postulate of a secondary structure (Π) of large spacing, which is superposed on the primary structure (p) of crystals. According to the theory, the Π-atoms are usually more densely packed than the p-atoms. It is $|E_\pi| > |E_p|$, where E_π and E_p are the respective atomic energies corresponding to the two structures. The p-atoms are therefore more easily removed from the crystal than the Π-atoms. Conditions may be reversed, however, by a plastic deformation, inasmuch as this process diminishes $|E_\pi|$ into $|E_\pi'|$ but does not change E_p. These conclusions lead at once to an understanding of evaporation, etching, and certain chemical reaction phenomena involving both plastic and plastically deformed crystals. As a practical criterion of the perfection or imperfection of a lattice, the inequalities $|E_\pi'| \gtrless |E_p|$ may be used. More detailed considerations are of course required to distinguish crystals of the "metallic" type, which are both macroscopically and microscopically plastic from other types like NaCl which are macroscopically plastic but microscopically brittle. The theory further leads to the interesting conclusion that a volcaic p.d. should be found between Π-planes and p-planes amounting in general to about 0·001–0·01 v.—S. G.

On the Plasticity of Crystals [Secondary Structure of Crystals]. F. Zwicky (*Phys. Rev.*, 1933, [ii], **43**, 765–766).—A note. Z. supports his theory of secondary structure in crystals as opposed to Smekal's (*Phys. Rev.*, 1933, [ii], **43**, 366) view that the difference between ideal and actual crystals are due to imperfections in the latter.—W. H.-R.

On the Theory of the Linear Velocity of Crystallization of Undercooled Melts and of Undercooled Solid Modifications. M. Volmer and M. Marder (*Z. physikal. Chem.*, 1931, [A], **154**, 97–112).—With respect to the linear rate of crystallization two formulæ are deduced and compared with measurements with glycerol.—B. Bl.

On the Theory of Crystal Growth. H. Brandes and M. Volmer (*Z. physikal. Chem.*, 1931, [A], **155**, 466–470).—Mathematical deductions show that, in the case of the 001 face of a sodium chloride crystal, the two dimensional formation of nuclei begins preferably at the corners and edges of that face.—B. Bl.

Condensation on Crystals. M. Volmer and W. Schultze (*Z. physikal. Chem.*, 1931, [A], **156**, 1–22).—Some conclusions from the theory of two-dimensional formation of nuclei.—B. Bl.

A Decade of Applied X-Ray Research. George L. Clark (*Chem. and Ind.*, 1933, **52**, 317–325, 336–346).—A lecture, which includes a review of work done on the structure of metals and alloys.—E. S. H.

A Method of Obtaining the Hull–Debye–Scherrer Pattern of Cathode Rays. Kyuzi Matukawa and Ken'ichi Shinohara (*Proc. Phys.-Math. Soc. Japan (Nippon Sûgaku-Buturigakkwai Kizi)*, 1930, [iii], **12**, 171–175; *C. Abs.*, 1931, **25**, 247).—[In English.] Platinum, gold and silver sputtered on glass plates were investigated with cathode rays. Fine diffraction rings were obtained and tables of their values are given.—S. G.

IV.—CORROSION

(Continued from pp. 307–309.)

Corrosion. Use of Aluminium for Liquid Fuel Containers. A. Audigé (*Rev. pétrolifère*, 1932, 10–11; *C. Abs.*, 1933, 27, 2416).—Corrosion at low temperatures is attributed chiefly to $MgCl_2$ and $CaCl_2$, FeS being only a secondary catalyst. Oxygen plays an important part. At higher temperatures corrosion is favoured more by mechanical or physical than by chemical effects, particularly by the attachment of carbon dioxide and hydrogen sulphide bubbles to the metallic surface.—S. G.

The Corrosion at Riveted Joints in Duralumin Constructions. G. W. Akimov (*Korrosion u. Metallschutz*, 1932, 8, 309–313).—Considerable corrosion occurs around the rivets in Duralumin constructions owing to the difference in potential between the sheet and the rivet; this difference is attributed to the different copper content of rivets and sheet, and experiments show that no corrosion occurs when the difference in the copper content is less than 2·5%. Rivets with a lower copper content than the sheet behave as anodes, and those with a higher copper content as cathodes.—A. R. P.

Modern Light Alloys with Particular Reference to Corrosion. L. Aitchison (*Met. Ind.* (*Lond.*), 1933, 42, 323–324, 330).—Abstract of a paper read before the Scottish Local Section of the Institute of Metals. The developments in improving the useful properties of light alloys are outlined. Pure aluminium and those magnesium-bearing alloys that require no heat-treatment usually offer the best resistance to corrosion. Of the heat-treated alloys, those which age-harden at ordinary temperatures are the most resistant. The least resistant are those which have had their maximum strength vigorously increased by precipitation heat-treatment.—J. H. W.

Corrosion Research on Light Metals. Freeman Horn (*Light Metals Research*, 1933, 2, (26), 2–20).—Full report of a paper read before the Chemical Engineering Group of the Society of Chemical Industry. See *J.*, this volume, p. 307.
—J. C. C.

Contribution to the Problem of the Solubility of Lead in Water. Julius Zink (*Z. anal. Chem.*, 1933, 91, 246–257).—The solubility of lead in water is appreciably reduced by the presence of bicarbonates, but considerably increased by free carbonic acid which forms the relatively soluble salt $Pb(HCO_3)_2$. Sulphates in the water reduce the rate of attack on lead in the presence of the HCO_3' ion. The bearing of these facts on the use of lead for water pipes is discussed.—A. R. P.

Lead and its Alloys for Cable Sheath. Hisakichi Shimba (*J. Inst. Teleg. Eng. Japan*, 1928, (68), 520–551; *Japanese J. Eng. Abs.*, 1932, 8, 64).—[In Japanese.] In the first part, S. discusses the effects and influence of constituent elements such as tin, antimony, and cadmium of less than 5% contents, the extrusion temperature and low-temperature annealing, on the mechanical properties of various alloys. The discussion is extended to age-hardening of lead–antimony alloys. He then deals with the measurement of the modulus of elasticity and other mechanical properties such as hardness and tensile strength of pure lead and an alloy of lead containing 3% tin at a high temperature. In the last part, the results are given of corrosion tests on pure lead, 3% lead–tin alloy, and 1% lead–antimony alloy. In these tests, in which more than a dozen dilute solutions of corrosive reagents were used, the corrosion of these materials by immersion was determined by loss in weight measurements. From the results of these, the following conclusions were arrived at: (1) In general, there is not much difference in corrosivity between the 3% lead–tin alloy and the 1% lead–antimony alloy. In nitric acid solution, however, the lead-antimony alloy is most readily attacked, followed by the lead–tin alloy, the pure lead being least affected.

The 1% lead-antimony alloy corrodes in this solution 5 times, and the 3% lead-tin alloy 1·6 times, as much as pure lead. (2) Pure lead is attacked by calcium hydroxide solution more readily than its alloys. Care must be exercised, therefore, where pure lead-covered cable is likely to come in contact with concrete or Portland cement. (3) Inorganic acid solutions (except sulphuric acid) and liquid organic acids, actively corrode lead and its alloys; a solution of solid organic acid has no effect on them.—AUTHOR.

The Dissolution of Magnesium in Aqueous Salt Solutions. I.—Effect of Impurities. L. Whitby (*Trans. Faraday Soc.*, 1933, **29**, 415–425).—The rate of dissolution of 4 grades of magnesium, all of more than 99·90% purity, has been measured in 0·1*N*-, *N*-, and 3*N*-sodium chloride solutions and in 0·05*N*-hydrochloric acid. In the salt solutions large variations in the rate of dissolution were obtained which are attributed to the differences in composition of the samples; in hydrochloric acid, however, dissolution always proceeds at the same rate. The effects of hard-working and of annealing are very slight, but the presence of manganese accelerates the attack with time. When freshly cleaned magnesium is immersed in salt solutions, hydrogen is rapidly evolved from innumerable points distributed at random over the surface, but after a short time these centres of attack diminish in number and the interstices exhibit a yellowish-brown interference colour. In about 1 hr. the hydrogen comes from only a few points, which appear as branches of thin black lines, the brown film becomes thicker, and finally a thin loose layer of magnesium hydroxide is formed. After prolonged attack, the black lines become patches, from which the hydrogen continues to evolve until perforation occurs; further corrosion proceeds by under-cutting of the film and proceeds outwards from the perforations. A tentative explanation of the mechanism of this process is given.—A. R. P.

Dissolution of Magnesium and Magnesium-Base Alloys by Natural and Artificial Sea-Waters. L. Whitby (*Trans. Faraday Soc.*, 1933, **29**, 523–531).—The corrosion of magnesium, of Elektron AZM, AM 503, and VI, and of one type of Duralumin has been examined in 0·5*N*-sodium chloride solution, in natural and in artificial sea-water. The results show that the sea-waters are much less corrosive than pure sodium chloride solution; this difference is due to the presence of sulphates, especially calcium sulphate, in the sea-waters. Addition of traces of saponin increases the rate of evolution of hydrogen from salt solutions by magnesium and its alloys; this behaviour is held to indicate the presence of obstructive hydrogen films on the metals. In salt spray and total immersion tests the losses in weight of the magnesium alloys were of the same order of magnitude as for pure magnesium.—A. R. P.

Metallic Contamination in [Milk] Processing. W. L. Davies (*Milk Ind.*, 1933, **13**, 55–57).—Raw milk normally contains 0·30–0·75 parts per million of copper and 1·18–2·52 parts per million of iron. An increase of copper content to 1·5 parts per million is sufficient to taint milk kept at 0°–5° C. within 24 hrs., a "tallowy" flavour being developed. The contents of copper and iron in milk have been determined at the following stages of processing: (*a*) in the raw milk, (*b*) after the pasteurizer, (*c*) after the holder, (*d*) after the cooler, (*e*) in the bottled product. Copper and iron contents generally increase together throughout the process, but the amount of iron taken up is insufficient to affect the flavour of the milk. Hot milk of uniform temperature, containing no dissolved oxygen, is not contaminated if the holder is properly tinned. In the cooler, detinning usually occurs at the top, where the hot milk enters, and is probably due to differences of potential caused by the variable temperature and oxygen concentration of milk in contact with the same surface.—E. S. H.

On the Resistance of Various Common Metals to the Aggressive Action of the Vapours of Phenol and Cresol. Otto Haehnel (*Korrosion u. Metallschutz*, 1932, **8**, 260–263).—Tin, aluminium, and brass are quite unaffected by moist air containing the vapours of phenol or *ortho*-cresol, copper is very slightly corroded, iron and zinc are more strongly corroded, and lead is severely corroded. Phenol is much less active than cresol on all the metals.—A. R. P.

Soil Survey with Shepard Rods. A. V. Smith (*Amer. Gas J.*, 1932, 137, (5), 21).—Paper read before the American Gas Convention, October, 1932. It is concluded that soil resistivity rods can afford useful information in soil corrosion studies provided consideration is given to the physical conditions of the soil surrounding the pipe.—J. S. G. T.

Notes on a Distribution System Soil Survey. A. B. Allyne (*Gas Age-Record*, 1932, 70, 207–208, 219).—Particulars of an extensive soil survey in California, employing the Shepard earth resistivity meter, are given.—J. T.

Soil Studies for Existing Pipe-Line Systems. William Thompson Smith (*Gas Age-Record*, 1932, 70, 369–370, 382, 390).—The immediate study of the corrosiveness of soils in which pipe lines are laid is advocated.—J. S. G. T.

A Soil Corrosion Survey with Shepard Soil Resistivity Rods. A. V. Smith (*Gas Age-Record*, 1932, 70, 403–408).—A fairly extensive survey leads to the conclusion that Shepard resistivity rods are reliable for the identification of corrosive conditions whether in acid or alkaline soil.—J. S. G. T.

A New Theory of Corrosion of Alloys. G. Akimov (*Korrosion u. Metallschutz*, 1932, 8, 197–205).—According to A.'s extension of the electrochemical theory of corrosion to the case of alloys the type and location of corrosion is due to potentials set up by the positions of the atoms in the lattice, or by heterogeneity produced by grain boundaries, the presence of solid solutions or compounds or differences in the physical state of various parts of the alloy. Potentials may be altered by the formation of films or by changes in the nature of the corrosive solutions. Anodic and cathodic areas may be predicted according to the following theory. Assuming that in a certain electrolyte the potentials of a series of connected electrodes 1, 2, 3 . . . N are V_1, V_2, V_3 . . . V_N respectively and that $V_1 < V_2 < V_3 \ldots . < V_N$, then an electrode X which is the external member of the series will be an anode when $V_N - V_X > V_X - V_1$ and a cathode when the converse is true. When $V_N - V_X = V_X - V_1$ the electrode X will divide the series into two and $V_X = \frac{1}{2}(V_N + V_1)$. Thus only an increase in cathode area results in increased corrosion, the anode area being inert in this respect. Experiments with aluminium alloys containing copper and zinc have confirmed the theory; thus, addition of zinc to aluminium reduces the resistance to corrosion. (Cf. following abstract.)—A. R. P.

On Akimov's Theory of Structure Corrosion. H. Röhrig (*Korrosion u. Metallschutz*, 1932, 8, 313–314).—Some examples are quoted in support of Akimov's theory (preceding abstract). In etching metallographic sections of aluminium alloys the $CuAl_2$ crystals in aluminium–copper alloys and the silicon and $FeAl_3$ crystals in commercial aluminium remain bright and unattacked, whereas the less noble ground-mass of aluminium-rich solid solution is dissolved. The formation of protective films does not always proceed over the entire surface. In the corrosion of aluminium sheet in 3% sodium chloride solution containing hydrogen peroxide a bright fringe appears around the silicon and $FeAl_3$ crystals, since the hydrogen evolved from them prevents the development of the black film which forms on other parts of the sheet.—A. R. P.

Generalization of the Electrochemical Theory of the Corrosion of Metals. E. Herzog (*J. Chim. phys.*, 1932, 29, 367–368).—Abstract of a lecture delivered to the Société de Chimie Physique.—E. S. H.

Accelerated Corrosion at Work. Anon. (*Inco*, 1932, 11, 21).—A description of the conditions resulting in rapid local corrosion of a steel bolt holding down the bed of a Diesel engine in a motor lighter. The corrosion occurred at a joint between the oak rib of the hull and the outer planking. The bolts have been replaced with copper–nickel alloy.—R. G.

Corrosion Fundamentals. C. E. Beynon (*Chem. and Ind.*, 1933, **52**, 359–362).—A lecture read to the South Wales Sections of the Society of Chemical Industry and of the Institute of Chemistry.—E. S. H.

Experimental Methods for the Study of Corrosion. J. C. Hudson (*Chem. and Ind.*, 1932, **51**, 975–976).—A lecture to the Birmingham and Midland Section of the Society of Chemical Industry.—E. S. H.

V.—PROTECTION

(Other than Electrodeposition.)

(Continued from pp. 309–310.)

On the Protection of Aluminium and Light Metal Alloys by Organic Coatings. Fritz-Jürgen Peters (*Metallbörse*, 1932, **22**, 1469–1470).—The selection of suitable paints for aluminium is restricted owing to the high coeff. of expansion of the metal which causes peeling of the paint film when subjected to large variations of temperature. Good adherence is obtained only if the metal is first provided with an inorganic film, *e.g.* by anodic or chemical oxidation. Methods of preparing the surface for painting and of testing the corrosion-resistance of the paint films are described. Red-lead paints should not be used, but white-lead paints provide good protection. Titanium white, iron oxide, alumina, and zinc yellow in linseed oil are also suitable, but zinc white gives brittle films. Cellulose lacquers are not satisfactory, but paints with an asphalt or a bitumen base are excellent.—A. R. P.

Oxide Coatings on Aluminium. J. D. Edwards, Martin Tosterud, and H. K. Work (*Elect. Eng.*, 1932, **51**, 778–780; *C. Abs.*, 1933, **27**, 52).—Characteristics of the oxide film and some of its many uses are described. Breakdown voltage of oxide films is roughly proportional to the thickness of the film, and is dependent on the specific physical and chemical characteristics of the film. The oxide coat is harder than the base metal. Certain types can be coloured readily with dyes and mineral pigments.—S. G.

Effect of Concentration of Electrolyte on the Formation of the Anodic Film on Aluminium. Shoji Setoh and Akira Miyata (*Rikwagaku-Kenkyō-jo Iho* (*Bull. Inst. Phys. Chem. Res. Japan*), 1932, **11**, 317–382).—[In Japanese.] See *J.*, this volume, p. 194.—S. G.

Effects of Anodic Treatment on the Abrasion and Corrosion of Aluminium. Shoji Setoh and Akira Miyata (*Rikwagaku-Kenkyō-jo Iho* (*Bull. Inst. Phys. Chem. Res. Japan*), 1932, **11**, 483–496; *C. Abs.*, 1933, **27**, 1276).—[In Japanese.] Cf. *J.*, this volume, p. 194. Anodic treatment of aluminium-rich alloys, particularly Silumin, "Y"-alloy, Lautal, and "No. 12" alloy, increases the resistance to abrasion. Thicker films or steam treatments do not increase this effect. Subsequent steam treatment increases the passivity to N-hydrochloric acid. Alloys with 5% copper contain $CuAl_2$ and are weaker after anodic treatment, but stronger after subsequent steam treatment.—S. G.

Protection of Metallic Surfaces Against Corrosion. G. Bargellesi (*Industria Meccanica*, **1932**, 381–385).—The uses of copper plating as direct protection, or as a base for further deposits, plating baths, and mechanical copper plating are discussed briefly.—G. G.

Music Wire Springs. I. V. Williams (*Bell Laboratories Record*, 1933, **11**, 134–136).—Service tests on compression springs wound from music wire protected with various electrodeposits showed that nickel- or zinc-plated springs withstood more reversals than springs plated with a double layer consisting of nickel on copper, which was formerly standard. Hot-tinning has the disadvantage of invariably producing uneven annealing which results in a non-uniform product.—J. C. C.

Tentative Recommended Practice for Safeguarding Against Embrittlement of Hot-Galvanized Structural Steel Products and Procedure for Detecting Embrittlement (A 143–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 162–165; and *Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 615–618).—Embrittlement rarely manifests itself except at points which have been cold-worked or where there has been stress concentration. Reduction in ductility depends on the type, nature, and size of the steel sections. Pickling may result in hydrogen embrittlement. Ageing in service or heating to 300° F. (150° C.) brings about complete recovery. Unless material has received severely localized cold-working, the operation of galvanizing does not materially reduce ductility. The tendency towards brittleness in galvanized steels is the greater the lower the temperature. Only open-hearth steels should be used for galvanizing if they are to be subjected to cold-work, without further annealing, before dipping. On testing, the elongation is specified to be not less than 5%, and the sum of the percentage elongation and the average percentage reduction in thickness shall exceed 10. The manner of testing is described.—W. A. C. N.

New Method of Heating Galvanic Baths. Anon. (*Emailletech. Monats-Blätter*, 1931, 7, 119–120; *Ceram. Abs.*, 1932, 11, 483).—After a discussion of the older heating devices for galvanizing baths, a new electric heating device is described in detail.—S. G.

Combating Rust with Metallic Finishes. R. B. Mears (*Bell Laboratories Record*, 1933, 11, 141–144).—Corrosion tests on steel samples protected with various finishes have been in progress for 3 years on a roof in New York City both under normal weather conditions and sprayed with water thrice daily. Loss of weight determinations made every 2 months have shown no correlation between relative corrosion rates under the two conditions, except among various zinc coatings. In the normal exposure tests, sprayed nickel and Monel metal failed within 2 months, but sprayed aluminium showed no change beyond discoloration after 3 years. Hot-dipped lead and tin weathered slowly but now show pinholes. Sprayed, electrodeposited, hot-dipped, sherardized, and galvannealed (galvanized, heat-treated) zinc coatings, and electrodeposited zinc–mercury alloy coatings all weathered at the same rate. Thickness appears to be the chief factor governing the life of any zinc coating, however applied. Electrodeposited cadmium, which is much superior to zinc in the salt-spray test, unexpectedly weathered twice as rapidly.—J. C. C.

Aircraft Finishing. M. R. Whitmore (*Indust. and Eng. Chem.*, 1933, 25, 19–23).—Read before the American Chemical Society. The available protective coatings for the framework and surfaces of army aircraft may be divided into 3 groups, *viz.* organic coatings, metallic coatings, and chemical or electrochemical treatments. Each type is used, and in practically all cases a paint coating is applied to the metal, previously treated by one of the other methods. Practically all steel, brass, and bronze parts and surfaces are cadmium-plated, and all aluminium and aluminium alloy parts are anodically treated. Various tests made of the effect of dissimilar metals and of the durability and other characteristics of paint coatings are described and illustrated.
—F. J.

Treatment of Feedwater. A Report of the Prime Movers Committee, Engineering National Section, National Electric Light Association [U.S.A.]. —— (*Nat. Elect. Light Assoc. Publ.* No. 235, 1932, 1–24; and (abstract) *Power Plant Eng.*, 1932, 36, 487–489).—Operating experience, data, and comments on the following subjects are included: caustic embrittlement, carry over, practical methods used in control of boiler water. Caustic embrittlement is said to be due to stress plus chemical attack. Various methods of determining water in steam are mentioned. A summary of the boiler-water tests undertaken by various companies is given in tabular form. Details of the methods employed in determining these factors are included in the report.—W. A. C. N.

The Deterioration of Boiler Metal. H. E. Wallsom (*Fuel Economist*, 1933, 8, 451–452).—Continued from pp. 377–378. See *J.*, this volume, p. 243. The significance of the definition of regions of protection of boiler metal in terms of the H-ion concentration of the water used is briefly discussed.—J. T.

Painting Aluminium. Junius D. Edwards and Robert I. Wray (*Indust. and Eng. Chem.*, 1933, **25**, 23–26).—Read before the American Chemical Society. The painting of aluminium and its alloys is discussed under the following heads, *viz.* paint adhesion, surface preparation, accelerated corrosion tests, priming paints, finishing coats, and clear finishes.—F. J.

Application of Finishing Materials on Zinc. Milford H. Corbin (*Indust. and Eng. Chem.*, 1933, **25**, 32–34).—Read before the American Chemical Society. Causes of breakdown of paint films, use of inhibitors to retard decomposition of lacquers, and mechanical and chemical treatments of zinc surfaces before applying finishing materials are discussed.—F. J.

Accelerated Tests for Metal Preservatives for Sub-Sea Water Service. H. A. Gardner and G. G. Sward (*Amer. Paint Varnish Manuf. Assoc. Circ.* No. **417**, 1932, 263–266; *C. Abs.*, 1933, **27**, 197).—Ordinary accelerated weathering methods employing light and water do not give results on paint on metal comparable to actual exposure. Good results are obtained by exposing the coated panels to the sun during the day and immersing them in a 3% salt solution during the night. Some results on paint containing rust-preventive pigments in linseed oil and in linseed oil–alkyd vehicles are given.—S. G.

Enamel as a Protection against Corrosion. —— Altmannsberger (*Emaillewaren-Ind.*, 1932, **9**, 360–361; *Ceram. Abs.*, 1933, **12**, 47).—The protection of metals against corrosion by enamelling is described. The suitability of various enamels for different purposes is discussed.—S. G.

Enamel as a Protection against Corrosion. H. Kalpers (*Glashütte*, 1933, **63**, 112–113; *C. Abs.*, 1933, **27**, 2549).—The corrosion of metals, especially of cast iron and steel plate, is prevented by an enamel coat. This protection of metallic surfaces depends on the production of a uniform enamel layer without defects. The testing of cracks, adherence, corrosion stability, acid stability, &c., is described.—S. G.

VI.—ELECTRODEPOSITION

(Continued from pp. 310–314.)

The Control of Electrodepositing Solutions. XV.—The Chromium Solution (1). Samuel Field (*Met. Ind.* (*Lond.*), 1933, **42**, 547–548).—The necessity for analyzing chromium baths is emphasized and the determination of the total chromic acid by titrating the solution against ferrous ammonium sulphate using potassium ferricyanide as an indicator and by the potassium permanganate method are described.—J. H. W.

On Defective Deposits of Chromium. O. Macchia (*Industria chimica*, 1932, **7**, 275–283).—The causes of the most frequent defects in chromium plate are enumerated and discussed.—G. G.

Chromium Plating in the Blown, Pressed-Glass Industry. K. Illig and W. Birett (*Ceram. Ind.*, 1929, **13**, 170–176).—A review.—S. G.

The Electrodeposition of Iron–Cobalt Alloys.—II. S. Glasstone and J. C. Speakman (*Trans. Faraday Soc.*, 1933, **29**, 426–429).—Cf. *J.*, this volume, p. 29. Experiments on the same lines as previously reported have been made, but at temperatures of 50° and 90° C. The results show that the compositions of alloys deposited from buffered solutions containing various proportions of ferrous and cobalt sulphates tend towards a constant value as the current density is increased, this value being independent of the p_H of the electrolyte. A tabulated comparison is made of the three series of alloys: iron–cobalt, iron–nickel, and cobalt–nickel; alloys deposited at all current densities show gradations in properties in harmony with this natural order. —A. R. P.

On the Deposition of Copper and Silver from Solutions of their Iodides. M. Schlötter, Joachim Korpiun, and Werner Burmeister (*Z. Metallkunde*, 1933, **25**, 107–111).—The conditions are given under which commercial deposits of silver and copper can be obtained by the electrolysis of their iodides dissolved in alkali and alkaline-earth iodide and bromide solutions. Under unsuitable conditions deposits are formed which in appearance and properties differ considerably from normal deposits owing to adsorption of silver or copper iodide. X-ray analysis and microscopic examination have shown that part of the iodide or iodine is dissolved in the crystal lattice of the silver or copper, and part dispersed in the deposit. Removal of the iodide by heating results in a return of the normal metallic properties of the deposits.—M. H.

Electroplating Solution Control. L. E. Stout (*Metal Cleaning and Finishing*, 1932, **4**, 607–610; *C. Abs.*, 1933, **27**, 1277).—A procedure is outlined for the determination of copper, free and total cyanide, and carbonate in a cyanide copper bath.—S. G.

On the Electrodeposition of Metallic Niobium and Its Separation from Tantalum. N. Isgarichev and A. F. Prede (*Z. Elektrochem.*, 1933, **39**, 283–288).—The process of the electrodeposition and separation of niobium consists of the pretreatment of the ore, the preparation of the niobium–tantalum concentrate, analysis, and electrolysis in either alkaline (potassium hydrate) or acid (oxalic or citric acid) solutions. The results of various conditions of the solution and of the current density and pressure are given.—J. H. W.

New Platinum Plating Process. Anon. (*Brass World*, 1932, **28**, 250).—See *J.*, this volume, p. 30.—J. H. W.

The Crystal Structures of Electrodeposited Alloys. An X-Ray Diffraction Study of Silver–Cadmium Deposits. Chas. W. Stillwell and Lawrence E. Stout (*J. Amer. Chem. Soc.*, 1932, **54**, 2583–2592; and (abstract) *Met. Ind.* (*Lond.*), 1932, **41**, 206–208; *C. Abs.*, 1932, **26**, 5237).—Electrodeposited silver–cadmium alloys from 96·0% cadmium to 31·0% cadmium are discussed. Deposits are either solid solutions or compounds. For any given composition the phase stable in a thermal alloy is the predominant phase in electrodeposited alloys. Because of appreciable amounts of phases not found in a thermal alloy of the same composition, the complete composition of the electrodeposited alloy cannot be predicted.—S. G.

The Structure of Electrodeposited Alloys. II.—The Effect of Current Density and Temperature of Deposition on the Structure of Silver–Cadmium Deposits. Charles W. Stillwell and Henry I. Feinberg (*J. Amer. Chem. Soc.*, 1933, **55**, 1864–1870).—A continuation of previous work on electrodeposition from the cyanide bath of Stout and Thummel, using sheet copper cathodes and Duriron anodes. X-ray diffraction data are given for deposits of silver–cadmium made at various current densities from 0·1 to 1000 amp./dm.^{2}, and 27° and 90° C. The metals were always deposited as solid solutions or compounds, whether the deposit was clean and metallic or of the non-adherent type containing hydroxide. The phases electrodeposited were roughly in agreement with the thermally prepared alloys, with some exceptions, but were heterogeneous. Low current densities gave the more homogeneous deposits.—R. G.

Aluminium Sulphate. Its Use and Action in Zinc Plating Baths. Anon. (*Chem. Trade J.*, 1932, **91**, 549).—Zinc sulphate baths containing aluminium sulphate have a number of advantages over alkaline cyanide baths, since they yield thick homogeneous, white, smooth deposits free from blemishes in a relatively short time at room temperature. The baths contain 50–60 parts of zinc sulphate to 2–6 parts of aluminium sulphate, and the acidity is adjusted to p_H 3 by addition of zinc carbonate or sulphuric acid as required; iron must be rigorously excluded from the electrolyte. The beneficial action of the aluminium salt is ascribed to its effect on the refining of the grain-size. —A. R. P.

A Simple Method for the Determination of the Acidity of Electrolytic Baths. G. Gollnow (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 9–10).—The colorimetric determination of p_H is described briefly.—A. R. P.

Practical Plating. Preparation of Work. III.—Pickling. E. A. Ollard (*Met. Ind.* (*Lond.*), 1933, **42**, 549–550).—See *J.*, this volume, p. 314. Pickling is used to remove heavy scale from unpolished metal, to remove superficial oxide films and to etch polished material. When removing scale with acids, a "restrainer," such as glue-size, is used to reduce the action, probably by retarding the evolution of hydrogen. Polished articles must be very carefully cleaned. The anode pickle is usually used for steel, the current density being 100 amp./ft.^{2} at 5–6 v. in a solution of sulphuric acid of 50°–55° Bé.
—J. H. W.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-Refining.)

(Continued from p. 311.)

Hydrogen Over-Voltage of Lead–Antimony Alloys.—I. Yogoro Kato and Iwajiro Nakanishi (*Toyoda Kenkyu Iho* (*Bull. Toyoda Res. Lab. Japan*), 1932, **1**, 72–77; *Japanese J. Phys. Abs.*, 1933, **8**, (2), 39).—[In Japanese.] This investigation was carried out in order (1) to test the existence of a high over-voltage for the lead–antimony alloys and especially for Pb_4Sb, which was suggested by Raeder and Brum (*Z. physikal. Chem.*, 1928, **133**, 15) and (2) to ascertain whether there is any specially low over-voltage for the constituent metals or their alloy. The low over-voltage for lead, antimony, or their alloys may give rise to the self-discharge on the negative plate of the lead accumulator, hydrogen being generated on the part of the low value. The voltage necessary for the formation of the first bubble on the round end of specimens under a constant current density in $2N$-H_2SO_4 solution was determined. Different specimens of lead, antimony, and their alloys were made by slow and rapid cooling (for example, molten lead was poured in cold water, in a copper tube immersed in cold mercury, and in a copper casting of good size). Those of lead and of antimony were also made by electrodeposition on lead and antimony, respectively. The results of the investigation may be summarized as follows: (1) The over-voltages of lead, antimony, and their alloys differed very little from each other with an exception which is to be mentioned. (2) The over-voltage of electrodeposited antimony was especially low; its difference from the mean of other values amounted to 0·3 v. This is very interesting, as it may account for the self-discharge referred to above. (3) No high over-voltage of lead–antimony alloy, as pointed out by Raeder and Brum, was observed. Cf. following abstract.—AUTHORS.

Hydrogen Over-Voltage of Lead and Antimony and Their Alloys.—II. Yogoro Kato and Risaburo Takase (*Toyoda Kenkyu Iho* (*Bull. Toyoda Res. Lab. Japan*), 1932, **1**, 78–86; *Japanese J. Phys. Abs.*, 1932, **8**, (2), 40).—[In Japanese.] The aim of this investigation was to confirm the results described in the first paper (preceding abstract). The methods of measurement of over-voltage and of preparation of specimens differed from those previously described. In this investigation values of the voltage necessary to maintain a definite current density on the cathode of a specimen were plotted against the latter, and a curve was obtained for the same specimen. The different curves for the various specimens were drawn on a sheet of paper. The distance between any two curves shows the difference of over-voltages of the respective specimens. The specimens were made by different processes from those used in the previous work. Single crystals were also made for lead. The results do not differ substantially from those summarized in the preceding paper.—AUTHORS.

The Relative Conductivity of Electrolytes by Resistance Measurements of Hydrogen-Containing Palladium Wire. C. A. Knorr and E. Schwartz (*Z. Elektrochem.*, 1933, **39**, 281–283).—The connection between the relative conductivity of electrolytes and resistance measurements of palladium wire containing hydrogen immersed in them has been investigated. The alteration of the conductivity of the electrolyte caused by polarization results in a temporary increase in the apparent resistance of the wire. The conductivity is greater the greater the activity of the wire and the more hydrogen the wire contains.—J. H. W.

A Detailed Study of Sodium Amalgam Formation from Sodium Chloride Solutions. K. S. Tesh and H. E. Woodward (*Trans. Electrochem. Soc.*, 1932, **61**, 397–403; discussion, 403–404).—See *J.*, 1932, **50**, 252.—S. G.

VIII.—REFINING

(Including Electro-Refining.)

(Continued from pp. 314–315.)

Sulphate Roasting of Copper Ores and Economic Recovery of Electrolytic Copper from Chloride Solutions. Edgar A. Ashcroft (*Electrochem. Soc. Preprint*, 1933, May, 229–250).—By the use of oxygen or air enriched with oxygen in the roasting of copper ores practically all the copper can be converted to water-soluble sulphate at 600° C. From the solutions obtained by leaching, the copper is precipitated with sponge iron and dissolved in cupric chloride solution, the resulting cuprous chloride solution being electrolyzed for pure copper. In the electrolysis half the copper is deposited from cuprous ions, and the remainder oxidized to cupric chloride, which is reduced again by the cement copper. The electrolyte contains per litre 150 grm. of copper, 300 grm. of chlorine as sodium or calcium chloride, and a little free sulphuric or hydrochloric acid; the current density is 1·5–2·5 amp./dm.^{2}, the terminal voltage 0·8–1 v., and the amount of copper deposited 2·3 grm. per amp.-hr.
—A. R. P.

The Development of the Electrolytic Method for the Extraction of Copper at the "Norddeutsche Affinerie," Hamburg. W. Schopper (*Cuivre et Laiton*, 1932, **5**, 179–182).—An historical account of the development of the process at this particular works. Present-day practice is included.—W. A. C. N.

Electrolytic Refining of Copper Using Complex Salt of Cuprous Chloride.—VI. Naoto Kameyama and Kei Onoda (*Kōgyō Kwagaku Zasshi* (*J. Soc. Chem. Ind. Japan*), 1930, **33**, (3); *C. Abs.*, 1930, **24**, 3176).—[In Japanese, with English summary in supplemental binding, pp. 101–102.] Cf. this *J.*, 1930, **43**, 609; 1930, **44**, 624. As a continuation of previous work, chlorides of nickel, zinc, iron, and lead were added to the complex cuprous chloride electrolyte, and the quantities of these metals deposited with the copper were determined. The temperature of the electrolytes was usually 50° C., current density 2 amp./dm.^{2} with 0·12–0·13 v. across the bath. The stock electrolyte contained 42–52 grm. Cu/kg. H_2O as cuprous chloride complex, besides free chloride, hydrochloric acid, and a small quantity of gelatin. When the metals were present to the extent of 11 weight-% of the copper present and electrolysis was carried out for 44 hrs., a deposit of 105 grm. copper being obtained (except where lead was present as 11% of the weight of copper, when 48 hrs. electrolysis gave only 83·44 grm. copper), the percentage contents of metals in the cathodes were nickel 0·0002, zinc 0·005, iron 0·002, and lead 0·007. From these results it is concluded that these metals can be eliminated successfully from crude copper by this method of refining.—S. G.

Electrolysis of Fused Salts and the Secondary Reactions. L. Andrieux (*Light Metals Research*, 1931, **1**, (12), 2–6).—An abridged translation from *J. Four Elect.*, 1931, **40**, 60–61, 98–100, 139–140, 177–180, and also published in *Chim. et. Ind.*, 1931, **25**, 1047–1057. See *J.*, this volume, p. 34.—J. C. C.

IX.—ANALYSIS

(Continued from pp. 315–322.)

Spectroscopic Investigations. XI.—New Contributions to the Method of Quantitative and Qualitative Spectrographic Analysis. Walther Gerlach and Konrad Ruthardt (*Z. anorg. Chem.*, 1932, **209**, 337–355).—The sputtering arc (Abreissbogen) has proved a particularly suitable excitation method for the spectrographic analysis of metals and solutions and examples are quoted. General and practical hints are given for qualitative spectrographic investigations with especial reference to a number of difficult qualitative problems in metal analysis, *e.g.*, detection of Cu in Pt, Pb in Pt and Ag, and Sb in Cu; detection of Pd and Co; examination of the purity of Pt (cf. this *J.*, 1932, **50**, 167).—M. H.

Development and Position of Quantitative Spectrum Analysis. II.—Spectrographic Metal Investigation in Practice. O. Findeisen (*Z. Metallkunde*, 1933, **25**, 12–16).—The different methods of quantitative spectrum analysis—(1) de Gramont's method of the comparison spectra, (2) Gerlach and Schweitzer's absolute method of homologous line pairs, (3) Scheibe and Neuhauser's rotating logarithmic sector method—are discussed. Some examples of the application of quantitative spectrographic analysis are described, *e.g.*, determination of Pb and Sn in Zn die-castings by method (1), determinations of Sn in Pb cable sheath, of the purity of Pb, and of Ni in an Al piston alloy by method (3).—M. H.

Some Notes on the Problem of Quantitative Spectrographic Analysis. O. Feussner (*Z. Metallkunde*, 1933, **25**, 73–75).—The importance of reproducible discharges of the arc for quantitative spectrographic analysis is stressed and the different methods of production of electric arcs are critically discussed. A new device for the production of a rather well reproducible "Überschlagsfunken" is described. Some practical hints are given.—M. H.

Analytical or Quantitative Spectral Lines of Rhenium. S. Piña de Rubies (*Anales Soc. Españ. Fis. Quim.*, 1932, **30**, 918–921; *Rev. Sci. Instruments*, 1933, **4**, 163).—A general method of quantitative spectrochemical analysis is described, of which the essential feature is the determination of the number of sensitive lines which will appear for a given concentration of the minor constituent of any impure specimen. Spectrograms are made from prepared samples made up in concentrations from 1 part in 100 down to the limit of sensitivity in steps differing by a factor of 10. The test spectrogram is then matched against the spectra of these samples to determine the concentration. In order always to duplicate conditions of observation, NaCl is taken as the major constituent and the same quantity of the sample is always placed in the source of radiation. The range of investigation has been confined to the region between 2350 and 3350 A. The method has been applied to a determination of the sensitive lines of Re in this region. A number of new lines of Re have been measured.—S. G.

Qualitative Analysis by Electrolysis and Spectrography. A. Schleicher (*Z. Elektrochem.*, 1933, **39**, 2–7).—The principles of micro-analysis by means of electrolysis and spectrography are explained. Metals are divided into 2 groups, according to whether they are separated in acid or ammoniacal solutions. The details of the process in each case are described. The spectrographic method enables metals to be detected to the extent of 1 part in 10^6 or 10^7. The advantages of the method are discussed.—J. H. W.

Tentative Revisions of A.S.T.M. Standards. Standard Methods of Chemical Analysis of Ferro-Alloys (A 104–27). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1129; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 985).—A revision in the form of separate tentative specifications entitled "Methods of Chemical Analysis of Ferro-Tungsten and Ferro-Molybdenum" (A 104-32 T) is intended, when adopted as standard, to replace the present standard methods (see following abstract).—S. G.

Tentative Methods of Chemical Analysis of Ferro-Tungsten and Ferro-Molybdenum (A 104-32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 197-205; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 641-649).—Reference is made to Specification A 104 for the determination of W, but special notes refer to the substitution of $HClO_4$ for H_2SO_4 in the breaking down of the material. Traces of Mo are determined colorimetrically. An accuracy of but 0·2% is all that can be expected in the direct determination of W in high-grade metal. Si is determined from the loss in weight after treating the separated mixture of W and silicon oxides with HF. S is estimated by dissolving the alloy in a mixture of HNO_3 and HF, adding KNO_3 and $HClO_4$ and evaporating until strong fumes of the latter are given off. The sulphates are then removed in a dilute solution of cinchonine in HCl and precipitated in the ordinary way. Cu, Sn, and Sb are separated and estimated according to standard methods. In the analysis of ferro-molybdenum, the use of a flux such as ingot iron or red lead is advised in the direct determination of C. Precautions must also be taken to remove all traces of sulphurous gases. The determination of Mo by titration with $KMnO_4$ is described. S, P, and Cu, it is suggested, may be dealt with by ordinary procedure.—W. A. C. N.

Tentative Revisions of A.S.T.M. Standards. Standard Methods of Chemical Analysis of Manganese-Bronze (B 27-19). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1137-1138; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 993-994).—A change is proposed in the description of the method for the determination of Mn by the persulphate method.—S. G.

A Practical Method for the Analysis of Some Metallic Powders of Industrial Use. P. Galimberti (*Ann. Chim. Appl.*, 1932, **22**, 497-500).—A simple apparatus for the measurement of the H_2 evolved when the powder is treated with acid is described.—G. G.

Indicators. G. A. Elliott (*Chem. Eng. Min. Rev.*, 1933, **25**, 130-136).—Read before the Chemical Society of Western Australia. The action of indicators and the meaning of p_H numbers are explained, the ranges of indicators commonly used are tabulated, and the requirements of good indicators and their applications are discussed.—J. H. W.

A Method for the Preparation of Telluric Acid. L. I. Gilbertson (*J. Amer. Chem. Soc.*, 1933, **55**, 1460-1461).—Te is readily oxidized in H_2SO_4 solution by 30% H_2O_2. Two volumes of H_2O_2 with one volume of concentrated H_2SO_4 are refluxed with the sample. The active oxidizing agent is permonosulphuric acid.—R. G.

Polarographic Studies with the Dropping Mercury Cathode. XXV.—An Investigation of Solutions of Gallium, Titanium, Vanadium, Niobium, and Tantalum. S. Zeltzer (*Coll. Trav. chim. Tchécoslov.*, 1932, **4**, 319-334).—[In English.] Ga deposits at − 1·08 v. (from the N-$HgCl_2$ electrode) from dilute solutions of $GaCl_3$ in 0·001N-HCl and at − 1·5 v. from NH_3 solutions; no deposition occurs from NaOH or KOH solutions. The presence of Ga in Al may be detected polarographically. In acid solutions $Ti^{\cdot\cdot\cdot\cdot}$ salts produce an increase of current at − 0·8 v. due to reduction to $Ti^{\cdot\cdot\cdot}$, V_2O_5 is reduced to V_2O_4 at 0·0 v. and to V_2O_2 at − 0·8 v., and Nb_2O_5 is reduced at − 0·83 v. in HNO_3 but not in HCl solutions. Ta^V is not reduced by the dropping Hg cathode.—A. R. P.

Polarographic Studies with the Dropping Mercury Cathode. XXVI.—The Decrease of Hydrogen Over-Potential Effected by Traces of Platinum. I. Šlendyk (*Coll. Trav. chim. Tchécoslov.*, 1932, **4**, 335-349).—[In English.] Experiments with the dropping mercury cathode indicate that minute traces of Pt enormously affect the hydrogen over-potential; this explains the poor results obtained in some earlier work on over-potentials in which Pt contacts or auxiliary electrodes were used.—A. R. P.

Micro-Test for Aluminium. Friedrich L. Hahn (*Mikrochemie*, 1932, **11**, 33–36).—The solution (2 c.c.) is treated with 6 drops of a solution of 1 : 2 : 5 : 8-tetrahydroxyanthraquinone; an acid solution is thus coloured red. NaOH is added until the colour changes to bluish-violet, the solution is boiled, and, after a few minutes, cooled; addition of $CH_3{\cdot}COOH$ produces a yellow colour in the absence of Al, but a pink to reddish-violet colour with increasing amounts of Al. A drop test based on this reaction is described.—A. R. P.

More Sensitive Cerium Reaction with Phosphomolybdic Acid and Some Cases of Molybdenum Blue Formation in Alkaline Solution. A. S. Komarowsky and S. M. Korenmann (*Mikrochemie*, 1932, **12**, 211–214).—When a mixture of a Ce‴ salt solution with saturated phosphomolybdic acid is made alkaline with 40% NaOH, a blue colour or precipitate forms, the amount of which is proportional to the Ce present. Co, Mn, and Fe″ salts produce a similar reaction, but not other rare-earth metals.—A. R. P.

Microchemical Reaction of Copper Salts. I. M. Korenman (*Pharm. Zentralhalle*, 1932, **73**, 738–741).—The reagent is made by adding dilute HCl to a mixture of equal volumes of water and aniline until the latter dissolves, then saturating the solution with NH_4CNS. With 1 drop of a Cu solution containing only 0·0005 mg. Cu, 1 drop of the reagent produces characteristic long, narrow crystals or dendrites of a complex Cu salt. Cd in concentrations of 0·003 mg. in 1 drop gives similar crystals. Modifications of the test are described and the effect of other elements discussed.—A. R. P.

The Use of Cobalt Thiocyanate as a Microchemical Reagent for Mercury. A. de Sweemer (*Mikrochemie*, 1932, **12**, 223–266).—[In French.] The solubility of $HgCo(SCN)_4$ is reduced considerably by an excess of $Co(SCN)_2$ and in a 0·35*N*-solution of this reagent is only 0·0062%. By addition of this solution to 1 drop of the solution to be tested, a blue precipitate is obtained with as little as $0·05 \times 10^{-5}$ grm. of Hg in 0·005 c.c.—A. R. P.

A New Microchemical Reaction for Molybdenum, Vanadium, and Tungsten. Ardoino Martini (*Mikrochemie*, 1932, **12**, 112–113).—When a drop of a solution containing Mo, V, or W as NH_4 salts is treated with pyrocatechol until a deep orange-red colour is obtained, and then a small drop of benzylamine is added, followed by 15% $CH_3{\cdot}COOH$ groups of crystals of compounds of the type $H_2[(C_6H_4O_2)_2OMOH]CH_3CO_2,CH_2{\cdot}C_6H_5{\cdot}NH_2$, where M is quinquevalent Mo, V, or W, are obtained. The Mo compound is orange, the V light yellow, and the W black.—A. R. P.

On the Microchemical Detection of Rhenium. E. Kronmann and V. Bibikowa (*Mikrochemie*, 1932, **12**, 187–188).—The HNO_3 solution of the metal is treated with a few drops of a solution containing Na_2S and nitron acetate which produces a mixture of crystals of nitron nitrate and nitron perrhenate. The mixture is caused to set to a jelly by adding a few drops of warm 10% gelatin solution, and a drop of 10% $TiCl_3$ solution is placed on the surface of the jelly. Diffusion of this drop into the jelly causes reduction of the ReO'_4 in the presence of the Na_2S to ReS_2 and the nitron perrhenate crystals become coloured brown after 1 hr.—A. R. P.

A Catalytic Method of Detecting Silver in Very Dilute Solutions. Friedrich L. Hahn (*Ber.*, 1932, [B], **65**, 840–842).—The reducing action of NaH_2PO_2 on $HgCl_2$ is accelerated by the presence of traces of Ag; a nephelometric method of detecting such traces is based on this reaction. Full directions are given. —P. M. C. R.

Contributions to the Separation of Selenium from Metals and to the Question of Selenium Losses in Analysis. W. Geilmann and Fr. W. Wrigge (*Z. anorg. Chem.*, 1933, **210**, 357–372).—(1) In strongly alkaline solutions metal selenites are decomposed by a reducing agent with the separation of the metal and the formation of soluble alkali selenite. This method is shown to be satisfactory for the separation of Cu, Bi, Hg and Ag as well as Au and some of the Pt metals from Se. $PbSeO_3$ is not decomposed in this way. (2) By distillation in a moist stream of HCl even very small amounts of selenium can be quickly separated from metals. The separation from Te is not quantitative, since small amounts of Te are also volatilized. (3) Losses of Se during evaporation of aqueous and HNO_3 solutions of SeO_2 do not occur in the presence of a sufficient quantity of metal salts.—M. H.

A Study of the Use of the Tungsten–Nickel Electrode System in Neutralizations. N. Howell Furman and George W. Low (*J. Amer. Chem. Soc.*, 1933, **55**, 1310–1315).—The W–Ni electrode system was shown to be of value in the titration of strong acid with strong base, and appeared to be one of the most satisfactory in the titration of weak base with strong acid. With weak acids or polybasic acids the system was of little use.—R. G.

The Detection and Determination of Small Amounts of Substances by Colorimetric Methods. Norman Strafford (*J. Inst. Chem.*, **1933**, (II), 117–118).—A lecture to the Leeds Section of the Institute of Chemistry, surveying recent methods of determining metals colorimetrically by means of organic reagents.—E. S. H.

Studies in the Precipitation of the Copper and Tin Groups Using Hydrogen Sulphide. Leo Lehrmann (*J. Chem. Education*, 1933, **10**, 50–55).—I. The influence of Increasing Concentrations of NH_4Cl on the Complete Precipitation of Pb and Cd Sulphides at 0·3*N*-HCl Concentration. II. The Influence of Increasing Concentrations of NH_4Cl on the Complete Precipitation of Metals Other Than Pb and Cd. III. The Effect of Ammonium Salts on the Precipitation of the Cu and Sn Group Metals by H_2S.—All the metals, except As, are precipitated as sulphides in more than one different acid concentration. Appreciable amounts of Pb^{++} and Cd^{++} are not precipitated by H_2S at 0·3*N* acid concentration when the solution contains NH_4Cl. When separate solutions of these 2 metals containing NH_4Cl are precipitated by H_2S at 0·3*N*-HCl concentration, as much as 25 and 30% Pb and Cd, respectively, escape precipitation. The behaviour of these 2 metals is apparently due to salt effect or to complex ion formation with NH_4Cl. The highest HCl concentration in which H_2S can cause precipitation separately, of the Cu and Sn group, except Pb^{++} and Cd^{++}, was determined. All the metallic ion remaining in the filtered solutions, adjusted to 0·3*N*-HCl, is completely precipitated by H_2S. Starting with solutions of each metal separately, Sn^{++++} is the only metal not completely precipitated under the conditions of the experiment.—J. H. W.

The Determination of Aluminium in the Presence of Phosphoric Acid by Means of 8-Hydroxyquinoline. Gr. Balanescu and Maria D. Motzoc (*Z. anal. Chem.*, 1932, **91**, 188–191).—The solution is treated with NaOH until the precipitate of $Al(OH)_3$ and $AlPO_4$ is completely redissolved, diluted to 100 c.c., treated at 40°–50° C. with a 5% alcoholic solution of the reagent, boiled, and filtered. The washed precipitate is dissolved in HCl and the Al determined bromometrically.—A. R. P.

Reduction of Antimonic Acid in Hydrochloric Acid Solution with Mercury. LeRoy W. McCay (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1933, **5**, 1–3).—Sb_2O_5 in HCl solution is completely reduced to $SbCl_3$ by shaking the solution with Hg in an atmosphere of CO_2 for 1 hr.; under these conditions H_3AsO_4 and $SnCl_4$ remain unchanged, but $CuCl_2$ is reduced to Cu_2Cl_2, which may, however, be reoxidized by drawing air through the solution for 30 minutes. The method is useful for the determination of Sb in Pb and Sn alloys, but slightly low results are obtained if much Cu is present.—A. R. P.

Bismuth in Copper. —— (*Found. Trade J.*, 1933, **48**, 368; and *Met. Ind.* (*Lond.*), 1933, **42**, 538 and 545).—A communication from the Fiscal Policy

Technical Sub-Committee of the Brass and Copper Industries. Owing to the difficulty in estimating Bi in brass and Cu, the amount of that element in these metals is often doubtful. For amounts of Bi up to 0·02%, the colorimetric method, using the reaction between $BiSO_4$ and KI, is recommended. The sample is dissolved in HNO_3. Any residue is filtered, fused with $KHSO_4$, dissolved in H_2SO_4, and added to the filtrate. To ensure that the whole of the Bi is precipitated during separation, a collector such as Fe is used. NH_4OH is used for the precipitation which is repeated. The final precipitate of the mixed hydroxides of Fe and Bi is redissolved in dilute H_2SO_4, the solution is neutralized, and Fe reduced with H_2SO_3.—J. H. W.

Determination of Cadmium. A Critical Study of the Evrard Method. Loren C. Hurd and Richard W. Evans (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1933, **5**, 16–17).—Precipitation of Cd as the CdI_2 complex of allyl iodohexamethylenetetramine yields unreliable results owing to solubility and adsorption errors; the reagent is not specific for Cd.—A. R. P.

Determination of Chromium and Iron in the Chromium Plating Bath by the Potentiometric Method. Erich Müller and Günther Haase (*Z. anal. Chem.*, 1933, **91**, 241–245).—The CrO_3 is determined by titration with $SnCl_2$ at room temperature and the Fe by titration with $SnCl_2$ at 75° C. after first reducing the CrO_3 with C_2H_5OH and HCl.—A. R. P.

On the Gravimetric Determination of Cobalt with Dinitroresorcinol. O. Tomíček and K. Komárek (*Z. anal. Chem.*, 1932, **91**, 90–105).—The method of Orndorff and Nichols (*J. Amer. Chem. Soc.*, 1923, **45**, 1439) gives good results for Co only by a fortuitous compensation of errors. Under the best conditions the precipitates contain only about 80% of the Co dinitroresorcinol compound. Attempts to obtain better results failed.—A. R. P.

Shorter Method for Determining Copper Iodometrically. T. H. Whitehead and H. S. Miller (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1933, **5**, 15–16).—Evaporation to dryness of the $Cu(NO_3)_2$ solution obtained in the usual course of analysis is unnecessary to obtain accurate results; it suffices to add 5 c.c. of 8*N*-HCl, HNO_3, and H_2SO_4, and evaporate to 5 c.c., cool, add 5 c.c. of 8*N*-CH_3COOH and the necessary KI, and titrate as usual with $Na_2S_2O_3$.—A. R. P.

Short Contribution to the Analytical Behaviour of Gallium. Erich Schwarz von Bergkampf (*Z. anal. Chem.*, 1933, **91**, 333–335).—Dissolution of Al alloys containing Ga in dilute H_2SO_4 leaves a residue of metallic drops of Ga. $Ga(OH)_3$ begins to precipitate at p_H 3·4 in acid solutions and at p_H 9·7 from alkaline solutions. For complete precipitation of Ga by cupferron in H_2SO_4 solutions not more than 6 c.c. of concentrated H_2SO_4 should be present in 400 c.c.; addition of tartaric acid prevents precipitation of Al, but not of Fe and Ti.—A. R. P.

Quantitative Spectrum Analysis. VI.—An Attempt to Determine the Amount of Gold Contained in Natural Ores. Arata Iwamura (*Mem. Coll. Sci. Kyōtō Imp. Univ.*, 1932, [A], **15**, 359–363).—[In English.] Methods for the preparation of electrodes containing natural gold ore for analysis are described. The spectra obtained are quite reproducible. The sensitivity of the gold line λ 2428 A. is 4×10^{-4}% in carbon electrodes and 3×10^{-3} in electrodes containing $AuCl_4$ cemented with ZnO and HCl.—E. S. H.

Quantitative Spectrum Analysis. VII.—Determination of the Ratio of the Concentration of Gold and Silver Contained in a Sample. Arata Iwamura (*Mem. Coll. Sci. Kyōtō Imp. Univ.*, 1932, [A], **15**, 365–370).—[In English.] In a mixture of Au and Ag the log. photographic density–log. concentration curves for the lines λ_{Au} 2676, λ_{Au} 2428, λ_{Ag} 3383, and λ_{Ag} 3281 A. were found to be straight lines. The concentration ratios calculated therefrom were in fairly good agreement with the composition of the prepared electrodes.—E. H.

Molecular Spectra and Spectrographic Analysis. II.—Determination of Lanthanum. G. Piccardi and A. Sberna (*Atti R. Accad. Nazion. Lincei*, *Rendiconti Classe Scienze Fisiche*, 1932, **15**, 83–88).—A method is described for the volatilization of La_2O_3, and its transformation to the monoxide; the spectrum of the latter is studied in order to establish the laws for the qualitative and quantitative determination of La.—G. G.

Lanthanum in Analysis. A. M. Vasil'ev (*Uchenuie Zapiski Kazan. Gosudarst. Univ.* (*Sci. Rep. State Univ., Kazan*), 1930, **90**, 997–1004; *C. Abs.*, 1933, **27**, 39).—A survey of methods of analysis of La shows that a salt of this element should be kept on hand in analytical laboratories as a reagent for CH_3COOH and HF.—S. G.

Colorimetric Determination of Magnesium in Very Small Quantities in Solutions Containing Magnesium Alone or Magnesium and Calcium. Josef Tischer (*Mikrochemie*, 1932, **12**, 65–86).—The Mg is first precipitated as $MgNH_4PO_4$, NH_4 citrate being added if Ca is present, the precipitate is converted into the yellow NH_4 phosphomolybdate, and the blue colour produced by addition of this salt to HCl solutions of $SnCl_2$ is compared with that of a standard. The method detects as little as 1×10^{-6} grm. of Mg per c.c. with an error of ± 2%.—A. R. P.

On the Determination of Manganese by Procter Smith's Method. A. Pinkus and (I) L. Ramakers, (II) Ch. Aronsfrau (*Bull. Soc. Chim. Belg.*, 1932, **41**, 529–548, 549–564).—The mechanism of the $K_2S_2O_8$–$AgNO_3$ oxidation of MnO to $HMnO_4$ has been studied and various methods of determining the $HMnO_4$ are critically examined. The application of the method to steel analysis is discussed.—A. R. P.

A Simple Electrolytic Micro-Determination of Mercury. F. Patat (*Mikrochemie*, 1932, **11**, 16–20).—The HNO_3 solution of the metal is adjusted to $0{\cdot}1N$ with respect to free acid and electrolyzed with a Pt spiral anode and a Au wire (0·3 mm. diam.) cathode for 15 hrs. at 20° C. using 3 v. and 0·015–0·08 amp. The cathode is washed, dried for 3 hrs. over P_2O_5 or for 24 hrs. over H_2SO_4, and weighed. The results are accurate to 0·002 mg.—A. R. P.

The Volumetric Estimation of Molybdenum by Potentiometric Oxidation of the Quinque- to the Sexavalent State with Ceric Sulphate or Potassium Permanganate. B. Stehlík (*Coll. Trav. chim. Tchécoslov*, 1932, **4**, 418–427).—[In English.] The MoO_3 solution containing 50% of concentrated HCl is reduced in a CO_2 atmosphere with Pb, Zn, $TiCl_3$, or, best, $SnCl_2$, and titrated with $Ce(SO_4)_2$ or $KMnO_4$. Sharp jumps occur in the potential curve when all the Mo^{III} is converted into Mo^{V} and when all the Mo^{V} is converted into Mo^{VI}.
—A. R. P.

The Quantitative Determination of Palladium by Means of Ethylene. S. C. Ogburn and W. C. Brastow (*J. Amer. Chem. Soc.*, 1933, **55**, 1307–1310).—C_2H_4, being specific in its reduction of Pd with respect to others of the group is preferable to Zn or Mg, &c., which although yielding the metal directly from acid solutions of the metallic chloride, precipitate also Pt and others. The method consists in passing C_2H_4 gas through the chloride solution, which may contain even large amounts of Pt, at 80° C. The precipitate is washed and dried to constant weight. Varying temperatures and acid concentrations were tested and found to have no effect. All other metals of the group remain in solution. The method is considered to be of value industrially.—R. G.

Determination of Phosphorus in Aluminium. —. Steinhäuser (*Z. anal. Chem.*, 1930, **81**, 433–438).—It has been proposed to test for P in Al by holding a filter paper soaked in $AgNO_3$ solution in the gases evolved by dissolution of the metal in dilute H_2SO_4; this is not reliable since Si hydrides, which also cause blackening of the paper, are usually present in the evolved gases. Previous method of determining P in Al are criticized and the following procedure recommended: the metal (30–50 grm.) is dissolved in HCl in a flask through which a current of H_2 is passed and the gases are burnt at a small jet beneath a funnel through which the products of combustion are drawn into a 0·25%

solution of NaOH. The funnel is rinsed with 3% HF to remove the SiO_2 deposit and the HF and NaOH solutions are evaporated with H_2SO_4 to expel HF and SiO_2; the P_2O_5 is then precipitated with $(NH_4)_2MoO_4$ in the usual way.—A. R. P.

Determination of Phosphorus in Aluminium. K. Steinhäuser and J. Stadler (*Z. anal. Chem.*, 1932, **91**, 165–170).—Good results are obtained by the method previously described (preceding abstract) if the minimum quantity of H_2SO_4 is used to expel the HF employed for removing SiO_2 and if the residue from this treatment is boiled with H_2O for 1 hr. before continuing the analysis.—A. R. P.

On a Method for the Quantitative Determination of Potassium Sodium Cobaltinitrite and Its Use in the Determination of Potassium. L. Cuny (*J. Pharm. Chim.*, 1932, **16**, 55–58; *Chem. Zentr.*, 1933, **104**, I, 269).—For small quantities of K the precipitate of $K_2NaCo(NO_2)_6$ is dissolved in HCl, the solution evaporated to dryness, and the residue gently heated until free HCl is completely expelled, then dissolved in hot H_2O. The Cl_2 in the solution is determined by Volhard's method, 5 atoms of Cl corresponding to 2 atoms of K.
—A. R. P.

Microchemical Determination of Potassium. B. V. J. Cuvelier (*Natuurwetensch. Tijdschr.*, 1932, **14**, 107–110; *Chem. Zentr.*, 1933, **104**, I, 269).—The precipitate of K_2PtCl_6 is collected and washed by centrifuging. It can then be weighed after drying, or dissolved in NaI solution, and the resulting red colour compared with that of a standard.—A. R. P.

The Application of Microchemical Methods in the Quantitative Determination of Rhenium in Quantities of About 1 mg. after Previous Separation from Molybdenum. Olga Michajlova, Sophie Pevsner, and Natalie Archipowa (*Z. anal. Chem.*, 1932, **91**, 25–28).—The Mo is separated in dilute $CH_3{\cdot}COOH$ solution containing $CH_3{\cdot}COONH_4$ by means of 8-hydroxyquinoline and the Re in the filtrate is precipitated at 80° C. by addition of a 5% solution of nitron nitrate. The precipitate of nitron perrhenate is dried at 110° C. and weighed; it contains 33·06% Re.—A. R. P.

Contribution to the Separation and Determination of Sodium and Potassium. László Szebellédy and Károly Schick (*Magyar gyógyszerésztudományi Társaság Ertesitöje*, 1933, **9**, 40–51; *Chem. Zentr.*, 1933, **104**, I, 1817).—The method depends on the solubility of NaI and the insolubility of KI in a mixture of equal volumes of anhydrous $(C_2H_5)_2O$ and *iso*butyl alcohol.—A. R. P.

The Precipitation of Telluric Acid as Hexamminechromic Salt. Theodor Bersin (*Z. anal. Chem.*, 1932, **91**, 170–171).—Te can be precipitated as $[Cr(NH_3)_6]_2(H_4TeO_6)_3$ by addition of a 40% solution of $[Cr(NH_3)_6](NO_3)_3$ to an ammoniacal solution of $Na_2H_4TeO_6$ at 80° C.—A. R. P.

A Rapid Method for the Determination of Small Quantities of Thallium in the Presence of Bismuth and Lead. F. Pavelka and Hermine Morth (*Mikrochemie*, 1932, **11**, 30–33).—As little as 0·02–0·1 mg. of Tl may be detected in the presence of Pb and Bi by the yellow turbidity obtained by treating a feebly HNO_3 solution of the metals with a few drops of 5% phosphomolybdic acid. Quantitative results may be obtained by comparing the colour produced with that of a standard, but K and NH_4 salts must be absent, as they produce a similar reaction.—A. R. P.

Note on the Character of the Colorimetric Determination of Titanium. Robert Schwarz (*Z. anorg. Chem.*, 1933, **210**, 303).—The yellow colour produced by the reaction of H_2O_2 with $(TiO)SO_4$ in H_2SO_4 solution is shown to be due to $[TiO_2(SO_4)_2]H_2$.—M. H.

The Volumetric Determination of Uranium with Potassium Dichromate as Reagent and the Application of the Method to the Indirect Titration of Minute Quantities of Sodium. I. M. Kolthoff and J. J. Lingane (*J. Amer. Chem. Soc.*, 1933, **55**, 1871–1876).—Quadrivalent U is titrated with $K_2Cr_2O_7$ using diphenylamine sulphonate as indicator. A simple method for determining small amounts is given. The indirect determination of Na by estimation of U in sodium uranyl magnesium acetate gives satisfactory results, and is especially advantageous for small quantities of Na.—R. G.

New Reagent for the Determination of Zinc. Armand J. Quick (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1933, **5**, 26).—In neutral or acid solution Zn in concentrations greater than 0·03% is precipitated quantitatively with borneolglycuronic acid as $(C_{16}H_{25}O_7)_2Zn,2H_2O$. The precipitate can be weighed or hydrolyzed by boiling with *N*-HCl for 15 minutes and the liberated glycuronic acid determined by any of the common sugar methods. Cd alone interferes in the precipitation.—A. R. P.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

(See also "Testing" and "Pyrometry.")

(Continued from pp. 322–323.)

A High Temperature Experimental Furnace. P. F. Thompson (*Soc. Chem. Ind. Victoria Proc.*, 1932, **32**, 693–699).—A solid-fuel blast-furnace for laboratory use using gas carbon is described. Temperatures of 1500°–1600° C. could be reached in a few minutes and more than 1900° C. was attained. The furnace was used for determination of the melting points of refractories and coal ash, and, with an internal silica tube, for combustion carbon estimations on steel.—R. G.

A Sensitive Thermostat with Thermionic Relay. R. E. Summers (*Soc. Chem. Ind. Victoria Proc.*, 1931, **31**, 535–536).—The thermostat is a mercury thermometer with two sealed-in contacts and means for setting by external application of a magnet. The thermostat is connected in the grid circuit of a triode valve. The instrument is made by Messrs. Bailey, Grundy, and Barrett, Cambridge.—R. G.

Improved Device for Recording Instantaneous Tool Pressures in Machineability Studies. O. F. Gechter and H. R. Laird (*Trans. Amer. Soc. Mech. Eng.*, 1932, **54**, MSP. 73–85; *Rev. Sci. Instruments*, 1932, **3**, 632).—The device described permits the measurement of the 3 tool-pressure components during the machining of short test-pieces. The advantages of the device as compared to similar devices used in the past are outlined. It is shown that the use of the piezoelectric pressure-measuring method makes possible a rigid tool mounting and the recording of relatively sudden pressure changes. The mechanical and electrical limitations are discussed, and improvements are suggested. A discussion of some of the test results illustrates the value of the device for machineability studies.—S. G.

A Laboratory Instrument for the Study of Rigidity in Twisting. Benjamin Allen Wooten (*Rev. Sci. Instruments*, 1933, [New], **4**, 297–298).—A simple form of laboratory apparatus for determining the modulus of rigidity of a wire by a static method and for subjecting the wire to the series of torques necessary to construct the complete torque-twist hysteresis curve, is described.
—J. S. G. T.

A Method for the Measuring of Length and Thickness with High Precision. Marcel Mennesson (*Compt. rend.*, 1932, **194**, 1459–1461; *Rev. Sci. Instruments*, 1932, **3**, 399).—The principal methods actually employed for obtaining a high precision in the measurement of lengths are based on methods of amplification obtained by optical or mechanical means. The new method presented by M. obtains this amplification by a pneumatic means. It consists essentially in replacing the measurement of a length by the measurement of the flow of air which escapes from an orifice, the section of which is a function of the length to be measured. The accuracy of the measurements cannot be extreme, yet the method is very ingenious in that it permits the measurement of the length of a specimen without ever making physical contact with it.—S. G.

A Differential Method for Measuring Specific Heats. S. Amossow, N. Dobronrawow, and J. Nelidow (*Physikal. Z. Sowjetunion*, 1932, **1**, 371–381; *Rev. Sci. Instruments*, 1932, **3**, 453).—A pair of identical calorimeters, wound with heating elements of equal resistance, having identical provisions against heat exchange with the surroundings, were placed within a single envelope. A differential thermoelement with a galvanometer was used by the null method to indicate temperature equality of the calorimeters. Each had the form of a hollow cylinder in which was placed the sample under investigation. A sample of known heat capacity was put in one and an unknown in the other. In order to obtain equal increases of temperature in the two calorimeters with samples, either of two methods could be followed: the heater of one could be shunted, or the heat capacity of the other could be increased by adding Wood's metal. The contents of the two calorimeters were interchanged in each complete measurement. It is estimated that, when mercury is used as a standard, values of specific heat for steel can be observed with a precision of 0·2% and that the specific heats of steels can be compared with a precision of 0·1% in this apparatus.—S. G.

Design, Construction, and Application of Aircraft Instruments. C. J. Stewart (*J. Coventry Eng. Soc.*, 1931, **12**, 134–139).—A description of various instruments, referring to the uses of different metals, corrosion, and manufacturing limits.—R. G.

The Sensitivity of Instruments. Georg Keinath (*Arch. tech. Mess.*, 1932, **1**, T 22; *Rev. Sci. Instruments*, 1932, **3**, 398).—K. points out that the ordinary practice of defining sensitivity as, for example, microvolts per mm. deflection, is illogical, since it leads to decreasing quantities with increasing sensitivity. He proposes to define the sensitivity of an instrument by the reciprocal of this quantity as, for example, mm. per microvolt. The article continues with a useful, though condensed, discussion of the sensitivities of various types of instruments. The data are finally collected in a systematic manner in a table at the end of the article.—S. G.

The Damping of Measuring Instruments. W. Hofmann (*Arch. tech. Mess.*, 1932, **1**, T 38–39; *Rev. Sci. Instruments*, 1932, **3**, 642).—The fundamental concepts and theoretical considerations which underlie the proper damping of measuring instruments are discussed. A sufficient amount of mathematical theory is developed to justify the various conclusions which are reached. An attempt is made throughout to present the conclusions in such a graphical form as will be most readily intelligible and useful to those primarily interested in the application of the principles discussed.—S. G.

Toledo Dynamic Weigher. Anon. (*Instruments*, 1933, **6**, 86–87).—A horizontal lever, pivoted at the middle, carries a scoop and the load at one end and a counterweight at the other. A catch holds the scoop end above the horizontal, and the extent of swing when the lever is released by an electromagnet is observed visually or by a photo-electric device. Models for laboratory weighing or for automatic classification are described. Speed, accuracy, and the possibility of automatic indication are claimed for these instruments.
—J. C. C.

New Method of Attaining Extremely Low Temperatures. F. Simon (*Physikal. Z.*, 1933, **34**, 232–233).—A comparatively simple method of producing liquid helium, comprising a preliminary cooling of the gas with solid hydrogen and subsequent expansion of the helium under 100 atmospheres, is described. The superconducting properties of lead and tin, the effect of a magnetic field on the superconductivity of tin, and the excitation of a constant current in a superconducting lead ring are demonstrated.—J. S. G. T.

Mercury Purification. Burrows Moore (*Indust. Chemist*, 1932, 8, 63–64).—An apparatus is described for filtering and distilling Hg in a vacuum and finally washing in dilute HNO_3. The final product contains no detectable copper, lead, or bismuth, and only 0·00015% of iron.—E. S. H.

The Capillary Depressions of Mercury in Cylindrical Tubes and Some Errors of Glass Manometers. W. Cawood and H. S. Patterson (*Trans. Faraday Soc.*, 1933, 24, 514).—A table is given, based on experimental results, showing the capillary depression (in mm.) of mercury in tubes having an internal diameter of 10–19 mm.—A. R. P.

XI.—PHYSICAL AND MECHANICAL TESTING AND RADIOLOGY

(Continued from pp. 323–325.)

Tentative Revisions of A.S.T.M. Standards. Standard Definitions of Terms Relating to Methods of Testing (E 6–30). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 1166; and *Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 1022).—The definitions of the terms "elastic limit" and "yield-strength" published under the title "Tentative Definitions of Terms Relating to Methods of Testing" (see following abstract) are intended to be added, when adopted, to the present standard definitions.—S. G.

Tentative Definitions of Terms Relating to Methods of Testing (E 6–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 1111–1113; and *Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 967–969).—The terms "elastic limit" and "yield-strength" are defined.—S. G.

Special Methods of Testing Aircraft Materials. David M. Warner (*Aeronaut. Eng.* (*Trans. Amer. Soc. Mech. Eng.*), 1932, 4, 141–149; *Rev. Sci. Instruments*, 1932, 3, 633).—A study of special methods employed at Wright Field in the mechanical testing of characteristic aircraft materials and construction, together with a practical exposition of the special equipment developed. The testing of welded joints, riveted joints and fittings, and of parts such as axles, wheels, and brakes is discussed, together with the combined loading of struts, columns, and beams. The proportional loading of wing ribs, the elimination of low-strength steel tubes, the reverse bending of streamline wires, the superiority of preformed cable, the determination of an economic pulley-cable diameter ratio, and the fatigue testing of streamline wires and of extra-flexible control cable are dealt with in detail. The advisability of testing aircraft-engine materials over the temperature ranges to which they are subject in service is emphasized by the tension and Brinell results obtained on typical light piston alloys. The importance of simulating service conditions, especially in all tests involving endurance in any form, is particularly stressed. —S. G.

A Bridge Method of Testing Welds. J. R. Batcheller (*Elect. Eng.*, 1932, 51, 781–783; *C. Abs.*, 1933, 27, 55).—A new method of testing welds can be applied in the field or in the shop. The apparatus consists of: (1) an oscillator which supplies the a.c. for the operation of the bridge; (2) the bridge; (3) the exploring device for weld examination, and (4) the balance indicator which shows the condition of the weld. The hook-up is illustrated and the method of applying the tests is outlined.—S. G.

Understressing and Notch Sensitiveness in Fatigue. J. B. Kommers (*Eng. News-Record*, 1932, 109, 353–355).—By understressing materials in a rotating-beam machine at stresses below the endurance limit, the fatigue endurance is increased. The effect is discussed with special reference to test results obtained with low-strength cast iron. By progressively raising the stress in small increments at intervals of 5×10^6 cycles, the fatigue endurance can be increased to a still greater extent. The effect of notching the specimen is less pronounced in cast iron than in steel, presumably because the flakes of graphite in cast iron are themselves discontinuities. Fatigue-testing of aluminium alloys, which have a very flat *S–N* diagram, can be accelerated by a knowledge of understressing effects. If the endurance at a fixed stress is found to be increased by under-stressing at a lower value, the lower stress is probably below the endurance limit. If it is decreased, the lower stress is probably above the endurance limit.—J. C. C.

Tentative Methods of Bend Testing for Ductility of Metals (E 16–31 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 1104–1106).—The method consists essentially of free-bending with measurement of fibre elongation. Bending forces are applied at the ends of the specimen and no additional forces are introduced at the point of maximum bending. The elongation of the fibres at the latter point is then measured. The full details of the method have not yet been worked out. There are obvious limitations—when the specimen bends completely on itself without failure, and when it is so brittle that it breaks without showing any bend at all. The specimen pieces are rectangular, of width three times the thickness. All the surfaces should be smooth. For plate ⅛ in. thick the elongation is measured on a gauge length of 0·3 in. For thicknesses of more than ⅛ in. the gauge-length is 1 in. and in every case should be located at the section of maximum bending. Speed of bending is not a vital factor provided actual shock is avoided. The procedure is given in detail.—W. A. C. N.

Cold Bend-Testing Machine. Anon. (*Instruments*, 1933, 6, 64).—A bend-test device should bend the bar with the minimum force, should introduce no lateral force, enable testing speed to be controlled, and should employ short specimens which need not be specially shaped. A device is described in which the bar is supported on 2 rollers of 6 in. radius and the load is applied by hardened steel pins carried on the end of a column which is gripped in a standard compression testing machine.—J. C. C.

Tentative Method of Tension Testing of Metallic Materials (E 8–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 1077–1092; and *Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 945–960).—Generally speaking, increase of speed in testing increases the values found for yield-point and tensile strength. The speed of the head of the testing machine should be such that the load can be accurately weighed. The cross-head speed for a 2-in. gauge-length on a yield-strength specimen should not exceed 0·125 in. per minute. Perfectly axial loading is essential. Various types of grips are illustrated and described. Specimens should be machined so that there are no severe strains left in the material; the surfaces should be smooth, and the reduced sections symmetrical. Specific recommendations are made as to the size and shape of test-pieces for different classes of material. The correct definitions of the various important physical tests are amplified by descriptions of the manner in which they may best be undertaken.—W. A. C. N.

Elongation after Fracture in Cylindrical Tensile Test-Pieces. G. Germean (*Metallurgia italiana*, 1933, 25, 235–248).—A mathematical study on the relations between the elongation and the shape and dimensions of test-piece with special reference to steels. In a short reply A. Bertella expounds his well-known rule and some of the principles upon which the above work is based.—G. G.

Tentative Methods of Rockwell Hardness Testing of Metallic Materials (E 18–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 1098–1103; and *Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 961–966).—A description of the general principles of this method of hardness testing, and of the apparatus is given. Limitations of thickness of material under test, according to its nature and the degree of loading required, are specified. A standard procedure is described, and, to supplement this, the adjustment and calibration of the apparatus are given in detail. In all circumstances the machine should be free from vibration, and preferably mounted on a rubber cushion. The latch on the operating handle should also be cushioned. The specimens must be carefully prepared with smooth surfaces free from oxide scale. A standard time of application of the load is essential.—W. A. C. N.

Hardness Values for Electrochemical Products. Raymond R. Ridgway, Archibald H. Ballard, and Bruce L. Bailey (*Electrochem. Soc. Preprint*, **1933**, May, 267–290).—Three methods of testing the relative hardness of electrochemical products are described. The results obtained show that Moh's scale can be extended as follows: (6) orthoclase, (7) vitreous silica, (8) quartz, (9) topaz, (10) garnet, (11) fused zirconia, (12) fused alumina, (13) silicon carbide, (14) boron carbide, (15) diamond. On this new scale Stellite has a hardness of 8, tantalum carbide 11, and tungsten carbide 12.—A. R. P.

Some New Processes for Treating Metals. Edward G. Herbert (*J. Coventry Eng. Soc.*, 1932, **13**, 160–170).—The paper deals mainly with the application of the pendulum hardness test, the "Cloudburst" surface hardening treatment, and the magnetic treatment to steels. Reference is made to experiments on gold, nickel, brass, and Duralumin. It was possible to set up periodic hardness fluctuations by heat-treatment, deformation, and rotary magnetic treatment and to stabilize the fluctuations by the action of a constant magnetic field.—R. G.

Tungsten Carbide Brinell Balls. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 21–22).—A review, summarizing and discussing a recent paper by H. Styri (*Metals and Alloys*, 1932, **3**, Dec.). Whilst the use of sintered tungsten carbide extends the useful range of the Brinell test, the upper limit is not greatly above that of the hard-steel ball, and the advantages are therefore small compared with those of the diamond pyramid.—R. G.

125 Kg. Hardness Testing Machine. Anon. (*Engineering*, 1933, **135**, 505–506).—Illustrated article describing a Brinell hardness testing machine which will accurately apply loads from 5 kg. to 125 kg. easily and quickly. The load is measured by means of a calibrated spring, but since only a definite, small proportion of the load is applied to the spring, this latter retains its calibration for many years.—W. P. R.

Olsen Hydraulic Universal Testing Machines. Anon. (*Machinery* (*N.Y.*), 1933, **39**, 362; also *Instruments*, 1932, **5**, 79–80).—A brief description. The machines are equipped with a large self-indicating pendulum dial and a lever weighing system.—J. C. C.

Large Testing Machine Built for California Laboratory. Anon. (*Eng. News-Record*, 1932, **108**, 217–218).—An illustrated description of the 4,000,000 lb. universal testing machine built for the University of California. See *J.*, 1932, **50**, 368; this volume, p. 144.—J. C. C.

RADIOLOGY

Non-Destructive Testing. Anon. (*Engineer*, 1933, **155**, 301).—Leading article in which is discussed the use of X-rays and γ-rays for testing of metals.
—W. P. R.

Radiographic Examination of Pressure Vessel Welds. R. E. Hiller (*Iron Age*, 1933, **131**, 736–739).—The methods employed in examining weld by X-rays and the technique of obtaining radiation pictures are outlined.
—J. H. W.

Apparatus for the Examination of Materials by X-Rays. O. Fischer (*Autogene Metallbearbeitung*, 1932, **25**, 321–325).—Describes the "Metalix" apparatus. See this *J.*, 1932, **50**, 560.—H. W. G. H.

XII.—PYROMETRY

(Continued from p. 326.)

Industrial Pyrometers, Using the Expansion of a Metal Alloy,—the Pyros. —— (*Génie civil*, 1933, **102**, 405).—Illustrated article, describing a pyrometer based on the expansion of a nickel-chromium-tungsten alloy bar. The pyrometer can be used at temperatures not exceeding 1100° C.—W. P. R.

Pyrometer Controller Employs New Principle. Anon. (*Instruments*, 1933, **6**, 67).—Cams driven from a synchronous motor are caused to operate mercury switches through a lever system which is "set" whenever the instrument pointer is brought down on a pallet by a depressor bar.—J. C. C.

Control of Thermal Operations with the Utilization of the Curie Point in the Case of Tempering. —— (*Génie civil*, 1933, **102**, 331–332).—A general discussion of the various methods of temperature measurement.—W. P. R.

Thermel Technique. Walter P. White (*Rev. Sci. Instruments*, 1933, [N.S.], **4**, (3), 142–146).—Errors in precision measurements of temperature with a thermoelectric thermometer are discussed. With a copper-Constantan thermocouple, a precision of 0·0001° C. is reasonably attainable.—J. S. G. T.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 326–327.)

Melting Point Determinations of Some Metallurgical Slags. Axel Wejnarth (*Jernkontorets Annaler*, 1933, **117**, 21–44).—The melting points were determined of a large number of ferrous silicates containing varying amounts of MnO, CaO, Al_2O_3, and MgO, by measuring the electrical conductivity on slow cooling. Most of the silicates investigated correspond with the formulæ $2RO{\cdot}SiO_2$, $4RO{\cdot}3SiO_2$, and $RO{\cdot}SiO_2$. The results obtained indicate that there is no simple relation between viscosity and electric conductivity, on account of the fact that the silicates have both electronic and electrolytic conductivity in solid as well as in liquid state. On the other hand, there is a relation between the viscosity and the temperature coeffs. of the conductivity. The increasing tendency of undercooling with the SiO_2 content and the number of components in the silicates is probably due to increased viscosity.—E. Ö.

Oxide in Metal Castings (Concluded). F. Höhne (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 103–104).—See *J.*, this volume, p. 266. A good cover and careful melting are of importance in minimizing oxidation of aluminium and aluminium alloys. To remove existing oxide, controlled deoxidation with deoxidizers of known composition and effect must be employed.—J. H. W.

The French Aluminium Company. Anon. (*Mem. et Compt. rend. Soc. Ing. Civils France*), 1932, **9**, 1003–1018).—Describes the organization and lay-out of a large French aluminium works and the manufacturing processes for various types of aluminium ware.—J. H. W.

Aluminium Fluxes. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 478).—A short note. The use of zinc chloride as a flux for aluminium introduces zinc into the metal. In most cases, this does not matter, but where it is not permissible, cryolite or cryolite-containing mixtures should be used. The advantages of such cryolite mixtures as compared with zinc chloride are discussed.—J. H. W.

Pouring Contrivance for Casting Ingots for Aluminium Foil. H. Obermüller (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 119–120).—Describes a machine for side pouring aluminium into inclined moulds which are gradually brought to the vertical as they are filled. The advantages claimed for this method are:—(1) no metal spray or cold shot; (2) oxide and scum are not included in the metal but remain on the surface; (3) absence of piping. —J. H. W.

Aluminium Alloys. The Effect of Melting and Pouring Temperatures. Edmund R. Thews (*Canad. Chem. Met.*, 1933, **16**, 278, 280).—A review of modern practice in melting and casting aluminium alloys.—A. R. P.

Aluminium Can Be Cast Dense and Free from Porosity in All Wall Thicknesses. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 179–180).—Zinc chloride is usually added to molten aluminium alloys to obtain sound castings, but, being hygroscopic, is liable to introduce moisture, and also chlorine gas into the metal. To obviate this, the use of "Dr. Weiss Alutin" as a cover is recommended. This melts at 620° C., just before the aluminium, and is said to form a light fluid slag over the metal.—J. H. W.

Practical Foundry Considerations for Improving the Soundness of Aluminium-Alloy Castings. H. J. Rowe and E. M. Gingerich (*Trans. Amer. Found. Assoc.*, 1932, **40**, 527–546).—Unsoundness of aluminium alloy castings is due to (1) metal shrinkage during solidification, (2) occluded gases or (3) a combination of these two. The correct control of the foundry variables is reviewed and a summary is given of the various methods in use and suggested for the removal of gas and solid impurities by fluxes and other means. A *bibliography* is given.—R. B. D.

Process for Producing High-Quality Large Castings of Aluminium Light Alloys. W. Claus (*Light Metals Research*, 1933, **2**, (24), 8).—Abstract of a paper read before the Verein deutscher Giessereifachleute, 1933, but not published. It is considered that gas inclusions and porosity can never be entirely overcome by changes in alloy composition or mould design only. Means must also be found to bring about rapid cooling. Encouraging results have been obtained from the use of metallic sands, the use of solid and, if required, water-cooled moulds faced with finely-powdered good conducting material, and the use of moulds built from good or bad conducting material and faced with sheet.—J. C. C.

Causes of Loss in Silumin. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 161–162).—The principal cause of loss in melting Silumin, as with other aluminium alloys, is overheating. When the melt appears dark red, the temperature is about 650° C., and a pyrometer should be introduced and the temperature raised to 730°–740° C. The metal is then skimmed, modified, and poured at about 720° C. If the temperature is allowed to reach, say, 830° C., modification is wasted. Blisters and sand inclusions are further causes of waste. For aluminium or brass castings, green-sand is used. A good mixture for the moulding sand is: coal dust 3 parts, dry binding material 1 part, new sand 36 parts, and old sand 60 parts. The metal should not be allowed to remain molten for too long a time.—J. H. W.

Aluminium Metallurgy. N. F. Budgen (*Found. Trade J.*, 1933, **48**, 241–243).—Abstract of a paper read before the Scottish Branch of the Institute of British Foundrymen. Briefly describes the production of aluminium from the ore by electrolysis and discusses the principal aluminium casting alloys and the methods of casting, melting practice, fluxes, the effect and removal of gases in aluminium alloy castings, and grain-refinement and control.—J. H. W.

Salving Aluminium Castings. N. R. Warre (*Machinist* (*Eur. Edn.*), 1933, **77**, 190E).—Welding is probably the most satisfactory method of repairing slightly defective aluminium castings. Porous castings can be treated with sodium silicate forced into the pores under pressure or by painting with linseed oil or lacquer after sand-blasting.—J. H. W.

Some Very Ancient Formulæ for the Preparation of Copper Alloys. A. Chaplet (*Cuivre et Laiton*, 1932, **5**, 187).—Taken mainly from the Papyrus of

Leyden and Berthelot's "Chimie des Anciens," the examples quoted are principally interesting for their similarity to certain alloys which are in use at the present time.—W. A. C. N.

New Demands on the Bronze Foundry. J. Arnott (*Found. Trade J.*, 1933, **48**, 27–28; discussion, 160).—Abstract of a paper read before the Newcastle Section of the Institute of British Foundrymen. Ordinary gun-metal or bronze is satisfactory for general use, but where a more durable alloy is required, the addition of nickel is very useful, and the addition of silicon still further increases the hardness. Such alloys containing upwards of 30% nickel are treated, as regards melting and deoxidizing, as nickel alloys. For high-strength castings, manganese–brass is recommended. For strength at high temperatures, copper–nickel alloys, such as Monel metal, give good results, but care must be taken to keep out undesirable impurities such as lead. Silicon–Monel metal is now being developed for certain applications. For alloys where lightness is essential aluminium–silicon alloys are used.—J. H. W.

The Manufacture of High-Class Marine Propellers. Wesley Lambert (*Met. Ind.* (*Lond.*), 1933, **42**, 169–172, 201–202).—Read before the Institution of Engineering Inspection. The principles governing the design of marine propellers are laid down and the relative advantages of various types are discussed. Manganese–brass, consisting of copper 56–58, zinc 40–41%, or copper 48–50, zinc 45–47%, with not more than 1% of tin and of iron and small amounts of aluminium, manganese, nickel, and lead, is most frequently used for the manufacture of high-class propellers. The methods of melting, moulding, casting, machining, and inspecting are described.—J. H. W.

Some Factors Affecting the Soundness of Bronze Castings. E. J. L. Howard (*Found. Trade J.*, 1933, **48**, 317–321).—Abstract of a paper read before the Lancashire Branch of the Institute of British Foundrymen. The effect on the soundness of bronze castings of shrinkage, distinguished as liquid, solidification, and solid shrinkage, of gas absorption, of the presence of oxides, and of the casting temperature are described. The characteristics required of deoxidizers and the action and suitability of those commonly used are discussed and the basic principles for sound melting practice are laid down.—J. H. W.

Metals for Large Tablets. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 489–490).—The methods of producing large metal tablets are repoussé work, kupronizing, and casting. For repoussé work, copper is usually used, but it is not completely satisfactory for large work. Kupronizing consists of electrodepositing copper on specially prepared plaster or wood models, and enables very thin and light tablets to be made. Casting has many advantages, and bronze is usually used for this method, but Monel metal and other nickel alloys and aluminium alloys are also employed.—J. H. W.

Industrial Brasses. M. Lencauchez (*Rev. Fonderie moderne*, 1933, **27**, 81–88; discussion, 88–89).—Read before the Association Amicale et Mutuelle de Fonderie. The methods of melting and the different types of furnace and systems available for the manufacture of brass for various industrial purposes are described. In the discussion, various practical points were discussed.—J. H. W.

The Manufacture of Nickel-Manganese Brass. Auguste Le Thomas (*Rev. Nickel*, 1932, **3**, 65–70).—A discussion of the general effects of special additions of small quantities of foreign elements to brass. Especial attention is directed to the influence on the mechanical and corrosion-resisting properties. The significance of, and methods for, calculating the zinc equivalence of a special brass are summarized. In the preliminary consideration the choice of composition, the selection of good primary constituents of the melting charge, and the methods of fusion and casting are important. The verification of the quality of the brass is undertaken in the following ways, among others—

analysis; rapid micrographic examination of a small specimen from the melt; and a torsion test on a small specimen.—W. A. C. N.

A New Process for the Deoxidation of Nickel Brass and Nickel Castings. A. Heinz (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 54, 99–101).—Describes the use of a new deoxidizing agent called "Aluphosphin N," and compares the results with those obtained with the ordinary deoxidizing agents. —J. H. W.

Magnesium Alloys of the Elektron Type for Casting. Methods of Preparation and Casting, Investigation of Mechanical and Casting Properties. M. Sharov and A. Maurah (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), 1931, (4), 69–78; (7), 33–38).—[In Russian.] In melting magnesium alloys containing: (*a*) aluminium 4, zinc 3, and manganese 0·4%; (*b*) aluminium 10, manganese 0·3, and silicon 2%; or (*c*) aluminium 2, manganese 0·2, copper 4, and cadmium 2%, the most suitable flux is magnesium chloride with the addition of 40% potassium chloride, and 10% calcium chloride or magnesium fluoride before pouring, to increase the viscosity. The use of iron crucibles coated with aluminium is recommended. In pouring, the stream of molten metal is dusted with flowers of sulphur from a specially-designed atomizer. The use of pouring ladles is objectionable as this increases oxidation. Although the mechanical properties of alloys (*a*) and (*c*) are not affected by heating to 150° C. above the melting point before pouring, those of alloy (*b*) deteriorate after overheating by more than 100° C., hence the lowest possible pouring temperatures should be used. Increase in wall thickness lowers the mechanical properties, and casting in horizontal moulds is preferable to casting in vertical moulds. Precautions to avoid slag inclusions and air-bubbles in shaped castings are described and an extensive bibliography on casting Elektron is given.—D. N. S.

The Melting and Casting of Magnesium Alloys. Edmund R. Thews (*Canad. Chem. Met.*, 1932, 16, 68, 70, 73).—The following points are briefly discussed: crucibles, fluxes, melting conditions, casting, nature of moulds and cores, precautions to obtain clean and sound castings.—A. R. P.

White Bearing Metals. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1933, 9, 27–30).—A detailed summary and discussion of the second portion of a monograph by E. Fleischmann. See this *J.*, 1932, 50, 774; this volume, p. 267.—R. G.

The Moulding and Casting of Architectural Decorations. Anon. (*Inco*, 1932, 11, 18–21).—A description of the foundry methods used in producing the decorative castings for the Federal Reserve Bank of Pittsburgh.—R. G.

Geometrical Quantities of a Parallel Isothermal Surface System and their Graphical Representation. Tsunezō Kawasakiya (*Tetsu-to-Hagane*, 1928, 14, (3), 244–252; *Japanese J. Eng. Abs.*, 1932, 8, 78).—[In Japanese.] This paper deals with the theory of analytical expression of geometrical quantities of casting moulds or furnace walls, in which isothermal surfaces are assumed to be parallel. By introducing a new set of co-ordinates originated by K., the distance, area, and volume of an isothermal surface system are expressed in the most general forms, containing hyperbolic functions and two constants which K. calls "form factor" and "discriminating area." K. defines a geometrical resistance as the definite integral of the reciprocal of area with respect to its distance, and also a geometrical contact resistance as the reciprocal of the contact area. Subsequently two integral quantities are given, which are expressed in the most general forms and are useful to express the thermal energy stored in an isothermal surface system. Simpler expressions, and finally a numerical example, are given to illustrate the applications of graphical and mathematical calculations.—AUTHOR.

The Manufacture of Fine Castings in Non-Metallic Permanent Moulds. Erich Becker (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 54, 201–202).—

Describes the composition, preparation, and use of permanent moulds of ceramic material for making small castings for household and electrical fittings.—J. H. W.

Centrifugal Casting of Non-Ferrous Metals. K. Hanser (*Mitt. Forsch. Anst. G.H.H. Konzern*, 1933, 2, 90–95).—The principles of centrifugal casting are described and illustrated examples are given of the use of this process for the production of large tubes of special brasses and other metals and alloys. Centrifugal casting yields much sounder products than sand-casting, and the finer grain-size and freedom from porosity result in a 20% increase in tensile strength with a 25–50% increase in elongation.—A. R. P.

Investigations of Centrifugal Casting of Phosphor-Bronze. B. F. Rukin (*Metallurg* (*The Metallurgist*), 1932, 7, (2), 79–86).—[In Russian.] Experiments were carried out on the centrifugal casting of a 6% tin-bronze containing 0·35% phosphorus, with a view to obviate the porosity and low density. The metal was cast at 1150°–1250° C. into moulds rotating at 940–460 r.p.m. Poor results were obtained at the latter speeds. It is concluded that satisfactory dense, non-porous castings can be obtained by this method. The resulting absence of surface defects, *e.g.* cavities, slag inclusions, &c., minimizes the number of rejects. Wire, both annealed and work-hardened, drawn from these ingots shows superior mechanical properties to that drawn from ordinary ingots. The effect of temperature is marked at 675, but negligible at 940, r.p.m. The best results as regards density are obtained with high mould speeds, but inequalities in the density occur along the axis of revolution, especially when the difference between the initial and the final radius of casting is too great; this must be considered a disadvantage of the method. —M. Z.

For Users of Cylindrical Shapes. Anon. (*Inco*, 1932, **11**, 9–10).—A reference to the development of the centrifugal casting process for non-ferrous metals. The mechanical properties of centrifugally-cast copper, bronze, gun-metal, manganese-bronze, and Monel metal are given.—R. G.

Non-Ferrous Metal Mould Castings. F. R. Francis (*Canad. Chem. Met.*, 1932, **16**, 299–300).—The preparation and properties of die-castings of tin-base, lead-base, zinc-base, aluminium, and copper-zinc alloys are briefly described.—A. R. P.

Die-Casting. A. H. Mundey (*Metallurgia*, 1933, 7, 194–196).—A general consideration of the process of die-casting includes a short history of the process, the classification of die-casting into two main divisions, namely gravity casting and pressure casting with a brief description of the types of castings made by each process, the reliability of the alloys used for die-casting, and a short reference to the methods and machines at present used for the production of such castings. The alloys dealt with are the low melting point, lead-base, tin-base, and zinc-base alloys, and the higher melting point aluminium alloys and copper-rich alloys, and tables are included giving the composition and mechanical properties of such alloys.—J. W. D.

Developments in Aluminium Alloy Die-Casting. Anon. (*Machinery* (*Lond.*), 1933, 42, 61–66, 121–123).—(I.—) An account of the practice of the Birmingham Aluminium Casting (1903) Co., Ltd., in the production of gravity die-castings. Details are included of the compositions, characteristics, and mechanical properties of the principal light metal casting alloys. (II.—) Equipment for pressure die-casting and heat-treatment of aluminium alloys at the above works, is described and illustrated.—J. C. C.

New Economies in Die-Casting. Gustav Nyselius (*Machinery* (*N.Y.*), 1933, **39**, 497–502).—An illustrated description is given of a system for reducing die costs by building up dies from small single cavity blocks mounted in a universal holder. Four of these holders are mounted so as to be fed by one machine, and in this way production is greatly increased. Any die can be changed without disturbing the others.—J. C. C.

Getting the Most out of Die-Castings. Anon. (*Machinist* (*Eur. Edn.*), 1933, **77**, 148–149E).—The physical properties, principal characteristics, and applications of typical tin, lead, zinc, aluminium, and copper die-casting alloys are described.—J. H. W.

Operations on Wireless Components [Die-Casting]. Anon. (*Machinery* (*Lond.*), 1933, **41**, 637).—Includes an illustrated description of a method of constructing ganged tuning condensers. The plates and spindle, made of cadmium-plated steel, are assembled in a die and are secured together by a zinc-base alloy cast from a pressure feed die-casting machine.—J. C. C.

Artists and Engineers Co-operate in Production of Die Casting Hardware. J. B. Nealey (*Iron Age*, 1933, **131**, 740–742).—The manufacture of zinc alloy die-cast motor-car parts as practised in the U.S.A. is outlined. The alloys consist of zinc with aluminium 4·10, copper 0–2·7, magnesium 0–0·04%, and have a tensile strength of from 35,000 to more than 50,000 lb./in.^{2}. The casting temperatures are 750°–850° F. (400°–455° C.) and the alloys take a wide range of metal finishes by electro-plating or by lacquer and enamel dipping and spraying.—J. H. W.

Design of Product to Utilize Die Casting Instead of Machine Parts. Louis H. Morin (*Amer. Soc. Mech. Eng. Preprint*, **1932**).—Alloys used in modern die-casting practice may be classified into 5 main groups: (1) tin-base alloys; (2) lead-base alloys; (3) zinc-base alloys; (4) aluminium-base alloys; (5) copper-base alloys. M. gives a description of the general properties of typical alloys from each group.—W. P. R.

Report on Definition of Gating Terms. Dietert, Dwyer, and Handley (*Trans. Amer. Found. Assoc.*, 1932, **40**, 510–514).—Reference to the summary of replies to an A.F.A. questionnaire given herein will facilitate understanding of American literature on foundry work. A series of recommended terms is given.—R. B. D.

Foundry Cores and Core Binders. Lawrence E. Barringer (*Better Enamelling*, 1932, **3**, (2), 27–28; *Ceram. Abs.*, 1932, **11**, 606).—B. outlines the properties required in the baked foundry core. It has been found that the alkyd resin type of synthetic resin possesses all the qualifications necessary for the foundry core binder.—S. G.

The Sand Question in Regard to Light-Casting Production. Frank Hudson (*Found. Trade J.*, 1933, **48**, 257–260, 264).—Abstract of a paper read before the Falkirk Section of the Institute of British Foundrymen. The physical properties required of sands for light casting production are described, and the control of moisture, strength, and permeability, the three fundamentals of foundry sands, is discussed. A number of tests and the interpretation of the results obtained, are given.—J. H. W.

Determination of [Grain] Fineness for Foundry Sands. G. Sulliotti and E. Capello (*Usine*, 1931, **40**, (43), 33).—Abstract of paper presented to the 6^e Congrès International de Fonderie. Three methods are available for determining the proportions of different grain sizes in a foundry sand, *viz.* sieving, sedimentation, and elutriation. The residue, called clay matter, is further treated, by S. and C., by simultaneous sifting and sedimentation in an apparatus used for soil analysis and the results (not given in the abstract) are said to be illuminating.—H. W. G. H.

On Methods of Testing Casting Sand. Moritarō Fujita (*Tetsu-to-Hagane*, 1928, **14**, (3), 209–228; *Japanese J. Eng. Abs.*, 1932, **8**, 77).—[In Japanese.] Various kinds of casting sand, presented by different Japanese factories, were investigated by means of chemical and mechanical analyses. A microscopic study was also carried out.—S. G.

Sand Testing in the Foundry. W. Y. Buchanan (*Found. Trade J.*, 1933, **48**, 171–173, 191–192, 196).—Read before the Edinburgh section of the Institute of British Foundrymen. Cf. this *J.*, 1932, **50**, 391–392.—J. H. W.

Some Foreign Methods of Testing Foundry Sands. H. Ries (*Trans. Amer. Found. Assoc.*, 1932, **40**, 345–359).—A comparison of published details of European methods in contrast with American, in particular B.C.I.R.A. elutriation and A.F.A. sieve tests. The effects of density, permeability, and other properties are considered. Several references are given.—R. B. D.

Foundry Mechanization. H. F. Coggon (*Metallurgia*, 1933, **7**, 171–172, 174).—A description of a continuous-casting system which consists of a double bogie type of mould conveyor 400 ft. in total length and weighing more than 80 tons, with a load carrying capacity of more than 150 tons. The three advantages of such a system are: (1) better castings are obtained by rendering constant those factors which, through their occasional variation, produce bad castings; (2) cheaper products are obtained by reducing the cost of production in many directions; and (3) less labour is used and such labour is employed under better working conditions. A sand preparing plant for use in conjunction with such a system is also described.—J. W. D.

XIV.—SECONDARY METALS: SCRAP, RESIDUES, &c.

(Continued from p. 327.)

Treatment of Copper Wire Scrap. Edmund R. Thews (*Engineer*, 1933, **155**, 381–382).—Wire scrap is divided into 3 groups: (1) scrap from wire manufacturers; (2) scrap from consumers of wire; (3) scrap from unknown sources. By melting and casting into ingots the scrap copper can be advantageously used for making copper alloys. T. describes suitable furnaces for remelting and the various " handling " processes necessary to use scrap economically.—W. P.-R.

On the Use of Scrap in Castings. G. Müller (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 159–161).—Scrap is often covered with dirt and oil and can take up an appreciable amount of moisture. Considerable care, depending on the condition of the scrap, is required when using it. It should be passed over a magnetic separator to remove the iron, and any white metal present must be removed. Scrap should not be used for making certain special alloys and aluminium scrap should not be used for any alloys. In melting scrap the shorter time of melting must be considered in relation to the proportionately greater loss of metal in melting and the possibly poorer castings.
—J. H. W.

XV.—FURNACES AND FUELS

(Continued from p. 328.)

FURNACES

Heat Transfer in Annealing Furnaces. G. Wagener (*Mitt. Forsch. Anst. G.H.H. Konzern*, 1933, **2**, 85–89).—Mathematical. The heat transfer (α) in kg.-cal./m.^{2} hr. °C. for aluminium, copper, and brass is given by the expression: $\alpha = 0{\cdot}038\ (T_0/100)^3 + 10$, where T_0 is the temperature of the furnace. A similar expression is derived for iron and a nomogram for determining the time required for heating various weights of metal to different temperatures in furnaces with various heating surfaces is constructed.—A. R. P.

The B.I.F. [British Industries Fair] at Birmingham. Anon. (*Engineering*, 1933, **135**, 183).—Various furnaces for melting non-ferrous alloys are described.
—W. P. R.

Design and Operation of Industrial Gas Appliances. E. A. Leask (*Gas J.*, 1933, **202**, 622–625).—Read before Manchester District Association of Gas Engineers. The design and operation of natural draught, recuperative, lead and type melting furnaces, heated by town's gas are discussed.—J. S. G. T.

Economies of Electric Heating. Chas. E. Foster (*Engineering*, 1933, **135**, 338).—A letter in which is discussed certain problems in the automatic control of temperature in electric furnaces for heating a considerable mass of material. —W. P. R.

Economies of Electric Heating. W. L. Howe and G. H. F. Windiate (*Engineering*, 1933, **135**, 338).—A letter in which comparative figures are given for the cost of running a furnace of internal area of 8·5 ft.^{2} on electricity and gas, respectively.—W. P. R.

Electrical Heat for Babbitting Bearings. Wirt S. Scott (*Heat-Treating and Forging*, 1933, **19**, 17–18, 20).—The process of melting down the Babbitt from old journal bearings, machining and turning the brasses, and Babbitting and milling the bearing is described. The use of electric furnaces for this process is discussed and considerable saving thereby in the cost of Babbitting is claimed.—J. H. W.

Economical Maintenance of Large Electric Furnaces. Anon. (*Machinery (Lond.)*, 1933, **42**, 127).—A heating element for an electric resistance furnace is in the form of a long hairpin attached by nuts to busbars at the back of the furnace. It can be renewed in a few minutes even when the furnace is hot.—J. C. C.

Determination of Maximum Current Carrying Capacity of Furnace Electrodes. Bruce L. Bailey and Raymond R. Ridgway (*Electrochem. Soc. Preprint*, **1933**, May, 147–162).—The behaviour of carbon and graphite electrodes in electric furnaces manufacturing abrasives is discussed. Both types of electrodes oxidize rapidly at points at which the surface temperatures reach 500° C., and the joint resistance of screw-threaded electrodes limits the permissible loading. The waste of power at the electrode clamps may be reduced by lining the clamps with bronze. Graphite electrodes are generally superior to carbon, even those specially prepared for high current densities.—A. R. P.

Canadian Electric Furnace Industry. Alfred Stansfield (*Electrochem. Soc. Preprint*, **1933**, May, 167–181).—Statistics are given of the growth of electrothermal industries in Canada, producing aluminium, abrasives, ferro-alloys, and carbides, and of the use of electric furnaces for melting, annealing, and galvanizing ferrous and non-ferrous metals.—A. R. P.

Removal of Soot from Furnaces and Flues by Use of Salts or Compounds. P. Nicholls and C. W. Staples (*U.S. Bur. Mines Bull.* No. **360**, 1932, 1–76; *Ceram. Abs.*, 1932, **11**, 631).—A list of compounds which have been proposed, patented, or sold for this purpose is included. A detailed report of tests made and results obtained is also given.—S. G.

FUELS

Electricity, Gas, and Other Fuels as Heating Agents. A. H. Barbour (*Nature*, 1933, **131**, 32).—A condensed account of a paper read before the Institution of Electrical Engineers. Discusses the relative, practical advantages and economic aspects of electricity, gas, oil, coke, and other solid fuels. —E. S. H.

The Industrial Uses of Gas. W. M. Carr (*Gas J.*, 1933, **201**, 552–558, 626–631).—Recent developments in the industrial use of town's gas, its advantages compared with other fuels, and its efficiency in use are briefly discussed. The subjects discussed include: soft-metal melting, drying ovens, non-ferrous metal melting, and bright wire annealing.—J. S. G. T.

The Use of Gaseous Fuel in South Wales Industries. A. J. Cruise (*Chem. and Ind.*, 1933, **52**, 124–126).—A lecture to the South Wales Section of the

Society of Chemical Industry, discussing the applicability and economic aspects of solid, liquid, and gaseous fuels, particularly in relation to the tinplate and chemical industries.—E. S. H.

The Development of Gas as an Industrial Fuel. Joseph E. White (*Gas J.*, 1933, **202**, 533–542).—Read before the Institution of Gas Engineers. Developments on the application of town's gas to industrial purposes in Newcastle and surroundings are briefly discussed.—J. S. G. T.

A Short Cut to the Ultimate Analysis of Coal. Leslie B. Bragg (*Gas Age-Record*, 1933, **71**, 514–516).—Nomographs for determining the ultimate analysis of coal from its proximate analysis are discussed.—J. S. G. T.

Blast-Furnace and Foundry Coke. Adolph Jenkner (*Colliery Eng.*, 1933, **10**, 10–13, 54–56).—(I.—) The importance of phosphorus and sulphur content is emphasized. Great stress is laid on the compressive strength, porosity, and friability of coke samples, and the limitations of certain testing methods are indicated. The standard method of strength testing adopted by the Midland, Northern, and Scottish Coke Research Committees is described. Reactivity must usually be balanced against friability. The Koppers method of determining reactivity in the laboratory is described, and specimen reactivity curves are shown. (II.—) Methods of microscopic examination are discussed, and typical microstructures are shown, and correlated with the results of electrical conductivity determinations, apparatus for which is illustrated. It is confirmed that the reactivity of coke depends on the degree of graphitization: the relation between this and coking temperature is also studied.
—P. M. C. R.

On the Problem of the Reactivity of Foundry Coke. G. Heidhausen and P. Liebaldt (*Mitt. Forsch. Anst. G.H.H. Konzern*, 1933, **2**, 96–98).—Methods for determining the reactivity of foundry coke are described, and the value of the results in determining the suitability of the coke for use in cast-iron foundries is discussed.—A. R. P.

Pulverized Coal: Significance of Its Analysis to the Consumer. Rapier R. Coghlan (*Rock Prod.*, 1932, **35**, (23), 20–22; *Ceram. Abs.*, 1933, **12**, 73).—C. shows how to calculate, from the proximate analysis and the ultimate analysis of a coal, the combustible elements present and the amount of air required for combustion of a unit weight of coal. The proper amount of primary air in combustion may mean a saving of thousands of dollars in a million dollar annual fuel bill. Tabular data on coals are given.—S. G.

Marketing and Industrial Uses of Charcoal. R. S. McBride (*Chem. and Met. Eng.*, 1932, **39**, 664–667).—The rate of operation of wood-distillation plants is governed directly by the extent of its use as a fuel and as a chemical raw material. The marketing and various uses of charcoal are discussed. Of 40·8 million bushels produced in 1929, 1·5 million bushels were used in non-ferrous metallurgy.—F. J.

Fuel. Arthur Grounds (*Ann. Rep. Prog. Applied Chem.*, 1932, **17**, 25–51).—A summary, with full references, is given of papers published during 1932 on fuels.—H. F. G.

The Application of Pulverized Fuel to the Foundry Industry. W. Boon (*Proc. Inst. Brit. Found.*, 1931–1932, **25**, 441–464; discussion, 464–474).—S. G.

XVI.—REFRACTORIES AND FURNACE MATERIALS

(Continued from pp. 328–329.)

Some Uses of Refractory Material in the Foundry. J. G. A. Skerl (*Refractories J.*, 1933, **9**, 19–22, 59–60, 63, 91–94; and *Found. Trade J.*, 1932, **47**, 369–372).—Read before the Sheffield and East Midlands Branch of the Institute of British Foundrymen. A general review of the composition and properties of the principal refractories, especially those used in iron foundries, is undertaken.—J. H. W.

Refractories for High-Frequency Furnaces. T. R. Middleton (*Refractories J.*, 1932, 8, (2), 47; *Ceram. Abs.*, 1932, 11, 309).—The pre-fired clay or plumbago crucibles have been replaced by linings built up by other methods. Sintered linings, acid or basic, are most generally used. In preparing the lining, 2–3 in. of suitably graded refractory is first rammed on to the furnace bottom, and on this is bedded a hollow mild steel cylinder having its bottom end closed. The space between cylinder and coil is then carefully rammed with refractory, the furnace top and spout being finished off with brick and ganister or by any other suitable method. The procedure then consists in charging raw material into the cylinder and melting down slowly; the refractory is thus sintered and bonded to the form of the cylinder. Such linings are satisfactory. Another type of lining is unfired silica or magnesite brick. The bricks are of special section, generally built into place without cement. —S. G.

Refractories for Industrial Furnaces.—I. F. H. Norton (*Fuels and Furnaces*, 1932, **10**, 383–392; *Ceram. Abs.*, 1932, **11**, 530).—N. discusses the following types of refractories used in the construction of industrial furnaces from the viewpoint of composition, manufacture, and physical characteristics: fireclay, kaolin, high-alumina, silica, magnesite, chrome, and special refractories such as zirconia, magnesium spinel, silicon carbide, fused alumina, &c. The important characteristics of the various types of refractories are summarized in tabular form.—S. G.

Refractories for Industrial Furnaces. II.—Classification of Industrial Furnaces. F. H. Norton (*Fuels and Furnaces*, 1932, **10**, 443–452; *Ceram. Abs.*, 1932, **11**, 530).—The classification of furnaces may be made according to the fuel used, the size, the maximum temperature required, continuous and intermittent, according to the type of slag occurring in the process, and according to the utilization of the heat produced. The last classification would include furnaces: (1) which produce a heated product, (2) used to alter the physical structure of a material, (3) used for melting, (4) required to produce a chemical reaction (a combination of the chemical reaction and melting furnace), and (5) for utilizing the heat produced for power or to supply heat to some external unit such as a drier. Data on a large number of typical furnaces in regard to the types and amounts of refractories used, as well as their life, are presented in concise tabular form.—S. G.

Refractories for Industrial Furnaces. III.—Selection of Refractories. F. H. Norton (*Fuels and Furnaces*, 1932, **10**, 521–528; *Ceram. Abs.*, 1932, **11**, 618).—N. discusses the selection of refractories for particular conditions such as constant temperature (never falling low enough to cause serious spalling), and variable temperature (having more or less rapid temperature changes in the spalling range) applications, as well as the testing of them for special purposes.—S. G.

Limits of Refractoriness. Anon. (*Tonind. Zeit.*, 1933, **57**, 149–150).—The limits of refractoriness may be considered as the melting point of the high-melting oxide. For use on a large scale a mixture of zirconia with 10% of magnesia is probably the most refractory. In inert or reducing atmospheres or in a vacuum, however, the carbides of zirconium, hafnium, tantalum, niobium, titanium, molybdenum, and tungsten, the nitrides of titanium, zirconium, hafnium, and tantalum, and the borides of zirconium, hafnium, and tungsten must be taken into consideration. The substance with the highest known melting point (4215° C.) is a mixture of 4 parts of tantalum carbide with 1 part of hafnium carbide.—B. Bl.

Super-Refractories. A. Granger (*Céram. Verrerie*, **1932**, 189–192, 245–248, 301–304; *Ceram. Abs.*, 1933, **12**, 63).—G. considers all materials having a fusion point higher than that of dehydrated kaolinite (cone 35) as super-refractories. In this class are included the anhydrous aluminium silicates, hydrated aluminates, natural and artificial corundum, chrome, the RO_2 group including zirconia and thoria, the RO group, of which magnesia and beryllia are important, graphite and silicon carbide, and the nitride and carbide of boron. The uses, characteristics, composition, and preparation of these materials are discussed in detail.—S. G.

Refractory Materials. —— Hayes (*World Power*, 1932, **1**, 49–54; *Ceram. Abs.*, 1932, **11**, 311).—H. discusses the question of resistance to corrosion and such factors as the nature and physical properties of the matrix of the material, its capacity to resist internal strains, the cohesion between the matrix and grog particles, and the effect of temperature variation on the matrix. Friability or the tendency of a refractory composition to crumble under service conditions is often due to the absorption of metallic oxides. Other properties of refractory materials dealt with are thermal and electrical conductivity, reversal and permanent expansions, sudden changes in temperature, and the causes and tests for spalling.—S. G.

Theory of Spalling. F. W. Preston (*J. Amer. Ceram. Soc.*, 1933, **16**, 131–133).—This paper registers objection to the purely mathematical parts of F. H. Norton's treatment of the subject (*ibid.*, 1925, **8**, 29–39).—The physical nature of the spalling process will be dealt with later.—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Method of Test for Porosity and Permanent Volume Changes in Refractory Materials (C 20–20). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1141–1142; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 997–998).—Changes to Section 5, paragraphs (*c*), (*d*), (*e*), (*f*), (*g*), and (*h*), and a new paragraph are proposed. —S. G.

The Disintegration of Fireclay Products by Carbon Monoxide. A. T. Green, W. Hugill, and H. Ellerton (*Bull. Brit. Refract. Res. Assoc.*, **1932**, 39–44; *Power and Fuel Bull.*, 1932, (**16**), 63).—For prevention of disintegration in those circumstances of industrial use which include an atmosphere of carbon monoxide, it is desirable that the clay be carefully selected and picked before manufacture, so that the presence of ferruginous nodules be reduced to a minimum. It is further suggested that the higher the maturing temperature within the limits of the production of a satisfactory product, the better the resistance to their disintegration.—S. G.

The Significance of Permeability of Gases in Relation to the Texture and Industrial Usage of Refractory Materials. F. H. Clews and A. T. Green (*Bull. Brit. Refract. Res. Assoc.*, **1932**, 3–11; *Power and Fuel Bull.*, 1932, (**16**), 63). —An attempt is made to illustrate the additional useful information that measurements of the permeability to gases can yield in regard to the structure and texture of refractory products. A few instances of industrial installations when gas losses may occur directly as a result of the permeability of the refractory materials are considered, but greater weight is attached to the relation of the permeability to gases to the mechanism of corrosion in different types of industrial service.—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Method of Test for Softening Point of Fire-Clay Brick (C 24–31). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1142–1144; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 998–1000).—It is proposed to change the title to read "Standard Method of Test for Determining the Pyrometric Cone Equivalent of Fire Clay and Fire-Brick." Changes are also proposed to Sections 1, 2, and 3, for which the original must be consulted.—S. G.

Refractory Fireclay Ware Produced by the Method of Dry Pressing at the Chasov-Yarsk Plant "Ukrogneupor." P. P. Budnikov (*Domez*, **1932**, (**12**), 58–60; *C. Abs.*, 1933, **27**, 2547).—[In Russian.] Refractory bricks, crucibles, and large blocks were prepared by the dry-press method.—S. G.

Proportioning the Grain Size in Clay Refractories. Stephen M. Swain and Stuart M. Phelps (*J. Amer. Ceram. Soc.*, 1931, **14**, 884–898).—A brief review is given of previous work pertaining to proportioning of the particle sizes. Experimental work presented concerns the proportioning of 3 sizes of flint clay. To the proportioned particle sizes there were added different amounts of plastic or bond clay. The effects of proportioning on density, porosity, and change during firing are given. Clays from two producing districts were used, and although the experimental work on these was comprehensive, similar work should be continued in plant-scale operations. The summary presents the benefits which may be expected from proportioning particle sizes of fireclay mixes used in refractories.—S. G.

Notes on the Structure of Refractories. S. M. Phelps (*Blast Fur. and Steel Plant*, 1932, **20**, 543–544).—Presents comments of a general nature on work which was the subject of a paper published in the *J. Amer. Ceram. Soc.*, 1931, **14**, 884–898. See preceding abstract.—R. Gr.

Introduction of Secondary Kaolin in the Firebrick Mix for the Purpose of Increasing the Alumina Content and the Refractoriness. P. P. Budnikov and B. I. Endovitsky (*Ber. deut. keram. Ges.*, 1932, **13**, 253–256; *Ceram. Abs.*, 1932, **11**, 616).—Details are given of some experiments on the addition of a secondary kaolin to a refractory mix in order to improve its refractoriness and other properties.—S. G.

Utilization of Semis–Bugu Corundums for High-Grade Refractories. E. Keler (*Trans. Ceram. Res. Inst.* (*U.S.S.R.*), 1932, (**34**), 20–41; *Ceram. Abs.*, 1933, **12**, 64).—K. describes attempts made to use powdered corundum for the manufacture of refractory products. The results were as follows: (1) The refractoriness of the products amounted to Seger cone 39. (2) The softening under load of 2 kg./cm.^{2} began at 1420°–1500° C.; for products fired to Seger cone 26 or 32, the softening began between 1525° and 1630° C. A complete softening appeared at about 1670° C. (for some samples, 1710° C.). The products shrink very little with increased temperature; their capability of absorbing water at Seger cone 12 or 14 amounted to from 10·7 to 17·8%. (3) The sensitivity to changes of temperature was determined. The stability to changes of temperature of corundum products is similar to that of grog products of high grade. (4) The resistance to the attack of slag was shown to be high, and considerably higher than that of grog brick with a high alumina content. (5) A microscopical investigation of the products of (4) showed that they did not contain any mullite crystals and that their chemical resistance is due to corundum crystals.—S. G.

Sinterkorund, a Ceramic Material of High Quality. Anon. (*Sprechsaal*, 1932, **65**, 526).—See *J.*, this volume, pp. 273, 329.—S. G.

Graphite as a Refractory. Richard H. Stone (*J. Amer. Ceram. Soc.*, 1933, **16**, 96–101).—Some properties of graphite are discussed and industrial applications as a refractory are enumerated. Previous work on graphite, particularly during the Great War, on graphite crucibles, is reviewed; that work was directed towards the discovery of a substitute for imported graphites and clays. Since peace-time conditions were restored manufacturers have returned to foreign sources of raw materials, and some reasons for this tendency are advanced. Analyses of several foreign and domestic graphites are tabulated. Reports are given of experiments on the thermal conductivity of clay–graphite bodies with the effect of varying percentages of graphite on the conductivity.—S. G.

Magnetic Refractories. P. P. Budnikov and Z. Ya. Tabakov (*Domez*, 1932, (**9**), 24–31; *C. Abs.*, 1933, **27**, 2547).—[In Russian.] A review.—S. G.

Thermal Conductivity of Magnesite Brick. Gordon B. Wilkes (*J. Amer. Ceram. Soc.*, 1933, **16**, 125–130).—The thermal conductivity of magnesite brick has been determined from 200° to 2500° F. (93°–1371° C.) with a new type of furnace, and the results compared with those of previous investigators. —S. G.

Method for the Removal of Iron from Ceramic Materials. R. Staufer and K. Konopicky (*Tonind. Zeit.*, 1933, 57, 126–127).—Sulphuric acid dissolves iron compounds only very slowly, but an equimolecular mixture of sulphuric acid and ferrous sulphate with a little ferric sulphate is almost as effective at 50°–60° C. as concentrated hydrochloric acid.—B. Bl.

XVII.—HEAT-TREATMENT

(Continued from p. 329.)

Tentative Revisions of A.S.T.M. Standards. Standard Definitions of Terms Relating to Heat-Treatment Operations (Especially as Related to Ferrous Alloys) (A 119–30). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1129–1130; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 985–986).—Changes are made to the definitions of the terms: "heat-treatment"; "annealing"; "normalizing"; and "tempering" and a new definition is given of the term "nitriding."—S. G.

XVIII.—WORKING

(Continued from p. 330.)

Improvements in Rolling-Mill Design. Alfred F. Dixon (*Metallurgia*, 1933, **7**, 151–154).—Developments in plant and equipment, as well as improved technique, are responsible for much of the progress achieved during recent years in rolling mills, resulting in increased accuracy and improvement in the quality of the products. The improvements made in design are summarized and discussed with reference to various types of rolling mills. Recent developments in mills for the hot-rolling of non-ferrous metals have resulted in the installation of plant embodying mechanical improvements, which have considerably increased production, reduced labour and maintenance charges and at the same time enabled better products to be rolled more efficiently and expeditiously. A plant on such lines for the hot-rolling of nickel and nickel alloys consisting of two 3-high mills is discussed in detail.—J. W. D.

Rolling of Light Alloys in Cogging Rolls. V. M. Aristov (*Niimash-Izvestia Nauchno-issladovatelskogo Instituta Mashinostroenia i Metalloobrabotki* (*Bulletin of the Scientific Research Institute of Machine-Building and Metal Treatment*), **1932**, (2), 123–130).—[In Russian.] Experiments on the rolling of aluminium alloy rods containing copper 2·48, magnesium 0·32, manganese 0·01, silicon 0·05, and iron 0·33% in grooved cogging rolls, show that this method is applicable to light alloys. In the open grooves of the rolls, a marked spreading of the metal is observed. The number of passes for the light metals is about the same as for ferrous metals. The average rate of rolling for the above alloy was 0·6–1·5 in./second, and the Brinell hardness (1000/10/30) was increased by rolling from 35 (annealed value) to 44.—N. A.

Aluminium Strip Mill. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 525–526).—Describes a complete rolling-mill plant equipment for the production of aluminium strip, recently installed at Sheffield.—J. H. W.

Temperature Control on Sheet and Tinplate Rolls. Anon. (*Fuel Economist*, 1933, **8**, 489–490).—A paper published in Proceedings of the Royal Swedish Institute for Scientific Industrial Research. Losses incurred in the breakage of rolls in sheet and tinplate rolling mills are largely due to over-heating, and an experimental plant devised to measure accurately the surface temperature of the rolls is described.—J. S. G. T.

Modern Lubrication on Hot Mills. Robert M. Gordon (*Blast-Fur. and Steel Plant*, 1933, **21**, (5), 251–254).—Of direct application to steel-mill plant, but the information is useful for non-ferrous practice.—R. Gr.

Reading of the Rolling Pressure with the Watt-Meter. L. Weiss (*Z. Metallkunde*, 1933, **25**, 98–99).—A supplement to papers by W., see this *J.*, 1931, **47**, 298, 401.—M. H.

Conserving Power by Electric Drag. A. L. Krause (*Blast-Fur. and Steel Plant*, 1933, **21**, (4), 211–212).—Describes the use of an electric drag generator instead of the usual mechanical friction drag customarily used on sheet mills. Varying loads with subsequent varying speeds result in shocks and back lash in the roll couplings, unless minimized by the use of a brake. A brake consisting of a generator geared to the roll train conserves the power, gives superior operation, and reduction in maintenance.—R. Gr.

Bearings for Rolling-Mill Gear Drives. F. Waldorf (*Blast-Fur. and Steel Plant*, 1933, **21**, (4), 201–206, 219).—Outlines the principles to be followed in selecting bearings for steel plant rolling mills in particular, but the principles are of universal application. The method of calculating maximum bearing loads is given and brief reference is made to bearing selection, mounting, and lubrication. Specific data are given in the case of a German mill.—R. Gr.

Mill Lift Table. Anon. (*Blast-Fur. and Steel Plant*, 1933, **21**, (1), 62).—Describes a new Schloemann lift table for 2- or 3-high mills. Conveyor chains move the material to the rolls.—R. Gr.

Preparation of Lead and Tin-Foil for the Manufacture of Capsules. Anon. (*Maschinenkonstrukteur*, 1933, **66**, 35–36).—For metal capsules a lead–tin alloy is employed, 0·5% tin being the proportion preferred; after cutting and forming sheet of this composition plated with tin, the waste is remelted, and the composition adjusted by additions of lead. If a gold or silver coating is required, the tin plating must be heavier; careful handling of scrap is therefore essential for economic working. The rolling, lubrication, and cleaning of the metal sheet are described, as are the preparation and cleaning of tin-foil; for some classes of work tinned lead is substituted for tin, necessitating some modifications of the process. Details of the rolling processes are tabulated.
—P. M. C. R.

Special Bronze for Telephone and Telegraph Conductors. III.—Wire Drawing, Dies, and Lubricants. Samuel J. Rosch (*Wire and Wire Products*, 1933, **8**, 40–41).—Part of an article by F. Freude published in *Metallbörse*, 1931, **21**, 1491, 1539, 1673, and translated by R. The translation appears to be incomplete. See this *J.*, 1932, **50**, 376.—J. H. W.

New Light on Wire-Drawing. F. C. Thompson (*Wire and Wire Products*, 1933, **8**, 69–72, 93, 101–103).—Discusses the relation between tension and drawing speed, lubrication, tension and tensile strength, die material and design, die angle and power consumption, rotating dies and the number of passes for a given reduction.—J. H. W.

Rotary Piercing and Extrusion for Tube Manufacture. Gilbert Evans (*Metallurgia*, 1933, **8**, 45–47).—The advantages and disadvantages of rotary piercing and extrusion, more particularly with regard to non-ferrous tube manufacture, are discussed, special reference being made to the Mannesmann and Stiefel processes, which have been almost universally adopted. Features of the extrusion process which are considered are the need of turning the outside of the solid billet, the value of preliminary boring of one or both ends of the billet as a means of securing concentric walls, and the speed at which various mixtures may be extruded. Many of the points raised are debatable, the solution depending on prevailing conditions. Consideration is also given to the progress which has been made in the extrusion process.
—J. W. D.

Machine and Other Forging Methods. F. W. Spencer (*J. Coventry Eng. Soc.*, 1932, **13**, 59–80).—A review, describing drop forging, machine forging, press forging, and electrical upsetting processes. The various types of plant in use are illustrated and described. The advantages of the different methods and the structures of the products are briefly discussed.—R. G.

Hot Pressing of Hard Brass. R. Hinzmann (*Met. Ind.* (*Lond.*), 1933, **42**, 520).—Abstract from *Z. Metallkunde*, 1933, **25**, 67–70. See *J.*, this volume, p. 276.—J. H. W.

Forging and Die Stamping of Light and Ultra Light Alloys. [E.] Decherf (*Génie civil*, 1933, **102**, 338).—Abstract from *Aciers spéciaux*, 1932, **7**, 329. See *J.*, this volume, p. 214.—W. P. R.

The Hammering and Fashioning of Sheet Copper. G. Dubois (*Cuivre et Laiton*, 1932, **5**, 245–254).—An interesting and instructive article on the coppersmith's art. It is illustrated profusely and D. is careful to explain the various steps—even to a mathematical exposition of the layout for particular classes of work.—W. A. C. N.

Researches on Cutting Force. II.—On the Relation between the Cutting Force of Metal and its Mechanical Properties. Makoto Ōkoshi (*Rikwagaku Kenkyō-jo Iho* (*Bull. Inst. Phys. Chem. Res. Japan*), 1931, **10**, 1158–1205).—[In Japanese.] See this *J.*, 1931, **47**, 455.—S. G.

Researches on Cutting Force. III.—On the Relation between the Cutting Force of Metal and its Mechanical Properties. Makoto Ōkoshi (*Rikwagaku Kenkyō-jo Iho* (*Bull. Inst. Phys. Chem. Res. Japan*), 1932, **11**, 175–262; *Japanese J. Phys. Abs.*, 1933, **8**, (1), 5).—[In Japanese.] In report II of "The Researches on Cutting Force," Ō. discussed the relation between the cutting force of copper–zinc cast alloys and their mechanical properties, and ascertained that there is a linear relation between the cutting force and the work done in the shear test. In this report, O. discusses whether the above relation exists in the cases of cold-worked 70 : 30 brass, annealed 70 : 30 brass, quenched 60 : 40 brass, hot-worked 60 : 40 brass, 60 : 40 brass containing a small amount of lead, and other metals such as mild steel, bronze, cast aluminium, rolled aluminium, tin, &c.—AUTHOR.

Researches on Cutting Force. IV.—On the Relation between the Cutting Force Acting at the Twist Drill and the Mechanical Properties of Working Material. Makoto Ōkoshi (*Rikwagaku Kenkyō-jo Iho* (*Bull. Inst. Phys. Chem. Res. Japan*), 1932, **11**, 263–269; *Japanese J. Phys. Abs.*, 1933, **8**, (1), 6).—[In Japanese.] Ō. examines whether the relation found in reports II and III do or do not exist in the case of the drilling action of the twist drill. The materials used in these experiments were mild steel, bronze, brass, copper, aluminium, zinc, and tin. According to the experiments, there seems to be a linear relation between the cutting force of the twist drill and the work done in the shear test.—AUTHOR.

Hard-Facing [Stelliting] in Machine Manufacture. J. C. Huston (*Machinery* (*N.Y.*), 1932, **38**, 513–514).—Examples are given of the use of the process of applying a layer of wear-resisting alloy in the manufacture and salvage of punches, dies, and machine parts.—J. C. C.

Machining the Magnesium Alloy Elektron. Anon. (*Machinery* (*N.Y.*), 1932, **38**, 532–533).—Typical cutting tools suitable for machining Elektron are illustrated, and a brief account given of the properties and applications of the alloy.—J. C. C.

Selecting the Right Cutting Tools in a Modern Machine Shop. J. M. Highducheck (*Machinery* (*N.Y.*), 1932, **39**, 30–32, 172–175).—The results of cutting tests at speeds from 25 ft./minute to 300 ft./minute on S.A.E. 1035 heat-treated steel using tools of tungsten and tungsten–cobalt high-speed steels, Stellite, tantalum carbide, and tungsten carbide are tabulated. The fields of application of these materials are discussed, and some results obtained in production work quoted.—J. C. C.

Some Results Obtained Through the Use of the New Cutting Alloys. Anon. (*Machinery* (*N.Y.*), 1932, 38, 680).—General.—J. C. C.

Recording the Progress in Metal-Cutting Steels and Alloys. Anon. (*Machinery* (*N.Y.*), 1932, 38, 642).—An editorial review of the uses and characteristics of the principal cutting alloys.—J. C. C.

A Demonstration of [Stellite] J-Metal Tools. Anon. (*Machinery* (*N.Y.*), 1932, 39, 281).—A lathe tool of Stellite J-Metal was heated by a blowpipe while undergoing a cutting test on a mild steel billet. It was in good condition after 16 hrs. of continuous work.—J. C. C.

Molybdenum Titanium Carbide Cutting Tools [Cutanit]. Anon. (*Machinery* (*Lond.*), 1932, 40, 365–367).—"Cutanit" is a sintered alloy containing molybdenum and titanium carbides, but no tungsten, and is produced in one grade for machining all materials. The results of cutting tests under a variety of conditions are quoted.—J. C. C.

New [Aluminium Alloy] Piston Material Cut by Carbide Tools. Anon. (*Machinery* (*N.Y.*), 1932, 39, 10–11).—Examples are given of the use of tungsten carbide tipped tools for machining pistons from "Lo-Ex," otherwise known as "Alcoa 132" aluminium alloy. This is extremely abrasive to cutting tools, contains 12–14% silicon, and is remarkable for its very low thermal expansion. The life of carbide-tipped fluted drills used on this alloy was greatly prolonged by making the bushings and shanks of Nitralloy steel.
—J. C. C.

The Present Status of Cemented Carbide Tools. Malcolm F. Judkins (*Machinery* (*N.Y.*), 1932, 38, 643–649).—A review of the design and operation of cemented tungsten carbide cutting-tools. Details of the performance of typical tools are tabulated.—J. C. C.

New Developments in Hard Carbide Materials. Gregory J. Comstock (*Machinery* (*N.Y.*), 1932, 38, 735–737).—When tungsten carbide tools are used for machining steel, "chip cavities" are formed owing to the chips seizing directly behind the cutting edge. Tantalum carbide tools do not develop this defect, but the particles of tantalum carbide lack strength. Both defects are overcome by tungsten carbide tools cemented with an alloy of tantalum, tungsten, carbon, and cobalt.—J. C. C.

Experiments with Cemented Tantalum Carbide for Turret Lathe Operations. M. E. Lange (*Machinery* (*N.Y.*), 1932, 38, 655–657).—Cemented tantalum carbide tools do not develop "chip cavities" when machining steel. Photographs are given of the chips produced under various operating conditions when using such tools having chip-curler grooves ground on the top surface.
—J. C. C.

The Application of Carbide-Alloy Tools to Turret Lathes. George M. Class (*Machinery* (*N.Y.*), 1932, 38, 671–672).—Modern turret lathes are well suited for the use of carbide-alloy tools.—J. C. C.

Boring—An Ideal Application of Tungsten Carbide. R. R. Weddell (*Machinery* (*N.Y.*), 1932, 38, 753–754).—The design and operation of inserted-blade boring tools are briefly discussed.—J. C. C.

Carburettors Bored with Tungsten Carbide. Anon. (*Machinery* (*N.Y.*), 1932, 38, 697).—Tungsten carbide cutter bits are used for the rapid rough-boring of carburettor bodies.—J. C. C.

Precision Boring with Diamond and Cemented Carbide Tools. Anon. (*Machinery* (*N.Y.*), 1932, 38, 823–825).—Details are given of the use of boring tools tipped with cemented carbides for producing accurate and highly finished holes at high speeds in bronze, aluminium, and Bakelite.—J. C. C.

Tungsten Carbide Broach Produces over a Million Pieces. Anon. (*Machinery* (*N.Y.*), 1932, 38, 695).—A broach fitted with tungsten carbide teeth and designed for finishing automobile valve guides is described and illustrated.
—J. C. C.

Precision Drilling. Anon. (*Automobiltech.-Z.*, 1932, 35, 74–76).—The use of carefully controlled drives and Widia or diamond tools is stated to give a clean surface and complete freedom from structural distortion, together with great accuracy, and a specially adapted machine is described and illustrated. —P. M. C. R.

Speeds and Feeds for Cemented Carbide Milling Cutters. Anon. (*Machinery* (*N.Y.*), 1932, 38, 480A).—Data sheets.—J. C. C.

Determining the Value of Tungsten Carbide Milling Cutters. B. P. Graves (*Machinery* (*N.Y.*), 1932, 38, 650–653, 761–763).—Details are given of the results of a series of tests on the effect of cutter design, rate of feed, and cutting speed in milling cast iron with tungsten carbide cutters. It is concluded that a speed of from 200–235 ft./minute is most generally suitable, with a feed which will give a chip of from 0·008 in. to 0·013 in. per tooth. Some particulars are also given of tests on tungsten carbide tools for machining steel and bronze in automatic screw machines.—J. C. C.

Economic Factors Affecting the Use of Carbide-Tipped Milling Cutters. Millard Romaine (*Machinery* (*N.Y.*), 1932, 38, 665–669).—A general review, illustrated by details of the tools chosen for the various milling operations on the cylinder blocks and heads of a twelve-cylinder motor-car engine. —J. C. C.

Milling with Carbide Insert Cutters. Frank W. Curtis (*Machinery* (*N.Y.*), 1932, 38, 685–689, 749–752).—The special precautions necessary when milling with carbide insert cutters are discussed, and typical examples of their applications are illustrated. Details of the methods of milling aluminium, cast iron, and steel, and recommendations on grinding procedure are given. —J. C. C.

Using Super-Hard Tools for Planer Work. Anon. (*Machinery* (*N.Y.*), 1932, 38, 670).—A brief review of the conditions under which tungsten carbide tools may be used for planer work.—J. C. C.

Can Tungsten Carbide Tools be Used Successfully on Planers? Coleman Sellers (*Machinery* (*N.Y.*), 1932, 38, 774).—Tungsten carbide is not satisfactory for general use on planers owing to its inherent weakness. Its use in special circumstances is discussed briefly.—J. C. C.

Long Life of Tungsten Carbide Tools in Machining Automobile Parts. Anon. (*Machinery* (*N.Y.*), 1932, 39, 247–248).—Details of the service life and cost of typical tools.—J. C. C.

Wimet-X Cutting Alloy. Anon. (*Machinery* (*Lond.*), 1932, 40, 315, 466). —Wimet-X is a new grade of Widia tungsten carbide alloy which is suitable for machining steel. With this alloy, the steel chips do not tend to seize and cause undue wear to the tool.—J. C. C.

Why are there Several Grades of Widia Cemented Carbide Materials? Roger D. Prosser (*Machinery* (*N.Y.*), 1932, 38, 770–771).—A brief account of the purposes for which each of the 5 grades of Widia is suitable.—J. C. C.

Tantalum Used as a Binder for Tungsten Carbide. Anon. (*Machinery* (*N.Y.*), 1932, 38, 488).—A brief note. Cutting alloys are being made from tungsten carbide (which is less brittle than tantalum carbide) bound by an alloy containing tantalum, tungsten, carbon, and cobalt. The tantalum in the binding alloy is said to have self-lubricating properties and to reduce, by its lower heat conductivity, the tendency of the tool to over-heat.—J. C. C.

How Carboloy Tools are Made. Adam MacKenzie (*Machinery* (*N.Y.*), 1932, 38, 727–730).—Tungsten carbide, mixed with binders, is pressed and "semi-sintered" at 800°–900° C. in a non-oxidizing atmosphere. In this state, the material is like chalk and can be machined. Final sintering is carried out at 1350°–1550° C. in hydrogen. The tools are brazed to steel shanks with copper in hydrogen, using an electric furnace.—J. C. C.

Selecting Suitable Wheels for Grinding Carboloy. A. MacKenzie (*Machinery* (*N.Y.*), 1932, 38, 679–680).—A soft wheel is recommended for grinding Carboloy. An account is given of a method of testing the suitability of grinding wheels by measuring the loss of weight of wheel and Carboloy after grinding under standard conditions.—J. C. C.

Odd Sections and Accessories for Tramcars. C. C. D. (*Tramway and Railway World*, 1932, 12, 201).—Many small parts used on tramcars can advantageously be cut from scrap, instead of casting them specially, given an efficient and easily operated gas cutter. An oxy-coal-gas cutter, with injected nitrogen, is found to cut cleanly without overheating or ragged edges. A magnetized rod attached to the burner adheres to a sheet-iron template cut to the desired dimensions, and follows its outer edge as burning proceeds; this ensures accuracy in repetition work. The system is successfully applied to copper and aluminium sheet, gun-metal bushes, and small nickel and steel sections. —P. M. C. R.

XIX.—CLEANING AND FINISHING

(Continued from pp. 278–280.)

Successful Finishing of Die Castings. Edgar Parkinson and Frank V. Faulhaber (*Iron Age*, 1933, 131, 783).—For successful baked finishes of tin-, lead-, zinc-, and aluminium-base die-castings entrained gases must be removed. The castings are first cleaned in caustic soda and then heated for ½–1 hr. at temperatures 15°–25° F. (8°–14° C.) higher than the baking temperature. Pimples are removed by sanding. The baking temperature must not be high enough to sweat out the more fusible constituent, and varies from 224°–350° F. (107°–177° C.).—J. H. W.

The Colouring of Copper and Brass. M. Gossieaux (*Cuivre et Laiton*, 1933, 6, 35–37).—For cleaning purposes the following solutions are recommended: 1–2% sulphuric acid; 10% sulphuric acid with 7% potassium dichromate; 200 parts 52% nitric acid together with 1–2 parts of salt; 100 parts of sulphuric acid, 75 parts nitric acid. To ensure a bright surface, a bath of hydrochloric and nitric acids in water, in the ratios 6 : 1 : 2, should be used. In colouring, oil and grease must be removed in a hot alkaline solution. The various patinas may then be obtained by simple exposure to atmospheric conditions, or by the application of one or more of a great variety of chemical mixtures, of which some typical examples are given.—W. A. C. N.

Explosions in Lacquer-Drying Ovens; Spontaneous Ignition of Vapours or Solvents. —— Freitag (*Oberflächentechnik*, 1931, 8, 217).—S. G.

Forms of Sparks Produced in Grinding. Anon. (*Maschinenkonstrukteur*, 1932, 8, (13–14), 81–82).—From *Grits and Grinds*. The size, colour, form, and frequency of grinding sparks produced by such materials as Stellite, nickel, tungsten carbide, and several varieties of steel, cast iron, and wrought iron, are tabulated, with some remarks on the use of spark-forms in the rapid identification of materials.—P. M. C. R.

Methods of Truing Grinding Wheels by Diamond. Fred Horner (*Canad. Mach.*, 1933, 44, (2), 13–14, and 31).—Manipulative methods are summarized. The support and adjustments of the tool are of great importance; examples are illustrated. Certain special cases are discussed, including the truing of wheels intended for grinding threads or gear teeth.—P. M. C. R.

Equipment for the Cleaning of Metal.—XIV.–XXV. R. W. Mitchell (*Metal Cleaning and Finishing*, 1932, 4, 71–78, 139–146, 207–214, 273–276, 333–338, 389–394, 445–450, 491–495, 541–545, 589–592, 637–642; 1933, 5, 31–35; *Ceram. Abs.*, 1932, 11, 316, 349, 404, 443, 483, 517, 555, 607; 1933, 12, 9, 46, 96, 183).—(XIV.—) Data are presented on the use of overhead conveying systems, mechanical agitators, baskets, trays, racks, &c., in connection with cleaning operations. (XV.—) Data are given on washing machines. (XVI.—) Constructional features of metal washing machines and characteristics of various cleaners are discussed. (XVII.—) The cleaning of large metal parts by means of the steam gun is dealt with. A description is given of various types of cleaning guns and their applications. (XVIII.—) The importance of good rinsing in metal cleaning operations is stressed, and typical practice and the equipment employed are discussed. (XIX.; XX.—) Typical equipment and practice employed in drying metal products following cleaning and rinsing operations are discussed. (XXI.—) The theory and methods employed in the electrolytic cleaning of metal products preparatory to the application of finishes are discussed. (XXII.—) The discussion of electrolytic cleaning in alkaline solutions is completed, and electrolytic cleaning is introduced. The particular adaptability of each type is given. (XXIII.—) Continuing the discussion of electro-cleaning in acid solution, M. describes the patented Bullard–Dunn electro-cleaning process, and partly covers the Hanson–Munning bright-dip acid cleaning process. (XXIV.—) The discussion of electro-cleaning in acid solution by patented processes is concluded by a description of the Madsenell process, the Mason patent, the Packard Motor Car Co. process, some foreign developments, and Schmutz's patent for removing buffing compounds. (XXV.—) In discussing the procedure and equipment employed in the mechanical cleaning of metal parts, tumbling, rolling, and barrel burnishing are dealt with.—S. G.

Modern Degreasing and Cleaning [of Metals Prior to Plating]. —— Firgau (*Oberflächentechnik*, 1933, **10**, 3–4).—The use of benzene, benzine, and trichloroethylene in the liquid and vapour phases for removing mineral oil and grease from metals, and of caustic soda and trisodium phosphate for removing animal and vegetable grease is described.—A. R. P.

Vapour Degreaser. Anon. (*Metal Cleaning and Finishing*, 1932, **4**, 805; *Ceram. Abs.*, 1932, **11**, 483).—A special metal cleaning unit has been developed for most economically using Cecolene (trichloromethane) in vapour form for degreasing metal surfaces.—S. G.

Production Testing Routine Developed to Maintain Efficiency of New [Ridoline] Metal Cleaning System. Anon. (*Automotive Ind.*, 1933, **28**, 315).—The system described emphasizes the importance of keeping uniform composition in the cleaning bath, and a routine has been developed for periodic testing.—P. M. C. R.

"Sandblasting" Without Sand. Henry R. Power (*Metal Cleaning and Finishing*, 1932, **4**, 515–516; *Ceram. Abs.*, 1932, **11**, 607).—The non-siliceous blasting materials that are being increasingly used for sanitary and humanitarian reasons are, other than steel grit, the so-called electric-furnace abrasives, silicon carbide and fused alumina, in both of which "free silica" is practically absent.—S. G.

Automatic Pickling Machines. H. R. Smallman (*Better Enamelling*, 1932, **3**, (6), 9; *Ceram. Abs.*, 1932, **11**, 607).—Automatic pickling machines are described, including the standard return type, straight-line full automatic machine, and the dwell-type automatic machine.—S. G.

Pickling Sheet Metal and Its Control. —— Lang (*Glashütte*, 1932, **62**, 490–491, 510–512; *Ceram. Abs.*, 1932, **11**, 554).—L. discusses pickling in detail, and emphasizes the necessity for: (1) careful heating before pickling; (2) control of the acid; (3) strength of the pickling batch; (4) control of the pickling time, and (5) control of the washing water and of the neutralizing liquid especially. Directions for procedure are given.—S. G.

Rubber Lining for Pickling Tanks. Anon. (*Metal Cleaning and Finishing*, 1932, **4**, 307–308; *Ceram. Abs.*, 1932, **11**, 483).—Discusses the advantages as a lining for acid-containing tanks of the Triflex rubber lining consisting of hard rubber cushioned between two layers of soft rubber, and attached by the patented Vulcalock process.—S. G.

New Process for Colouring Aluminium and Its Alloys. L. C. Pan (*Platers' Guide*, 1933, 29, (4), 15–16).—Brief description of the applications of the "Coloral" process which is said to render aluminium and its alloys practically immune from atmospheric corrosion, besides giving them an attractive coloured finish.—J. H. W.

Statuary Finishes on Naval Bronze. Walter Fraine (*Platers' Guide*, 1933, 29, (2), 9).—The following solutions give good finishes on naval bronze: light, potassium chlorate 1 oz., copper sulphate 4 oz., water 1 gall.; dark, potassium chlorate 1 oz., nickel sulphate 2 oz., copper sulphate 4 oz., water 1 gall.; dark to blue-black, potassium or ammonium sulphide ½–1 oz., water 1 gall. The solutions are used hot, and immersion is repeated, and the sections are scratch-brushed wet until the colour is even.—J. H. W.

On the Use of Denatured Salt for Silvering Brass. Karl Bihlmaier (*Mitt. Forschungsinst. Edelmetalle*, 1933, 6, 136–137).—To avoid the payment of duties, salt used for technical purposes in Germany is adulterated with small quantities of various substances; the effect of these on the use of the salt for silvering brass by the usual method of rubbing the metal with a mixture of argol, silver powder, and salt has been investigated. It is recommended that 1% of soap be used as the adulterant in salt for this purpose.—A. R. P.

Abrasives. V. L. Eardley-Wilmot (*Mineral Ind.*, 1932, 40, 1–14).—Statistics of production and consumption are given for corundum, garnet, grindstones, pulpstones, millstones, pebbles, pumice, tripoli, amorphous silica, rottenstone, diatomite, and certain non-silicious soft abrasives. Among the latter class, silt and some clays are used as polishes for soft metals such as aluminium. Chalk is sometimes used for polishing plated ware. The use of both emery and flint paper and cloth is declining in favour of the artificial abrasive. Progress has been made in wheels for grinding extremely hard alloys, such as Carboloy, very low abrasive packing being employed.—E. H.

Adhesion of Glue and Fused Alumina Abrasives.—IV. Henry R. Power (*Metal Cleaning and Finishing*, 1932, 4, 611–612; *Ceram. Abs.*, 1933, 12, 41).—Cf. this *J.*, 1932, 50, 705. Glue briquet tests for adhesiveness made on 3 types of abrasive, untreated, glossy, and surface tenacity type, showed that the latter was superior both before and after exposure and is also superior in capillarity tests. All three types are wet by liquid oil at about the same rate.—S. G.

High Finishing of Metal Surfaces. Otto Nieberding (*Anz. Berg-, Hütten- u. Masch.*, 1933, 55, (23), 3–5).—The surface properties obtained by various methods of finishing and polishing and by chromium plating, and the advantages of a high finish are discussed.—B. Bl.

From the Practice of Polishing. Fritz Riedel (*Oberflächentechnik*, 1933, 10, 39–40).—A review of modern practice in hand, disc, and barrel polishing of metal before and after plating.—A. R. P.

High Lighting Cast Aluminium. Anon. (*Abrasive Ind.*, 1932, 13, (9), 11; *Ceram. Abs.*, 1932, 11, 547).—High lighting is a trade term given to the mechanical finish applied only to raised sections of castings subsequent to the application of a base finish such as sand-blasting or deplating. High lighting may be accomplished by a belt sander or rotary abrasive wheels. On flat castings the belt sander proves the most efficient, whilst on irregular castings wheels are necessary. Abrasive wheels recommended for high lighting are made from 6- to 12-in. standard sewed muslin buffs by gluing enough buffs together to give the desired thickness. For general use, wheels 1½ to 2 in. thick are used. Polishing wheels of this type are used with horizontal high-speed air grinders operated at from 3400 to 4400 r.p.m.—S. G.

Measuring the Depth of Grinding Scratches. Anon. (*Machinery* (*Lond.*), 1933, 41, 729–731; *correspondence*, 42, 71–72).—Methods for measuring the depth of scratches are of importance in connection with the standardization of surface finishes, and have been studied by *W. G. Collins.* Neither photomicrographic methods, the use of a knife-edge stylus passed across the work in conjunction with sound, current, or oscillogram recording devices, nor the use of micro-sections are entirely satisfactory. The method of grinding optical flats until the scratches disappear involves difficulties, but has given good results. It may be possible to take impressions with cellulose acetate and section these with a microtome for microscopical examination.—J. C. C.

XX.—JOINING

(Continued from p. 331.)

White Alloy for Fine Soldering. —— (*Sci. American*, 1932, **88**, 302).—A corrosion-resisting white alloy especially useful in dental and jewellery work consists of manganese, copper and nickel in addition to 49% silver and 1% gold, and can be used for soldering nickel, nickel alloys, and stainless steels. —W. P. R.

Notes on Soldering. New Magnetic Soldering Irons. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 348).—New magnetic soldering irons, consisting of a wire element embedded in a suitable refractory, are used for medium to heavy duty or for heavier work in factory production. The results of tests with this type of soldering iron and the use of "semi-weld" solders are discussed. —J. H. W.

Making Successful Test [Telephone] Pole Connections. T. DeWitt Talmage (*Telephone Eng.*, 1932, **36**, (10), 18–19, 22).—Faulty test connections on telephone lines may be due to corrosion resulting from too vigorous use of emery cloth on galvanized wire. Excessive strain or vibration may cause troubles. When copper and iron wires are to be joined by soldering, each should first be "tinned."—H. F. G.

Continuous Process Plays Important Part in Manufacturing of Radiators. J. B. Nealey (*Automotive Ind.*, 1932, **67**, 332–334).—The making of tanks, shells, and cores, and the assembling and soldering of the various parts, are now made continuous by the use of conveyor systems. The complete sequence of operations is described, with illustrations.—P. M. C. R.

Fluxes for Brazing. D. J. Thomas (*Mech. World*, 1932, **92**, 430).—The preparation and application of suitable fluxes in brazing operations are discussed. Compositions of a variety of solders are given. [*Note by Abstractor:* The term "brazing" is used to include soft-soldering.]—F. J.

Concerning Welding Rods, Hard Solders, and Fluxes for Non-Ferrous Metals. Erich Lüder (*Autogene Metallbearbeitung*, 1932, **25**, 305–312).—The importance of fluidity of the welding rod is stressed. This is influenced by the flux. The properties of suitable fluxes and their evaluation are discussed. Sample welds for test purposes should be both long and short, on material of various thicknesses and carried out by different methods. Improvement of the rods is effected by small additions of certain elements, *e.g.* copper rods may contain silver and phosphorus, whilst nickel rods may have cobalt added in the form of a thin coating. In some cases—that of nickel, for example—right-hand welding gives the best results. Special-brass welding rods (incorrectly called bronze-welding rods) should be used with an oxidizing flame so as to form an oxide film which prevents further oxidation of zinc. The formation of this film is encouraged by the presence of silicon in the rod. Silver is also added, to lower the melting point and reduce oxidation. As a substitute for silver solder, phosphor–copper is suggested, although the joints produced are brittle. —H. W. G. H.

Oxy-Acetylene Welding Aluminium Crankcase. J. Thompson (*Mech. and Weld. Eng.*, 1932, 6, 304–305).—Practical details of holding, preheating, and welding a motor-cycle crankcase are given.—H. W. G. H.

Welded Aluminium Tanks. W. E. Archer (*Welding Eng.*, 1932, 17, (11), 30–31).—Three Duralumin tanks for soap-making are described, each 12 ft. high and 11 ft. in diameter. Welding was carried out by the oxy-acetylene process, using "special Duralumin" filler rods and flux and a copper backing plate.—H. W. G. H.

Tank-Waggons in Welded Aluminium. Anon. (*Soudeur-Coupeur*, 1932, 11, (8), 3–4).—Describes some examples of welded aluminium transport tanks, and enumerates the advantages of the material and the method of fabrication. A tank waggon of 1000 litres capacity is illustrated.—H. W. G. H.

Autogenous Welding in the Fabrication of Aluminium. Anon. (*Soudure et Oxy-Coupage* (Suppt. to *Rev. Soudure autogène*), 1932, 9, 150).—It is stated that the oxy-acetylene process is used almost exclusively for fabricating aluminium. The welds are hammered and annealed. The method of welding "in two runs" is recommended in order to ensure perfect penetration. Two brewing vessels are illustrated.—H. W. G. H.

Concerning the Welding of Aluminium. Anon. (*Rev. Soudure autogène*, 1932, 24, 2558).—Although the successful welding of aluminium by the blowpipe has been possible since 1904, when Odam discovered the first suitable flux, the general public is still surprised to hear of its weldability. "Brazing" by means of aluminium alloys containing zinc or silicon is quite successful, but "soldering" with low melting-point alloys of tin, antimony, &c., is useless on account of the extremely poor corrosion-resistance of the joint.—H. W. G. H.

Practical Points on Welding Aluminium. Edward Searles (*Machinery* (*N.Y.*), 1932, 38, 536–537).—J. C. C.

Welding Aluminium Electrically. A. J. T. Eyles (*Elect. Rev.*, 1932, 110, 564).—As the result of extensive investigations in the U.S.A. it is now possible to arc-weld aluminium successfully. The electrodes used should be of the same composition as the material being welded and should have a heavy flux coating to envelop the arc, which should be as short as possible. Reversed polarity and comparatively low currents are used (85–100 amp. for $\frac{1}{8}$-in. rod). Welding should be carried out as quickly as is possible consistent with good work. Where applicable, arc-welding will be found to be more economical than either oxy-acetylene or oxy-hydrogen processes. Homogeneous and ductile welds can also be obtained with the atomic hydrogen arc, but it is advisable to use a good flux. Resistance-welding offers no particular difficulties, but for spot-welding special electrodes are useful, owing to the ease with which aluminium alloys with copper. Copper electrodes tipped with a copper–tungsten alloy have been used.—S. V. W.

Welding of Copper. H. Martin (*Met. Ind.* (*Lond.*), 1932, 41, 627–628; 1933, 42, 7–8; discussion, 8–10).—Read before the Birmingham Local Section of the Institute of Metals. Deoxidized copper is used, the 0·01% oxygen contained in tough-pitch copper being sufficient to cause trouble. Phosphorus is usually used as the deoxidizer, up to 0·05% remaining in the metal. Fluxes containing high phosphorus for deoxidizing are not recommended. The filler rods should have about the same melting point as copper, and an alloy containing 0·5% silver is satisfactory. Welding steel flanges to copper pipes presents no difficulties. Repair welds to tough-pitch copper are not so good. The advantages of the metal arc are discussed, and the atomic hydrogen and carbon arc processes are explained.—J. H. W.

New Investigations on the Gas Welding of Copper. K. Altmannsberger (*Oberflächentechnik*, 1932, 9, 21–22).—A review of modern welding methods for copper with especial reference to the function of various deoxidizers in the welding rod. The most satisfactory deoxidizers are considered to be lithium and phosphorus; addition of silver is recommended to reduce the viscosity. —A. R. P.

The Autogenous Welding of Copper. Anon. (*Rev. Soudure autogène*, 1932, **24**, 2535–2537).—A brief description of copper-welding technique, based on a booklet published recently by the Office Central de la Soudure Autogène. Forward welding is recommended, preferably up an incline. Where the back of the seam is accessible, it is an advantage, especially for thin material, to use an auxiliary blowpipe there. For thick material, welding in two runs with a backing plate is recommended.—H. W. G. H.

Repair of a Welded Copper Locomotive Fire-Box by Welding. H. Specht (*Schmelzschweissung*, 1932, **11**, 203–204).—Examples are given of the method of effecting repairs in locomotive fire-boxes by welding and of the excellent service given by boxes so repaired.—B. Bl.

Welded Copper Fire-Box. Anon. (*Locomotive*, 1932, **38**, 282–283).—An acetylene-welded copper fire-box recently fitted to a locomotive of the Chemin-de-Fer de L'Est of France is described, with scale drawing and full list of dimensions. The absence of riveted joints not only helps to eliminate surface irregularities, but also renders possible the insertion of additional stays. —P. M. C. R.

Autogenous Welding Applied to Copper Locomotive Fire-Boxes. A. Boutté (*Cuivre et Laiton*, 1932, **5**, 149–157).—An interesting account of the application of autogenous welding to the manufacture and repair of locomotive fire-boxes. The article is well illustrated by diagrams and illustrations. It enters into all details of arrangement of the work, organization of the various operatives engaged on it, and of the initial preparation and final finishing.—W. A. C. N.

Control of Expansion in Copper Plate Welding. Anon. (*Welding Eng.*, 1932, **17**, (6), 37–38, 44).—From an article entitled "Oxy-Acetylene Welding of Copper Fermentation Vats," *Mech. and Welding Eng.*, 1932, **6**, 70–71, 73. See this *J.*, 1932, **50**, 697.—H. W. G. H.

The Welding of Everdur. Hans A. Horn and Karl Tewes (*Schmelzschweissung*, 1932, **11**, 196–200).—Everdur can be satisfactorily welded with an oxy-acetylene flame using 10% excess of oxygen; no special welding rod is necessary. KMB paste and Canzler's copper-welding flux were used. Mechanical, technological, and X-ray tests of welded joints in Everdur are recorded.—B. Bl.

Extruded Bronze Fabrications (Weld and Colour Finish). Anon. (*Indust. Gases*, 1932, **13**, 129).—The extruded "bronzes" used in architecture are usually manufactured with a view to being weldable. An oxidizing flame is generally required, and the welding rod should, where possible, be of the same composition as the base metal.—H. W. G. H.

Oxwelding Brass and Bronze. Anon. (*Oxy-Acetylene Tips*, 1932, **11**, 119–122; also *Welding News*, 1932, **3**, 45–47; *Indust. Gases*, 1932, **13**, 139–142; and (abstract) *Met. Ind.* (*N.Y.*), 1932, **30**, 352–354).—Through the use of an oxidizing blowpipe flame, the exact adjustment of which is easily determined by observation of the oxide film formed on brass or bronze, oxy-acetylene welds of high quality can be made in commercial brasses and bronzes. Forward welding usually produces the best results, and a suitable flux is essential. —H. H.

The Autogenous Welding of Brass. H. Gerbeaux (*Rev. Soudure autogène*, 1932, **24**, 2538–2539).—It is necessary to use an oxidizing flame, which produces a film of zinc oxide on the surface of the molten metal and prevents further removal of zinc by oxidation. The excess of oxygen must be adjusted according to the zinc content of the brass and to the extent of preheating. On account of the latter factor, regulation is often necessary during welding. A flux consisting principally of borax and boric acid is used.—H. W. G. H.

Concerning the Welding of Brass. Anon. (*Rev. Soudure autogène*, 1932, **24**, 2578).—An extract from the *Bulletin des Associations Françaises de Pro-*

priétaires d'Appareils à Vapeur, in which the welding of brass tubes for steam is condemned. A letter of protest from the Chambre Syndicale de la Soudure Autogène is also reprinted. The latter states that, given the correct technique, welds in brass may be consistently obtained with mechanical properties very similar to those of the parent metal. A brief *résumé* of this technique is also given.—H. W. G. H.

Autogenous Welding of Brasses. Anon. (*Soudure et Oxy-Coupage*, 1932, **9**, 156).—The use of an oxidizing flame is recommended and a flux of borax and boric acid.—H. W. G. H.

Lead "Burning" or Welding. Robert L. Ziegfeld (*J. Amer. Weld. Soc.*, 1932, **11**, (9), 33–37; and *Welding Eng.*, 1932, **17**, (10), 34–37).—The history, technique, and applications of the process are discussed.—H. W. G. H.

Welding of Lead on to Iron and Steel. Anon. (*Technik u. Industrie u. Schweiz. Chem.-Zeit.*, **1932**, 105).—Thin films of lead may be deposited on iron and steel by means of the Schoop pistol, but adherent thick coatings are best applied by tinning the metal with solder and applying the lead with a blowpipe using a zinc chloride flux.—A. R. P.

Welding Practice for Nickel-Clad Steel Plate. F. P. Huston (*Welding Eng.*, 1932, **17**, (9), 24–29).—The steel is usually welded first, by any suitable method, and presents no difficulties. In welding the nickel, however, precautions must be taken which are described in this article for metallic and carbon arc, oxy-acetylene, and atomic hydrogen processes. Before welding is commenced, the seam should be chipped out to a depth slightly greater than the thickness of the nickel. The nickel weld is contaminated by iron, a maximum of 15% being found in acetylene butt-welds. With the arc process, butt-welds contain 4–8% iron; lap-welds 7–15% iron; and fillet-welds (nickel inside) 3–7% iron. The nickel–iron alloy is said to have good corrosion-resistance. Peening of the nickel weld metal is recommended.—H. W. G. H.

[Contribution] to the Question of Welding of Nickel and Its Alloys. Hans A. Horn and Wilh. Geldbach (*Schmelzschweissung*, 1932, **11**, 5–11, 40–43).—Good welds in nickel have been obtained with a welding rod containing manganese and a special flux, and welding by the method in which the rod is held behind the flame and is kept continuously immersed in the liquid metal. Welding is commenced 100–200 mm. away from the edge of the sheet, and there should be a sufficient gap between the sheet edges to prevent them being drawn over one another. A slight excess of acetylene is used in the flame, and the gas should be as free as possible from sulphur. Copper–nickel alloys can be welded with the same flux as is used for copper; cast and rolled metal can be readily welded if the welding flame is not too big, about 100 litres of acetylene per hour being necessary for every mm. of thickness of the sheet. Monel metal and Nicorros are welded in the same way as nickel. A rod of similar composition to the alloy is used; nickel silver, owing to its zinc content, can be welded only in an oxidizing flame with the use of the fluxes which are satisfactory for copper and copper–nickel alloys.—B. Bl.

Gas Welded and Brazed Joints for High-Nickel Alloys. F. G. Flocke, J. G. Schoener, and R. J. McKay (*Internat. Acetylene Assoc. Proc.*, **1931**, 152–162).—See this *J.*, 1932, **50**, 188.—I. M.

Hard-Facing in Grain Grinding. Anon. (*Oxy-Acetylene Tips*, 1932, **11**, 176).—Economies were effected by hard-facing the hammers of a machine used to pulverize hay and grain. Stellite was applied by the oxy-acetylene process.—H. W. G. H.

Metallurgical Problems Arising from Internal Combustion Engine Valves. J. R. Handforth (*J. Iron Steel Inst.*, 1932, **126**, 93–131, discussion, 132–157; and *Engineering*, 1933, **135**, 55–58, 83–85).—*The Protection of Valves by Stellite.*—Welding Stellite to valve seats rendered them very hard both at normal and at working temperatures. The composition of the Stellite was: carbon 2·5–2·75, cobalt 40–50, chromium 25–30, tungsten 15–20%, and its melting point 1275° C. Welding was effected by an oxy-acetylene blowpipe with a reducing flame and without the use of a flux. The operation is not very difficult, but requires some skill. The chief difficulties are: (1) pinholes in the deposited Stellite, (2) uncertain adhesion, (3) cracking in the Stellite during cooling, and (4) overheating of the valve seat during welding. The first two difficulties depend on the welding technique and the third chiefly on the coeff. of expansion of the valve steel. Silchrome valves were successfully treated in this way, but the Stellite applied to cobalt–chromium–steel cracked, whilst with austenitic steel, a coarse structure resulted which was not removable by heat-treatment.—J. H. W.

Metallurgical Problems Arising from Internal-Combustion Engine Valves. Anon. (*Mech. World*, 1932, **92**, 509).—The increasing use of tetra-ethyl lead in fuel for internal-combustion engines has revived the troubles which formerly arose through scaling of valves. The paper by J. R. Handforth (preceding abstract) is discussed, wherein it is shown that the welding of Stellite on to the seats of valves eliminates entirely the wear and distortion which occur under normal running conditions.—F. J.

Lead-In Wires for Vacuum Tubes. Thos. F. Faulhaber (*Wire and Wire Products*, 1932, **7**, 379–381, 402).—Unusual methods for "two-piece" and "three-piece" welds for electrical conductors for lamps, radio-tubes, &c., are described in detail. Two-piece welds include iron, nickel, aluminium, copper, and nickel to copper-clad; three-piece welds include copper to copper-clad to nickel, manganese–nickel, and molybdenum, and silver–copper alloy to copper-clad to nickel.—J. H. W.

All-Welded Tubular Frames. Anon. (*Automobile Eng.*, 1932, **22**, 382).—The advantages of welding tubular longitudinal and transverse members, and panels either in steel or aluminium and its alloys in car construction are considered. It is shown that the adoption of such technique would result in the raising of the power-to-weight ratio by the saving of metal and the elimination of bolts, nuts, and gusset plates. In addition, there would be greater ease in painting, minimum wind resistance, and a saving in production time.
—J. W. D.

Fabricated Structures. Anon. (*Mech. World*, 1932, **92**, 434–435).—Examples are given of welded structures, including aluminium, to demonstrate their superiority to castings as regards lightness and certainty of knowledge of the relative strengths of various parts.—F. J.

Desirable Qualities of Weld Metal. Anon. (*Metal Progress*, 1932, **22**, (4), 43–44).—The welded joint made under proper conditions is and should be harder, stronger, and less plastic than the materials it connects; when it becomes possible by careful control to produce a welded joint with higher elongation and lower yield-point than the surrounding materials, it will be equally possible to achieve the ideal joint—indistinguishable from the base material. A more precise use of such terms as "ductility" is advocated.
—P. M. C. R.

Metallurgical Properties of Metals and Their Effect upon Welding Operations. Joseph F. Osterle (*Welding Eng.*, 1932, **17**, (7), 28–29, 39).—A brief outline is given of physical metallurgy, explaining the nature of crystal structure, the formation of solid solutions, intermetallic compounds and eutectics, and the effects of heat and work. The importance of a knowledge of metallic structure when considering welding is emphasized.—H. W. G. H.

Are Inclined Joints Stronger than Transverse Joints? Otto Mies (*Schmelzschweissung*, 1932, **11**, 234–237).—From considerations based on the theory of elasticity it is concluded that scarf-welds have no advantages over butt-welds whether the material is tough or brittle, or whether it is subjected to tensile or compression stresses.—B. Bl.

The Formation of Stresses in Welds. L. de Jessey (*Rev. Soudure autogène*, 1932, **24**, 2554–2555).—It is pointed out that those who condemn welding on account of the internal stresses it causes, should remember that many assembling operations, such as shrinking fits, hot riveting, &c., actually depend on such stresses for their success. The causes of internal stresses in welds are explained, with particular reference to steel.—H. W. G. H.

The Experimental Determination of the Values of Fillet Welds in Tension. Leon C. Bibber (*J. Amer. Weld. Soc.*, 1932, **11**, (5), 16–19).—A method of calculating the stresses in fillet welds is explained and experiments are then described to confirm the theoretical results.—H. W. G. H.

Dangerous Welding Operations. Anon. (*Giesserei u. Masch.-Zeit.*, 1932, **5**, (6–7), 12–13).—A long discussion of the many dangers attending all kinds of welding operations and the precautions which are necessary.—W. A. C. N.

Developments in Fusion Welding. T. S. Murphy, Jr. (*Welding Eng.*, 1932, **17**, (6), 41–43).—Modern methods in the inspection of welds for pressure vessels are discussed. X-ray examination reveals bad technique or the use of unsuitable electrodes. Qualification X-ray tests are valuable in the training of welders and for maintaining a high standard of workmanship. Tensile and free-bend tests are taken on sample welds. For the former, the test-pieces should be machined so as to have a parallel length of at least 1 in. on either side of the weld. Annealing of completed vessels is carried out in special furnaces designed for the purpose. [*Note by Abstractor:* Only ferrous applications are considered.]—H. W. G. H.

Research Covering Alternating-Current Arc Welding. Grover A. Hughes and R. C. McBride (*Iron Steel Eng.*, 1931, **8**, 241–246; *C. Abs.*, 1931, **25**, 3949). —Results of the research are shown for welded steel, aluminium, Ascaloy, Monel metal, and copper. A.-c. arc welding was found satisfactory as to tensile strength, ductility, rate of depositing metal, and current consumption. Efficiency of welder is high and voltage and current curves are ideal. Satisfactory welds can be made with bare electrodes and with non-ferrous metals. —S. G.

Metal Deposition in Electric Arc Welding. Gilbert E. Doan and J. Murray Weed (*J. Amer. Weld. Soc.*, 1932, **11**, (9), 31–33; and *Welding News*, 1932, **3**, 56–59).—The various factors causing the transfer of metal from electrode to work were investigated by moving a polished strip of metal under the welding arc so rapidly that the various forms of metal deposition were distinctly separated from one another on the surface of the strip. Oscillograph records of the current and voltage of the arc were taken at the same time. Close correspondence between these records and the form of deposition was found. It was concluded that liquid globules are the chief form of metal transfer. The method is suggested as a means of testing electrodes.—H. W. G. H.

Researches in Arc Welding. G. E. Doan and J. L. Myer (*J. Amer. Weld. Soc.*, 1932, **11**, (11), 26–28).—Experiments are described to determine the characteristics of the iron arc in argon, moist air, and dry air. It was found that, in absolutely pure argon, it was impossible to strike an arc between pure iron electrodes with 120 v.—H. W. G. H.

Autogenous Welding and Its Applications to Construction. Anon. (*Technique moderne*, 1932, **24**, 393–401).—A review of the latest developments in welding plant, technique, and applications. Several types of automatic welding machine are described, both gas and arc. The applications discussed are mainly ferrous. The radiography of welds is briefly touched on and a *résumé* is given of the results of recent research.—H. W. G. H.

The Control of Spot Welds and Automatic Interrupters. J.-E. Languepin (*Technique moderne*, 1932, **24**, 237–241).—Discusses the theory of interrupters for spot-welding machines.—H. W. G. H.

Spot-Welding Methods and Arrangements. [J.-E.] Languepin (*Bull. Soc. Ing. Soudeurs,* 1932, 3, 591–609).—The technical considerations of spot welding are reviewed; the shape and size of the pieces to be joined; the position, size, and number of welds; the placing of the pieces in position; electrical and mechanical arrangements of the machines; and the handling of the pieces, being discussed. The influence of these factors on the economics of the process is explained.—H. W. G. H.

Holding Down Costs in Production Arc Welding. R. Kraus (*Amer. Machinist* (*Eur. Edn.*), 1932, 76, 137–141; and (abstract) *Mech. World*, 1932, **91**, 467, 556).—Various precautions, devices and methods, the use of which will tend to lower production welding costs, are described. These points include preliminary cutting and fitting, cleaning when necessary, economical size of electrodes, uniform welding, and overcoming the blow of the arc by altering the position of the ground lead.—J. H. W.

The Practical Application of the Arcogen Welding Method. H. Münter (*Apparatebau*, 1932, **44**, 87–92, 99–102, 111–116; also *Z.V.d. Kupferschmied.*, 1932, **44**, 99–104, 111–114, 123–128; and *Schmelzschweissung*, 1932, **11**, 54–59).—An illustrated description of the welding of iron, low-carbon steel, alloyed steel, cast iron, copper, copper–nickel alloys, aluminium, and their alloys by means of the "Arcogen" combined autogenous-electric welding method. The method cannot be used for copper alloys with a high zinc content.—M. H.

Arcatom Welding Process. —— Irmann (*Aluminium Broadcast*, 1932, **3**, (32), 2–3).—From Neuhausen Research Report No. **516**. Comparative test welds were made by the Arcatom process and blowpipe on aluminium and aluminium alloy sheets. Good welds were obtained by the Arcatom process. For sheets thinner than 3 mm. it is unnecessary to use an addition metal, and this may be of particular importance where good corrosion-resistance is required. The zone of softening is smaller than in blowpipe welding, but the discoloration of the flux may be a disadvantage, though it washes off readily with water. Costs, however, may be from two to three times as high as for blowpipe welding.—J. C. C.

Large Copper Hydrogen Welding Furnace. Anon. (*Met. Ind.* (*N.Y.*), 1932, **30**, 432).—A large tubular, electrically-heated furnace for the welding of steel with copper powder in an atmosphere of hydrogen is described and illustrated. —A. R. P.

Atomic Hydrogen Welding Used to Repair Dies. Anon. (*Iron Age*, 1932, **130**, 612).—In addition to welding steels, the process has been successfully applied to the welding of nickel, Monel metal, aluminium, brasses, bronzes, and zinc-base die-castings.—J. H. W.

Welding with Atomic Hydrogen. Samuel Martin, Jr. (*Technique moderne*, 1932, **24**, 366).—Abstracted from *Iron Age*, 1932, **129**, 537. See this *J.*, 1932, **50**, 326, 699.—H. W. G. H.

Concerning Crater Formation. Gilbert E. Doan (*J. Amer. Weld. Soc.*, 1932, **11**, (7), 17–18).—The crater formed during arc welding is caused partly by the pressure of a gas or electron stream, and partly by the temperature gradient in the pool of liquid metal, the surface tension being lowest where the temperature is highest—at the centre of the crater.—H. W. G. H.

[Bicaloy] A New Metal for Spot Welder Electrodes. Anon. (*Machinery* (*Lond.*), 1932, **40**, 718).—Bicaloy is claimed to have a life of 4 to 8 times that of copper when used for electrode tips.—J. C. C.

Offset Electrodes can be Water-Cooled. G. N. Sieger (*Automotive Ind.*, 1932, **67**, (16), 48).—Offset electrode shanks are needed to enable the welder to reach difficultly accessible portions of welded structures. Solid hard-drawn copper, the material generally used, has proved short-lived, very hot in working, and liable to oxidation. A method for cheaply installing water-cooled electrodes, preferably with Elkaloy tips, is described and illustrated.—P. M. C. R.

Sifbronze. Anon. (*Met. Ind.* (*Lond.*), 1932, 41, 84).—Short note of a trade publication entitled "Sif-Tips," recommending the use of bronze welding rod in bi-metal welding.—J. H. W.

Qualified Welders Make Joints Strong and Uniform. H. Malcolm Priest (*Metal Progress*, 1932, **22**, (6), 29–33).—An account is given of the qualifying and further tests carried out by welders on standard types of work recommended by the American Bureau of Welding. Some result cards are shown. Tests on butt- and fillet-welds are described, with a discussion of "forging effect," with special application to the relative strengths of symmetrical and non-symmetrical welds. Conclusions as to the effect of the welding process and the degree of variation between the strengths of welded joints, together with recommendations as to future qualification tests, are given.—P. M. C. R.

Selecting and Using Welding Rods. Stuart Plumley (*Welding Eng.*, 1932, **17**, (12), 25–29).—Attention is given chiefly to steel rods, but the following non-ferrous rods are briefly touched upon: Tobin–, silicon–, and manganese–bronze, phosphor–bronze, copper, and Everdur.—H. W. G. H.

A New Instrument for Measuring and Tracing Weld Seams. Hans Schmuckler (*Schmelzschweissung*, 1932, **11**, 243–245).—Two pieces of apparatus are described by the aid of which welding seams can be marked out and the dimensions of channel, V and X seams determined.—B. Bl.

Distribution of Stresses in Welded Double Butt-Strap Joints. S. C. Hollister and A. S. Gelman (*J. Amer. Weld. Soc.*, 1932, **11**, (10), 24–31).—Straps with side welds only, diamond-shaped straps and rectangular straps, welded along four sides, were investigated. The distribution of elastic stresses was determined photo-elastically and by means of extensometers, measuring deformations in various positions on the test-pieces. The diamond-shaped splices were found to show the best distribution of stress.—H. W. G. H.

What the Welding Industry Must Do to Receive Engineering Acceptance More Rapidly. S. C. Hollister (*Internat. Acetylene Assoc. Proc.*, **1931**, 191–197).—A better method for examination of welds in the field is needed. Fundamental knowledge is urgently required concerning stress distribution, in and fatigue of, welded joints.—H. W. G. H.

Notes on the Relation of Physical Tests to Quality and Service Value. E. D. Connor (*Mech. and Weld. Eng.*, 1932, **6**, 233–235).—The value of the notched-bar impact test is emphasized.—H. W. G. H.

Is High Ductility an Important Property of Weld Metals? R. R. Blackwood (*Mech. and Weld. Eng.*, 1932, **6**, 229–233).—The only sound method of measuring the ductility of a weld is to use a specimen cut exclusively from deposited metal. So long as the weld metal has a capacity for plastic flow of 1% linearly at the yield stress, there is not thought to be any danger from stresses due to welding, and the only important physical properties of a weld metal are given as: the yield stress and its relation to the ultimate stress, the fatigue-limit, and the impact resistance. [*Note by Abstractor:* These conclusions are based on results given by steel.]—H. W. G. H.

Phases of Gas Welding. Glenn O. Carter (*Internat. Acetylene Assoc. Proc.*, **1931**, 29–32).—See this *J.*, 1932, **50**, 258.—I. M.

Reduce Wear for Economy. Anon. (*Oxy-Acetylene Tips*, 1932, **11**, 83–87). —Hard facing with the oxy-acetylene blowpipe in the iron and steel, mining, manufacturing, and agricultural engineering industries is surveyed.—H. H.

Diesel Engine Repair by Oxwelding. Anon. (*Motorship* (*N.Y.*), 1932, **17**, 351–352).—Typical repairs which include, a broken engine base, a cracked piston, and a cracked cylinder head, are discussed, where the work was carried out by the oxy-acetylene process using high-strength bronze welding rods. —J. W. D.

Automotive Repair. Anon. (*Oxy-Acetylene Tips*, 1932, **11**, 99–108).—The applications of the blowpipe, in automobile repair work, are described and a very comprehensive table is given showing the parts for which each application is suitable.—H. W. G. H.

Oxy-Acetylene Welding in Production. H. O. T. Ridlon (*J. Amer. Weld. Soc.*, 1932, **11**, (7), 18–20).—Abstract of a paper read before the Chicago Section. Reviews the three principal factors—equipment, use of jigs, and the personal element.—H. W. G. H.

The Classification of Welding Blowpipes. Anon. (*Soudeur-Coupeur*, 1932, **11**, (8), 11).—Blowpipes are of two main types—high-pressure and low-pressure, or injector, pipes. The second group may be sub-divided into two classes—fixed delivery, and variable delivery. An example of each group is illustrated.—H. W. G. H.

The Metallurgical Aspects of Welding. Discussion, introduced by R. A. Holland and E. J. Raymond (*Mech. and Weld. Eng.*, 1932, **6**, 201–211).—Arc and oxy-acetylene welding, mainly of ferrous materials, are discussed. Aluminium and copper are briefly referred to.—H. W. G. H.

Preheating. Raymond Cook (*Mech. and Weld. Eng.*, 1932, **6**, 124–127).—Explains the need for preheating, and describes the methods usually employed, with some typical examples.—H. W. G. H.

A Little-Known Cause of the Burning-Out of Oxygen Reducing Valves. M. Maier (*Schmelzschweissung*, 1932, **11**, 269–270).—The "striking-back" of acetylene into the valve can be the cause of the trouble.—B. Bl.

Ignition of Blowpipes. E. Sauerbrei and W. Scheruhn (*Autogene Metallbearbeitung*, 1932, **25**, 337–342).—The formation of an explosive gas mixture in the back-pressure valve and connecting tubes to a blowpipe frequently takes place, especially if the apparatus has been lying idle. It is good practice, therefore, to allow free passage of the gases for some time before lighting the blowpipe, and it is advisable to open the oxygen tap before the acetylene tap. Experiments are described to show the length of time required before the oxygen content of such an explosive mixture falls to safe limits for ignition without risk of back-firing into the hydraulic valve. There does not appear to be much difference in the behaviour of injector and high-pressure blowpipes.—H. W. G. H.

Safety-Valves for High-Pressure Acetylene Apparatus. E. Sauerbrei and G. Lottner (*Autogene Metallbearbeitung*, 1932, **25**, 275–283).—Common defects in safety-valves are explained and, in the light of these, the requirements of a good valve are set forth. A method of testing is described and results are given for several types of spring-loaded valves. Dead-weight valves are said to be inferior to these. It is concluded that diaphragm valves are much superior to disc valves, and that they should be designed to permit cleaning and lifting of the diaphragm while in working position.—H. W. G. H.

The Methods of Production of Acetylene. Anon. (*Soudeur-Coupeur*, 1932, **11**, (12), 1–5).—Acetylene for welding is used at low pressure, from contact, carbide-to-water, or water-to-carbide generators, or at high pressure, in which case it may be obtained by boosting the low-pressure generated gas, from high-pressure generators, or from dissolved-acetylene cylinders. The advantages and disadvantages of each method are discussed with a distinct bias in favour of dissolved acetylene.—H. W. G. H.

The Purification of Acetylene. Anon. (*Rev. Soudure autogène*, 1932, **24**, 2659).—The principal impurities are ammonia, hydrogen sulphide, and phosphoretted hydrogen. These are removed by passing the gas through a compound such as "Catalysol." This is capable of regeneration by exposing to the atmosphere.—H. W. G. H.

Comparative Optical Testing of Cutting Nozzles. H. Malz and H. v. Conrady (*Autogene Metallbearbeitung*, 1932, **25**, 283–287).—The method described utilizes Toepler waves (sound waves inside the moving gas stream from the nozzle which produce small pressure differences). These are recorded photographically and are capable of interpretation in terms of the gas velocity. Results are given for different nozzles under various conditions.—H. W. G. H.

Eye Protection in Welding Operations. Raymond R. Butler (*Welding J.*, 1932, **29**, 361–364).—A useful review of the subject and a plea for standardization of protective goggles, followed by a lengthy discussion.—H. W. G. H.

Conventional Signs and Symbols in Autogenous Welding. M. Couturier (*Rev. Soudure autogène*, 1932, **24**, 2637–2639).—An advance announcement of the proposals shortly to be published by the standardization committee of the Fédération de la Mécanique.—H. W. G. H.

Contribution to the [Study of] Graphic Symbols for Welded Joints. Gillis Em. Huss (*Autogene Metallbearbeitung*, 1932, **25**, 342–344).—A system of symbols is proposed for international use to replace the many systems standardized in different countries.—H. W. G. H.

Sales Advantages of Welded Products. J. J. Fiechter (*Canad. Mach.*, 1933, **44**, (2), 27–28 and 30).—F. illustrates from the development of automobile construction the gradual displacement of ordinary jointing by welding, with concomitant increases in strength, efficiency, and simplification of design. Many modern applications of sheet metal would be impossible without welding, which also, by producing what is practically a one-piece structure, confers on the product greatly increased durability.—P. M. C. R.

Pre-Qualification Tests for Welders. Ernest Lunn (*J. Amer. Weld. Soc.*, 1932, **11**, (10), 10–12; discussion, 8–11).—Describes the recommendations of the Committee on Qualification Tests for Welders, of the American Welding Society, for a standard method to determine the qualifications of an operator to make sound fusion welds. *H. E. Rockefeller* proposed preliminary fracture tests to avoid the expense of special test-pieces. Typical fractures (in steel) were described to illustrate defects resulting from faulty technique.—H. H.

Qualifications for Welders. Vincent P. Marran (*J. Amer. Weld. Soc.*, 1932, **11**, (10), 31–34).—Discusses the selection of men suitable for training as welders, their classification and gradation.—H. W. G. H.

Regulations and Form of Examination for Training Craftsmen Transferred to Fusion Welding from Allied Trades. Issued by the Arbeitsgemeinschaft für Schmelzschweisserausbildung (*Autogene Metallbearbeitung*, 1932, **25**, 378–382).—H. W. G. H.

Basic Principles of Education and Training in Industry as They may be Applied to Welding Instruction in Trade and Vocational Schools. W. H. Magee (*Internat. Acetylene Assoc. Proc.*, **1931**, 183–190).—See this *J.*, 1932, **50**, 259.—I. M.

To-Day's Opportunities for Welding-Trained Men in the Metal Working Trades and Industries. S. Lewis Land (*Internat. Acetylene Assoc. Proc.*, **1931**, 35–45). **Training Gas Welders for the Job.** T. M. Jones (*ibid.*, 46–50). **The Growing Importance of Tests—What They Mean to the Welder and to the Welding Industry.** H. L. Whittemore (*ibid.*, 51–55). **Weld Tests.** John J. Crowe, A. B. Kinzel, and W. B. Miller (*ibid.*, 56–65). See this *J.*, 1932, **50**, 259.—I. M.

Pioneer Work on Technical Welding Methods in Works with Manual Labour. E. Stursberg (*Schmelzschweissung*, 1932, **11**, 217–223).—An illustrated article with examples of the welding of aluminium containers, crank-cases, &c.—B. Bl.

French Standardization. Anon. (*Usine*, 1931, **40**, (39), 39).—An extract from the bulletin of the Comité de Normalisation, illustrating and explaining a proposed system of indicating on drawings the exact form and dimensions of welds.—H. W. G. H.

L'Office Central et Institut de l'Acétylène et de Soudure Autogène. Anon. (*Technique moderne*, 1931, **23**, 24–25).—A description of the new building and its equipment.—H. W. G. H.

XXI.—INDUSTRIAL USES AND APPLICATIONS

(Continued from pp. 331–334.)

Aluminium and Bauxite. C. L. Mantell (*Mineral Ind.*, 1932, **40**, 15–33).—Statistics of world production and consumption of aluminium are given, and extensions of its uses are reported. Several American railways now have aluminium coaches and freight trucks in service, and the great saving of weight thus effected will probably lead to extensions in this direction. Among new alloys, No. 133 " Lo-Ex," containing 14% of silicon and varying amounts of nickel, copper, and magnesium, has a low coeff. of expansion and permits small piston clearances. New developments in the drawing of aluminium wire have made aluminium fly-screens and fences possible. Extended uses in dairy equipment and in architecture are reported. The application of oxide coatings for protective and decorative purposes has increased.—E. S. H.

The Trend and Progress of Aluminium. N. F. Budgen (*Metallurgia*, 1933, **7**, 105–108).—Developments in the metallurgy of light alloys are reviewed and their application to various industries such as the motor industry, railway engineering, shipbuilding, aeronautics, architecture, and the electrical industry are discussed, together with the use of aluminium for cooking utensils. The latest technical developments, such as casting of rolling slabs, gas inclusions, and methods of eliminating gas, are dealt with, and the application of general castings to various industries and the trend of developments with the new alloys are considered. Reference is also made to corrosion-resisting aluminium alloys particularly those containing silicon and magnesium.—J. W. D.

[Aluminium] The Material of the Textile Industries—Bobbins. [J. Bally] (*Aluminium Broadcast*, 1931, **3**, (5), 14–27).—Translated from *Rev. Aluminium*, 1930, **6**, 1175–1184, 1214–1221; **7**, 1276–1289.—J. C. C.

New Uses for Aluminium in the Textile Industry. J. R. Whitelegg (*Textile Weekly*, 1932, Oct. 28; *Aluminium Broadcast*, 1932, **3**, (40), 2–7).—J. C. C.

Preparation of an Aluminium Printing Plate. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 206–207).—The method of cleaning and etching the plate, coating it with a chromate–gelatin film, and developing the design, is described.—A. R. P.

Practical Metal Hull Construction. Anon. (*Aircraft Eng.*, 1932, **4**, 165).—Details are given of the processes employed in the erection of metal hulls of flying boats. Reference is made to the danger of working Duralumin which has been finally heat-treated and the age-hardening of which has proceeded too far. Anodic oxidation treatment of the manufactured components precedes final assembly. Rivets are anodically treated, then heat-treated, and used immediately. Any marking of datum lines, &c., is made with indelible pencil.—H. S.

Float Construction and Repair. Anon. (*Aircraft Eng.*, 1932, **4**, 247–249, 282–283, 288).—The process of building seaplane floats and methods of replacing damaged parts are described. Reference is made to the necessity for " normalizing " Duralumin before cold-working. Provision should be made for removal of water, and the construction should be such that any water entering the float will not be retained behind stringers and frames, but allowed to flow to the lowest parts, so that it can be removed at the drain-holes. Lanoline solution is sprayed over the surface of the interior and the inspection covers are closed down immediately to keep the lanoline soft.—H. S.

Aluminium Ship Furniture. Anon. (*J. Commerce* (*Ship. and Eng. Edn.*), 1932, Jan. 21, 2).—A description of aluminium furniture installed in the liner *Mariposa* with a view to minimize the risk of fire and allowing a saving in weight. The installation in the dining-saloon of 570 aluminium chairs each of 11 lb. weight is the first in a merchant-ship. The frames of the chairs are fabricated from the same strong aluminium alloys as are employed for aeroplanes and dirigibles, trucks, buses, railroad cars, &c.—J. W. D.

[Use of Aluminium in] A Proposed 800-ft. Atlantic Liner. Edgar P. Task (*Marine Eng. and Shipping Age*, 1932, **37**, 268–275).—In a description of a 28,000-ton liner various means of saving weight are suggested. These include the use of aluminium alloys for deck houses and decks above the sun deck and for practically all divisional bulkheads in the main hull and houses; the substitution of aluminium alloys for wood divisional and passage-way bulkheads in the passenger and crew quarters and for overhead ceilings where used in these places; and the use of aluminium for furniture. The use of aluminium foil for insulation of engine, boiler, and galley trunks, and decks in the way of these spaces, and also of refrigerating chambers is suggested. It is also stated that a general use might be made of aluminium paint, except the priming coat, for the inside of the hull, and the inside and outside of the deck houses. —J. W. D.

Marine Applications of Aluminium. —— De Biran (*Usine*, 1931, **40**, (47), 27).—Abstract of a paper presented to the Salon Nautique. See this *J.*, 1932, **50**, 180.—H. W. G. H.

Cast Alloys of Aluminium in the Construction of Aero Engines. C. Panseri (*Usine*, 1931, **40**, (43), 29–31).—Abstract of a paper presented to the 6e. Congrès International de Fonderie. See this *J.*, 1932, **50**, 567.—H. W. G. H.

Aluminium Castings in the Construction of Diesel Engines. W. Hartl (*Aluminium Broadcast*, 1932, **3**, (33), 2–11).—Translated from *Automobiltech. Z.*, 1931, **4**, 94–98. See this *J.*, 1931, **47**, 591.—J. C. C.

Light Alloy Pistons. J. S. Irving (*Automobile Eng.*, 1933, **23**, 19–22, 57–60).—The development of aluminium alloy pistons is first considered, and reference is made to composite pistons consisting of an aluminium alloy crown and a skirt formed either from cast-iron or steel. The requirements of aluminium pistons are then discussed, special reference being made to low weight, high thermal conductivity, strength at high temperatures, low coefficient of expansion, resistance to wear, and stability of structure. Data are given for various alloys for the effect of temperature on the mechanical properties, for friction tests on die-cast and forged piston alloys, for wear, for fatigue at 15° and 100° C., and for heat-treatment, and such data are discussed in considerable detail. Consideration is also given to the design of pistons, taking as the basic points of design, heat flow, mechanical strength, and minimum friction.—J. W. D.

Lynite T-Slot Piston Developed for Engines. Anon. (*Automotive Ind.*, 1932, **67**, 331).—The type of slotted piston described is produced in any of the usual aluminium piston alloys, including "Lo-Ex" (alloy "No. 132"). The latter is recommended on account of lightness, low coeff. of expansion, and good bearing qualities.—P. M. C. R.

Causes of Cylinder Wear: Piston Rings. Anon. (*Indust. Australian*, 1932, **87**, 327–328).—Light alloy construction, by reducing piston weight, gives quicker acceleration, lower bearing pressure, and decreased friction; the high thermal conductivity lessens the thickness and adhesive character of carbon deposits, and admits of higher compression than with cast iron. The high coeff. of thermal expansion, however, necessitates a large clearance, leading to "tipping" and rapid wear unless lubrication is perfect; also, modern practice tends to reduce oil consumption. A new type of compensating piston, having a light alloy body and Invar struts, is claimed to maintain an almost constant diameter on the thrust faces, and to require a clearance even less than that needed by cast iron.—P. M. C. R.

Structural Development of High-Powered American Motors. Anon. (*Automobiltech. Z.*, 1932, **35**, 42–47).—Materials for cylinders and pistons for different classes of work are described, and the latter are tabulated. A high proportion of models are fitted with aluminium or light alloy pistons, occasionally with reinforcements, *e.g.*, of Invar.—P. M. C. R.

Alloy Ring Carrier Cast in Light Piston Resists Wear. Anon. (*Automotive Ind.*, 1932, **67**, 747–749).—A series of wear tests is described on Bohnalite and aluminium–silicon alloy pistons, with solid skirt and inset ring carriers; beryllium–bronze and alloy cast iron were the materials employed. Axial wear on the rings was found to be comparatively small; radial wear was greatest in each case on the top ring. Ring grooves of beryllium–bronze were noticeably more worn than those of alloy cast iron, which showed so little wear that new rings were fitted without re-machining.—P. M. C. R.

Use of Aluminium for Cylinder Heads Eliminates Excessive Dead Weight. Anon. (*Automotive Ind.*, 1932, **67**, 749).—The construction, casting, and assemblage of aluminium cylinder heads are described. A saving of 50–60% on the weight of the cylinder is effected by their use, which further ensures even heat distribution in the head; this renders possible the employment of higher compression ratios, with a corresponding increase in power. Cost of production is lowered, owing to the smaller cost of machining aluminium.
—P. M. C. R.

Cause and Prevention of Cylinder Wear in I.C. Road Engines. R. Wake (*Mech. World*, 1932, **92**, 60–63).—Pistons and rings cause 45–65% of cylinder wear in internal combustion engines used in vehicles. This has led to the design of special types the aim of which is to distribute loads evenly and to avoid the effect of peak pressures. The " B.H.B." light-alloy piston, now being widely used for replacement purposes for heavy-duty and car engines, is self-adjusting under high temperature and load, minimizing oil consumption and risk of seizure. It is made in the " R.R.50 " alloy, the average composition of which is given. " Y " alloy is most commonly used for car and commercial-vehicle engine replacements. Its composition and mechanical properties are given.
—F. J.

Aluminium Corporation Plans to Make Motor-Truck Parts. Anon. (*Daily Metal Reporter*, 1932, **32**, (208), 6).—Restrictions on weight have increased the importance of light metals and alloys in truck body-work; carrying capacity can be increased, the dead-weight of a truck body can be reduced from 45 to 65%, with corresponding savings in cab and chassis, by the use of light alloys. The cost of the materials and of their fabrication is greater than with steel but the saving in weight more than balances the extra cost.—P. M. C. R.

The Importance of Weight Saving [by Aluminium Alloys]. Anon. (*Motor Cycle*, 1932, July 28; *Aluminium Broadcast*, 1932, **3**, (36), 6–12).—Details are given of an analysis, conducted by the British Aluminium Co., of the materials used in the construction of a standard 500-c.c. motor-cycle. It is concluded that by the use of light alloys the weight could be reduced from 350 lb. by 78 lb. 12½ oz.—J. C. C.

European Use of Light Alloys Gains. Anon. (*Automotive Ind.*, 1932, **67**, 49).—Considerable reduction of weight in commercial vehicles has been effected by the use of Duralumin (forged or rolled), magnesium, or Alpax (for castings), and Alfol as insulation ; the latter material consists of crumbled aluminium foil, weighing approx. 0·188 lb./ft.^{3}, as against 9·3 lb./ft.^{3} in the case of cork insulation. The vehicles most affected are motor-omnibuses, tanks and trucks for railway and road transport, and fire-engines and waggons.—P. R.

Edinburgh's New Tramcar. Anon. (*Tramway and Railway World*, 1932, **21**, 171–175).—The use of aluminium and light alloys has effected a 12·7% reduction of body-weight per seat in an experimental tramcar built for the Edinburgh Corporation. Important structural members of the body framework are of Duralumin, which is also used in roof-sticks and angles. Less heavily stressed members are of aluminium, aluminium–silicon Alloy No. 14, or Alpax; Alhambrinal, a composition-coated aluminium sheet, and plain aluminium sheeting are used in ceilings and roof. Other light-metal parts are heater brackets, controller backs and shields, switch and junction boxes, and cable tubing, all of aluminium, whilst a casting in "M.C.U." alloy carries the trolley-base.—P. M. C. R.

Vestibule Tramcar-Screens of Alpax Alloy. Anon. (*Tramway and Railway World*, 1932, **70**, 91–92).—Alpax is used for the metal vestibule-screen frames in certain new London County Council tramcars; it is claimed that it combines in the cast condition low sp. gr. and high deflection before fracture as compared with aluminium–copper and aluminium–zinc cast alloys. It also finds application as die-castings or sand-castings, as motor-car sumps, gear-cases, window-frames, Diesel engine inspection doors, sliding doors, and seat frames for railway coaches.—P. M. C. R.

Aluminium for Rolling Stock. Anon. (*Locomotive*, 1932, **38**, 433–434).—The introduction of the electric train has increased the demand for lightness in railway work. Aluminium and suitable light alloys, although much dearer than steel as regards first cost, are stated to be much more economical in running, repairing, and finishing, apart from economy in weight. Special alloys considered are a "modified" aluminium–silicon alloy [*Note by Abstractor:* Alpax?], Duralumin, aluminium–copper alloys (Cu 8–12%); the latter are recommended for carriage fittings in place of chromium-plated iron or steel. Aluminium paint is recommended for its heat-insulating qualities and also as an anti-corrosive coating, and directions for mixing and application are given.—P. M. C. R.

New Aluminium Rail Car. Anon. (*Daily Metal Reporter*, 1932, **32**, (234), 6).—A rail car constructed largely of aluminium, and about a quarter of the weight of the steel-built car of similar capacity, is about to be put into service on the New York Central Railway.—P. M. C. R.

Alpax Doors in Railway Construction. M. Leroy (*Rev. Aluminium*, 1932, **9**, 1893–1899).—The applications of Alpax in the construction of railway carriages are described.—J. H. W.

Permanence for Roofs [Aluminium Roofing]. Owen C. Jones (*Sheet Metal Industries*, 1932, April; *Aluminium Broadcast*, 1932, **3**, (32), 13–15).—Examples are quoted of the use of aluminium sheet joined by welding for roofing installations.—J. C. C.

Aluminium for Roofs and Roof Accessories. Anon. (*Contract Record and Engineering Review*, 1932, May 18; and (reprint) *Aluminium Broadcast*, 1932, **3**, (33), 12–14).—Examples of the use of welded aluminium sheet for the construction of roofing, gutters, leaders, and roof flashing are briefly described.—J. C. C.

Alloy 43 in Architecture. —— Baducci (*Usine*, 1931, **40**, (43), 33).—Abstract of a paper presented to the 6e. Congrès International de Fonderie. See this *J.*, 1932, **50**, 180.—H. W. G. H.

The Building Spandrel of Cast or Aluminium Alloy. Anon. (*Eng. News-Record*, 1932, **108**, 216–217).—Pressings from "3 S" alloy sheet or castings in "43" alloy have been used for filling the spandrel space between windows in recently erected buildings. The operations of casting spandrels weighing 90–240 lb. are illustrated. Finishing methods include polishing, sand or carborundum blasting, wire-brushing, and "deplating."—J. C. C.

Federal Conservatory Uses Aluminium-Alloy Framing. Anon. (*Eng. News-Record*, 1932, **108**, 539–542).—A detailed, illustrated account of the design and construction of the framework of the new conservatory of the U.S. Botanic Garden, Washington, U.S.A. Aluminium alloys and cast aluminium were extensively used to reduce the cost of maintenance in hot moist atmospheres. For heating the alloy rivets, a special pyrometer-controlled furnace was used.—J. C. C.

Aluminium as Window " Glass " in Germany. Anon. (*Amer. Glass Rev.*, 1932, 52, (2), 22; *Ceram. Abs.*, 1933, 12, 58).—Aluminium window panes are being manufactured in Germany which are said to be so transparent that they may be used as glass. The aluminium eliminates the yellow rays of the sun. —S. G.

Aluminium in the Electrical Industry. Anon. (*Elect. Rev.*, 1932, **110**, 671). —Aluminium, being non-magnetic and having a high electrical conductivity, forms an effective electrostatic shield, and for these reasons the metal is extensively used for wireless apparatus. It is also being used in the form of cases for electrical measuring instruments. Aluminium further protected by anodic oxidation and coloured is used for electrical fittings. Aluminium reflectors are also extensively used.—S. V. W.

Aluminium Castings in the Electro Industry. R. Schaumann (*Aluminium Broadcast*, 1932, **3**, (35), 8–12).—A slightly abridged translation from *Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1931, **3**, 267–269. See this *J.*, 1932, **50**, 102.—J. C. C.

Aluminium Conductors and Corona. Edgar T. Painton (*Electrician*, 1930, **104**, 137–138; *C. Abs.*, 1930, **24**, 1300).—The steel-cored aluminium conductor is lighter, stronger, and cheaper than hollow copper. The 1·093-in. cable has 7 steel wires (core) and around it are 54 aluminium wires. It is used for 220,000-v. transmission lines and weighs 2·41 tons per mile *versus* 3·46 tons per mile for the hollow copper conductor of equal electrical resistance and corona voltage.—S. G.

Steel-Cored Aluminium. Edgar T. Painton (*Electrician*, 1931, **107**, 733–735; *C. Abs.*, 1932, **26**, 383).—Steel-cored aluminium is being used extensively in transmission lines throughout the world. Where steel-cored aluminium has but one layer of aluminium over the core, the galvanized core can be dipped in a bituminous solution before stranding up the cable. The latest important development is the use of sector-shaped aluminium wires instead of wound wires, resulting in a reduced diameter with attendant savings.—S. G.

Aluminium–Steel Conductors in the English Grid System. Anon. (*Alluminio*, 1932, **1**, 315).—A short note.—G. G.

Properties of Metal Foil as an Insulating Material. J. L. Gregg (*Refrigerating Eng.*, 1932, **23**, 279–283; *Aluminium Broadcast*, 1932, **3**, (36), 15–18).—A review of work carried out at the Battelle Memorial Institute (U.S.A.). Low-conductivity units made of bright metal sheets, arranged with wooden or other separators to enclose air spaces having a thickness of ½ in. or less, were found to be light in weight and very efficient. The emissivity of commercial aluminium foil suitable for this purpose was determined and found to be about 5% of the black body and was not appreciably altered when the foil was stored in ordinary atmospheres.—J. C. C.

Heat Insulation with Metal Foil. Anon. (*Amer. Machinist* (*Eur. Edn.*), 1932, **76**, 356E–358E).—Metal foil is used as a heat insulator either in flat sheets separated by suitable spacers or as crumpled and stacked sheets. Both methods decrease the amount of heat transferred by convection and by reflection. Aluminium is an ideal metal for this purpose on account of its low sp. gr. and the ease with which it can be rolled, and on account of the oxide which forms on the surface and increases its resistance to atmospheric attack without appreciably affecting its reflectivity. Details of this method of insulation and the testing of the insulating properties of the foil are given. —J. H. W.

Roof Covering to Exclude the Sun's Heat. Anon. (*Architect*, 1932, **130**, 279).—Tests made at the Building Research Station show that outer roof surfaces should be non-metallic and inner surfaces metallic. A coating of aluminium paint is recommended for reducing downward radiation, although the necessary presence of a binding medium must reduce this effect in some degree.—P. M. C. R.

Aluminium Powder and Bronze Colours in the Painting Industry. H. Rabaté (*Rev. Aluminium*, 1932, **9**, 1789–1820).—Cf. *J.*, this volume, pp. 102, 169.—J. H. W.

Antimony. K. C. Li (*Mineral Ind.*, 1932, **40**, 34–40).—Statistics of consumption and production are given. The present chief uses of metallic antimony are in storage-battery plates, sheathing of telephone and telegraph cables, type metals, bearing metals, and solders. The largest single use (for storage batteries) is applied mainly to the automobile industry.—E. S. H.

Arsenic. Paul M. Tyler (*Mineral Ind.*, 1932, **40**, 41–47).—Statistical data are given. The main use for the metal is in hardening shot and to a less extent in various copper alloys. The main consumption of arsenic is in the form of oxide or arsenate.—E. S. H.

Barium and Strontium. Charles Hardy (*Mineral Ind.*, 1932, **40**, 63–67).—Mainly statistical and economical. The increasing uses of metallic barium in the lamp, radio, and spark-plug fields have reduced the price, and wider applications may be anticipated. Experiments are now being conducted on alloys of barium with magnesium, nickel, and other metals. No uses for metallic strontium are reported.—E. S. H.

Beryllium. Anon. (*Mineral Ind.*, 1932, **40**, 594–595).—At present, the alloys of beryllium with copper, iron, nickel, and cobalt show the most promise, and the results of work on alloys of beryllium with the light metals are disappointing. The use of a beryllium–copper alloy (10–12% beryllium) as a deoxidizer for cast copper gives a product almost equal in electrical conductivity to drawn copper.—E. S. H.

New Materials [Beryllium]. Anon. (*Automobiltech. Z.*, 1932, **35**, 132–133).—A review of the sources, properties, and present and future applications of beryllium, with special reference to beryllium–bronzes, nickel–beryllium alloys, and beryllium–chrome steels.—P. M. C. R.

Bismuth. Anon. (*Mineral Ind.*, 1932, **40**, 595–597).—Statistics are given. Among new uses, particularly in the applications of alloys of low melting point, are: (1) filling thin-walled tubing during bending, (2) facilitating bending of light sections, especially in aircraft construction, (3) sealing glass joints, (4) non-shrinking matrices for holding together parts of composite dies, (5) printing alloys.—E. S. H.

Matrix Alloy Used for Setting Die Parts. Anon. (*Automotive Ind.*, 1932, **66**, 920).—" Matrix " alloy, a proprietary alloy of bismuth, lead, tin, and antimony, is used for the permanent fastening of punches, punch plates, &c., the alloy being poured in after the punches have been correctly adjusted. The alloy is claimed to obviate, by its low melting-point, damage to heat-treated parts, and to be hard, rigid, and almost free from shrinkage.—P. M. C. R.

Cadmium as a Substitute for Casting Wax. M. Wastrow (*British J. Dental Sci., Prosthetics Section*, 1932, **77**, 233).—Extracted from *Zahnartliche Rundschau* and *La Presse Dentaire.* Cadmium is suggested as a substitute for casting wax, on account of its volatility. It can be completely removed by heating to 767° C.—J. C. C.

Calcium. Anon. (*Mineral Ind.*, 1932, **40**, 599–600).—Large quantities of metallic calcium are now obtainable and its applications are increasing. Some important uses are: as a deoxidizer and degasifier in casting other metals; as a reagent in removing bismuth from lead; and in hardening soft metals, particularly lead.—E. S. H.

Chromium. Anon. (*Mineral Ind.*, 1932, **40**, 68–73).—Statistics of production and consumption are given. Chromium plating does not absorb a very large tonnage, and the greatest application is in alloy steels. No new uses are reported.—E. S. H.

Cobalt. C. W. Drury (*Mineral Ind.*, 1932, **40**, 109–113).—No changes in the metallurgy of cobalt are reported. Continued increased use in both magnet and high-speed steels appears to be probable. Stellite alloys are being used more extensively in mining and construction work, especially for pumps, crusher parts, dies, &c. These alloys have been improved considerably during 1931. The tungsten carbide cutting tools use an appreciable amount of cobalt as a binder for the tungsten carbide.—E. S. H.

Application of Stellite. J. L. Spence (*Clay Prod. News*, 1932, **5**, (2), 1–3; *Ceram. Abs.*, 1932, **11**, 626).—S. cites the use of Stellite beads around the periphery on the forward face of the augers in the plant of the Sun Brick Co., Ltd. This procedure increased the life of the augers from about 30 days to 6 or 7 months. The wearing edges of other machinery and tools were Stellited with similar results.—S. G.

Stellite and Festel-Metal in Tool-Making. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1932, **8**, (19/20), 115–116).—The properties of Stellite, both as cast and after appropriate heat-treatment, are described. The alloy can be hardened further by additions of tungsten or molybdenum; the presence of iron and a small amount of nickel produces sufficient softening to render the alloy workable. The softened iron-bearing form of Stellite is known as Festel-metal.—P. M. C. R.

Utilization of Copper and Copper Alloys. Wm. G. Schneider (*Mineral Ind.*, 1932, **40**, 145–151).—Statistics are given of the consumption of copper in various forms by different industries in the U.S.A. Nearly 50% is absorbed by the electrical industries. A list is appended, showing the compositions of the principal alloys of copper in general use.—E. S. H.

Steel Fire-Boxes for Locomotives [a Comparison with Copper]. Anon. (*Locomotive*, 1932, **38**, 400–405).—Copper is compared to steel as a fire-box material. The author considers that the lower corrodibility of copper is more than balanced by its greater softness and consequent susceptibility to wear, and by the scarifying action of the exhaust. Repairs are stated to be more difficult than in the case of steel, which is readily welded. Steel is preferred as being lighter, stronger, cheaper, and less likely to suffer under exceptional demands than copper.—P. M. C. R.

Tentative Revisions of A.S.T.M. Standards. Standard Specifications for Copper Plates for Locomotive Fire-Boxes (B 11–18). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1131; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 987).—*Section* 3 (*b*). Change to read as follows by the addition of the italicized figures and the omission of the figures in brackets: (*b*) Non-arsenical copper.—Non-arsenical copper shall have a purity of at least [99·880] *99·90*%, as determined by electrolytic assay, silver being counted as copper. The total impurities other than silver shall not exceed [0·120] *0·10*%.—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Specifications for Copper Bars for Locomotive Staybolts (B 12–21). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1131; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 987).—*Section* 3 (*b*).—Make the same change in this paragraph as recommended in Section 3 (*b*) of Specification B 11–18 (see preceding abstract).
—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Specifications for Seamless Copper Boiler Tubes (B 13–18). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1131; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 987).—*Section* 3 (*b*). Make the same change in this paragraph as recommended in Section 3 (*b*) of Specification B 11–18 (see abstract above).—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Specifications for Copper Pipe, Standard Sizes (B 42–24). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1132; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 988).—*Section* 3.—Change to read as follows by the addition of the italicized figures and the omission of the figures in brackets: 3. The copper shall have a purity of at least [99·880] *99·90%* as determined by electrolytic assay, silver being counted as copper. *Section* 12.—It is recommended that the first sentence in paragraph (*a*) of this section be omitted as it conflicts with the requirements of paragraph (*b*).—S. G.

Copper Roofs. Anon. (*Cuivre et Laiton*, 1932, **5**, 343–351, 391–397, 439–449, 505–515, 549–562; 1933, **6**, 5–12).—A general discussion of the properties which render copper suitable for permanent use in exposed places, and of certain instances where it has been employed with great advantage. Of all the metals that might be considered for such work, copper alone, it is stated, possesses advantages in every direction—resistance to corrosion, physical properties; uniformity of contraction and expansion, &c. The thickness of copper employed varies in different countries, but is generally dependent on the average thickness of the resistant film which may be expected in the particular locality. Excellent diagrams are given of the manner in which copper sheeting may be attached and anchored for roofing purposes, and also of the character of the joints which have been found to be most serviceable in practice. The second article deals with the system of vertical jointing, and the third with ordinary flat or ribbed joints. Succeeding sections are concerned with the dimensions and manipulation of copper guttering and lead-off piping.—W. A. C. N.

A New System of Roofing Using Thin Copper.—The Rabbeted Hammer-Beam System. Anon. (*Cuivre et Laiton*, 1932, **5**, 495–499).—The economical advantage of using thin copper sheeting—down to $\frac{1}{10}$ mm. thick—whilst preserving all those corrosion resisting characteristics inherent in the metal, is discussed. The method of applying this material with security is described and illustrated.—W. A. C. N.

Copper in Refrigerating Apparatus. A. Chaplet (*Cuivre et Laiton*, 1932, **5**, 261–262).—In the various systems the tubes and plates used in conveying the freezing mixtures are now frequently made of copper.—W. A. C. N.

Copper Radiators for Central Heating. Anon. (*Cuivre et Laiton*, 1932, **5**, 367–375, 415–423).—(I.—) A theoretical study of heat-exchange relationships bearing on the question of the supply of heat in houses, offices, and large stores. The matter is viewed from three successive and connected angles—the transmission of heat to the internal wall of the radiator from the circulating fluid, the transmission across the substance of which the radiator is composed, and the radiation from the outer wall into atmosphere. Formulæ are derived which are applicable in average circumstances and are then applied in a comparison between copper and other metals as the material for radiator construction. (II.—) Typical examples are given of radiator manufacture by firms in America, France, and Italy. This section is useful because the method of assembly is fully illustrated by a series of clear illustrations and diagrams. —W. A. C. N.

Bearing Metals for Heavy Duty Engines. —— (*J. Soc. Automotive Eng.*, 1932, **31**, 402).—Copper–lead bearings will carry heavier loads and are stronger at elevated temperatures than Babbitt metals. Their high thermal conductivity is also an advantage. Up to the present time the difficult technique of producing copper–lead bearing of uniform quality has prevented their extensive use.—W. P. R.

Steam Locomotive Design: Axle-Boxes. E. A. Philipson (*Locomotive*, 1932, **38**, 392–394).—Gun-metal or bronze (" brass ") axle-boxes are preferable to those of cast or forged steel, in spite of their greater first cost, on account of (1) reduced machining and fitting cost; (2) higher thermal conductivity and consequent reduced liability to overheating; (3) possibility of recrowning if overheating actually occurs; (4) considerable scrap value. The steel box with inserted brasses is sometimes preferred for heavy duty. If the brasses do not themselves provide a bearing surface for the wheel boss, a separate liner of brass or white metal is fitted. Analyses of suitable bearing brasses and white metals, and also of gun-metal and bronze mixtures for the boxes themselves, are quoted, and details of lubrication and fitting are given.—P. M. C. R.

Nickel–Bronzes in Steam Valves. Anon. (*Nickel Bulletin*, 1932, **5**, 188).—High-nickel nickel–bronze and nickel–copper alloys are used for steam valve seats and faces. For valves up to 2 in. bore, 63% nickel–copper and for larger valves 36% nickel–copper are used. Valve lids are made of 15 : 65 nickel–copper " bronze."—J. H. W.

Cold-Rolled Phosphor–Bronze for Bridge Bearing Plates. J. C. Pettigrew (*Eng. News-Record*, 1932, **108**, 866).—A letter. Although under dry frictional tests, leaded phosphor–bronze bearing plates slide easier than plates of cold-rolled phosphor–bronze it is questionable how far such tests represent actual conditions. More heat is possibly generated during these accelerated tests, and in service nearly all plates are lubricated with graphite. Cold-rolled phosphor–bronze is stronger and on this account has been found by many users more satisfactory than leaded phosphor–bronze, which must be cast. Tensile test results on cold-rolled phosphor–bronze are tabulated.—J. C. C.

Tin–Bronzes with High Lead Content as Novel Bearing Materials in Automobile Construction. H. Blume (*Automobiltech. Z.*, 1932, **35**, 398–399).—Recent investigations have shown that bronzes containing up to 50% of lead may find industrial application. The constitution and mechanical properties of certain leadless and leaded bronzes are reviewed, and the suitability of the latter in certain special types of work is discussed. Necessary modifications in casting practice are enumerated. The influence of nickel additions is considered. It is claimed that the use of lead in proper conditions diminishes friction, lessens wear, assists lubrication, and effects economy both in oil and in cost of materials. A table giving analyses and mechanical properties of several bearing metals, with and without lead, is appended.—P. M. C. R.

Tentative Revision of A.S.T.M. Specifications. Standard Specifications for Brass Pipe, Standard Sizes (B 43–24). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 1132–1134; and *Proc. Amer. Soc. Test Mat.*, 1932, **32**, (I), 988–990).—Extensive alterations are proposed to Sections 3 (*b*), 4, 6, 7, and 14, for which the original must be consulted.—S. G.

Tentative Revisions of A.S.T.M. Specifications. Standard Specifications for Seamless Admiralty Condenser Tubes and Ferrule Stock (B 44–29). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1134; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 990).—*Section* 14.—Change from its present form to read : 14. The length shall not be less than that ordered when measured at a temperature of 20° C. (68° F.), but may be more than that ordered by the amounts given in the following table :

Ordered Length, ft.	Permissible Tolerances, in.
Up to 15, inclusive	$+\frac{1}{16}$
Over 15 to 20, inclusive . . .	$+\frac{3}{32}$
Over 20	$+\frac{1}{8}$

—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Specifications for Seamless 70 : 30 Brass Condenser Tubes and Ferrule Stock (B 55–25). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1134; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 990).—*Section* 14.—Make the same change in this section as recommended in Section 14 of Specification B 44–29 (see preceding abstract).—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Specifications for Seamless Muntz Metal Condenser Tubes and Ferrule Stock (B 56–25). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 1134; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 990).—*Section* 14.—Make the same change in this section as recommended in Section 14 of Specification 44–29 (see abstract above).—S. G.

Tentative Revisions of A.S.T.M. Standards. Standard Specifications for Sheet High Brass (B 36–27). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 1135–1137; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 991–993).—Extensive alterations are proposed to Sections 1, 3, 5, 6, 7, 8, 9, 10, and 11, for which the original must be consulted.—S. G.

Aluminium–Brass Condenser Tubes. Anon. (*Mech. World*, 1932, **92**, 106–107).—Cf. 1932, **50**, 52. Discusses the alloy, copper 76, zinc 22, aluminium 2%—here referred to as " Alumbro."—F. J.

Gallium. Anon. (*Mineral Ind.*, 1932, **40**, 600).—Gallium is now produced on the technical scale by the Vereinigte Chemische Fabrik, Leopoldshall, Germany. The wide range of stability of the liquid phase makes it suitable for use in high-temperature thermometers. Possible future uses are in optical mirrors and dental amalgams.—E. S. H.

Gallium Now Commercially Available. Anon. (*Chem. and Met. Eng.*, 1932, **39**, 675; and *Met. Ind.* (*Lond.*), 1933, **42**, 38).—Improved production methods in Germany have brought down the price of gallium to $3·6 per grm. (in U.S.A.). This metal, which melts at body temperature and has a boiling-point of 2000° C., has numerous applications, chiefly in the fields of thermometry, dentistry, atomic and astrophysics and, particularly, radio and electro-technology. Thermometers can be made for temperatures of 500°–1000° C. Substituted for mercury in dental alloys, it has the advantage of being non-poisonous, whilst its substitution in rectifiers permits operation at higher capacity, owing to its high boiling-point.—F. J.

New Applications Found for Gallium. Anon. (*Indust. and Eng. Chem.* (*News Edn.*), 1932, **10**, 39; *Met. Ind.* (*Lond.*), 1932, **40**, 380).—See preceding abstract.—J. H. W.

Industrial Alloys of Gold. A. Labò (*Monitore Tecnico*, 1932, (9), 391–394).—A review of the uses of gold alloys in industry.—G. G.

U.S. Navy Uses Lead as Filler for Stair Treads. Anon. (*Daily Metal Reporter*, 1932, **32**, (208), 5).—Stair treads with brass base, lead-filled, are in use in the U.S. Navy, the lead or lead-base alloy employed being found to give a firm, non-slipping surface under marine conditions, and to resist sea-water corrosion. Treads composed solely of lead can be remelted and used again after they have become worn, effecting considerable economy in use. —P. M. C. R.

Conditions for the Use of Lead-Base Bearing Alloys Having High Copper Content. A. Ricard and H. Ackermann (*Cuivre et Laiton*, 1932, **5**, 523–528).—A general discussion of lubrication and of the factors which are of greatest importance in carrying it out correctly—the nature of the surfaces, character of the oil, amount and method of introduction of the lubricant, and the composition of the bearings themselves. Photomicrographs of alloys containing up to 30% lead, together with varying proportions of copper with tin or nickel, are given, and the function of the lead in promoting good bearing surfaces is explained.—W. A. C. N.

Sockets of Low-Melting Alloy Best for Wire-Rope Test Samples. D. H. Corey and E. T. Cope (*Eng. News-Record*, 1932, **108**, 652).—Samples of wire rope broke near the ends in tensile tests when the ends were sweated to sockets with spelter. The use of 83 : 7 : 10 lead–tin–antimony alloy (since adopted as standard) or 60 : 30 : 9 : 1 lead–tin–antimony–bismuth alloy enabled the samples to be held without slipping and prevented softening of the wires. —J. C. C.

Lithium and Its Applications. G. Nain (*Industrie chimique*, 1932, **19**, 882–885).—A review, describing the occurrence of lithium, the production of the metal in Germany, and its uses. Although no industrial application has been found for metallic lithium alone, it is an important constituent of certain alloys, particularly the ultra-light alloys of aluminium. Small quantities of lithium are also used along with calcium in lead as a bearing alloy, particularly on the German railways. A further use is as a refining agent for copper and nickel. The uses of some lithium compounds are discussed, and a table is given, showing the world production over the period 1925–1930.—E. S. H.

Magnesite [and Magnesium]. Anon. (*Mineral Ind.*, 1932, **40**, 351–359).—The demand for magnesium has increased, especially in alloys, in which the consumption of magnesium during 1931 was more than 5 times that during 1930.—E. S. H.

The Development of Uses of Magnesium. John A. Gann (*Technique moderne*, 1932, **24**, 638–639).—Abstract of paper presented to the American Institute of Mining and Metallurgical Engineers, Feb., **1932**. See this *J.*, 1932, **50**, 380, 419, 691.—H. W. G. H.

Magnesium. John A. Gann (*Met. Ind.* (*N.Y.*), 1932, **30**, 235–238).—A lengthy abstract from *Min. and Met.*, 1932, **13**, 179–182. See this *J.*, 1932, **50**, 380.—I. M.

Quicksilver. H. W. Gould (*Mineral Ind.*, 1932, **40**, 481–487).—As a result of the adverse economic conditions of 1931, no new uses or progress in the metallurgy of mercury have appeared.—E. S. H.

Molybdenum. Alan Kissock (*Mineral Ind.*, 1932, **40**, 378–381).—Alloy steels continue to be the main field for the consumption of molybdenum. Well-equipped research laboratories for molybdenum have now been established and already investigations on the use of molybdenum in non-ferrous alloys are in progress. Extended applications of the metal may be expected.—E. S. H.

Tentative Specifications for Ferro-Molybdenum (A 132–31 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 192–193).—See this *J.*, 1931, **47**, 671.—S. G.

Nickel. Thos. W. Gibson (*Mineral Ind.*, 1932, **40**, 382–391).—The amount of nickel used in coinage is steadily increasing. The most important outlet for nickel is in nickel-steel, but the applications of Monel metal are expanding considerably. Statistical data are given and recent publications are reviewed.—E. S. H.

Advances in the Nickel Industry. Robert C. Stanley (*Iron Steel Canada*, 1933, **16**, 5–6).—Progress in the development of nickel alloys during the year 1932, based largely on successful researches, is reviewed.—J. H. W.

Nickel Catalysts in Chemical Reactions. P. Sabatier (*Rev. Nickel*, 1932, **3**, 18–20).—An historical account of the researches of Sabatier and his contemporaries into the use of nickel in the finely-divided state for promoting chemical syntheses which previously had either been unknown or had been difficult to bring about on a large scale—*e.g.* the conversion of ethylene into alcohol and the hydrogenation of oils and organic products in general.—W. A. C. N.

The Alloys of Nickel in Prosthetic Dentistry [Uranox]. —— Husnot (*Brit. J. Dental Sci., Prosthetics Section*, 1932, **77**, 172–173).—Reprinted from *South African Dental J.* Uranox is a malleable nickel alloy suitable for the base of artificial dentures.—J. C. C.

Nickel-Chromium Alloys for Weights. —— (*J. Franklin Inst.*, 1932, **214**, 594–595).—Note from the U.S. Bureau of Standards. Sample weights made from alloys containing nickel 80, chromium 20, and nickel 60, chromium 15, iron 25%, respectively, have been tested under various conditions. All samples lost weight on exposure to hydrochloric acid fumes, and for this reason these alloys are not considered suitable for high precision laboratory standards. Similarly, these alloys are not considered suitable for Class A of commercial standard weights, whilst for Classes B and C, which include what are termed office and field test weights, these alloys are satisfactory.—S. V. W.

Tentative Specifications for Drawn or Rolled Alloy, 80 per Cent. Nickel, 20 per Cent. Chromium, for Electrical Heating Elements (B 82–31 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 247–250).—See this *J.*, 1932, **50**, 107.—S. G.

Tentative Specifications for Drawn or Rolled Alloy, 60 per Cent. Nickel, 15 per Cent. Chromium, and Balance Iron, for Electrical Heating Elements (B 83–31 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 251–254).—See this *J.*, 1932, **50**, 107–108.—S. G.

Report of Committee B–4 [of A.S.T.M.] on Electrical-Heating, Electrical-Resistance and Electric Furnace Alloys. Dean Harvey and F. E. Bash (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 252–254).—See this *J.*, 1932, **50**, 693.
—S. G.

Nickel–Chromium Alloys for Heating Elements. Anon. (*Rev. Nickel*, 1931, **2**, 120–124).—These alloys may be roughly divided into two classes according to the iron content: (1) those which contain practically no iron; (2) those which contain up to 25% iron. The characteristics of these various alloys are discussed. In some instances part of the nickel has been replaced by molybdenum, tungsten, or cobalt, but it is doubtful whether this is advantageous. From the point of view of electrical resistance the difference between the binary and the ternary alloys is practically unimportant. Details are given for the melting and casting of these materials, for their forging, hot working in general, and their drawing into rods and wire. Although the ternary alloys may be chosen for economic reasons, the binary ones are generally better in service. Illustrations are given of several methods of installing heating elements of the alloys.—W. A. C. N.

The Applications of Nickel in the Electrical Industries. M. Ballay (*Rev. Nickel*, 1931, **2**, 2–15).—A review of the majority of the uses of nickel in electrical services, and, in most cases, of the fundamental considerations on which they are based. It is divided into six sections: (1) The resistivity and temperature coeff. of nickel alloys—pure nickel; nickel–manganese; copper–nickel; nickel–copper–manganese; nickel–copper–zinc; nickel–chromium; nickel–chromium–iron; nickel–chromium–copper; nickel–iron; nickel–cobalt. Various electrical applications of these alloys are noted. (2) Thermoelectric couples, including discussion on the electromotive force of the nickel–copper series of alloys and of Monel metal–copper at various temperatures. (3) The use of nickel in the construction of electrical machinery, embracing mainly a summary of the mechanical properties of nickel–steels. (4) Alkaline accumulators of the nickel–iron, nickel–cadmium, and potassium borozincate varieties, the latter having an anode of small perforated tubes containing nickel oxide powder. (5) Various uses of nickel and its alloys in materials having low coeff. of expansion, in thermionic valves.—W. A. C. N.

Steel and Nickel Alloys in Railway Work. J. Galibourg (*Rev. Nickel*, 1932, **3**, 130–144).—Contains an account of nickel and nickel–chromium steels, followed by a summary of certain copper–nickel alloys, including Monel metal and those containing tin. A considerable amount of nickel is used in accumulators of the Drumm type where the negative consists of a nickel or Monel metal grid on which zinc has been deposited, and the positive is made of oxide of nickel or silver or a mixture of both. A number of alloy specifications are included.—W. A. C. N.

Steel and Nickel Alloys in Naval Construction. J. Galibourg (*Rev. Nickel*, 1932, **3**, 34–51).—Alloys of nickel 80, chromium 20%, and of nickel 65, chromium 20, and iron 15%, are recommended because of their resistance to oxidation at high temperatures and their generally good mechanical properties. White metals are used for bearings and for internal fitments. Nickel–brass is employed because of its greater mechanical strength as compared with ordinary brass. Cupro-nickel, including Monel metal, possesses great resistance to average rises in temperature and to many of the corroding influences usually encountered. The physical characteristics of all these alloys and also of the important aluminium alloys are given.—W. A. C. N.

Nickel and Its Alloys in Decorative Work. —— (*Rev. Nickel*, 1931, 2, 35–54).—The effect of nickel in modifying the working properties of the metals with which it forms commercial alloys and in increasing their resistance to corrosion is first discussed. In decorative work atmospheric corrosion is the primary factor to consider. The relative advantages and disadvantages of electrolytic nickel and electrolytic chromium deposits are examined, and their different uses under economical conditions are critically reviewed. There follow discussions on the individual merits of various types of alloys—pure nickel, copper–nickel, "stainless" steel, white metals, &c. Their uses in internal and external situations for artistic and utilitarian work are very widespread, and photographs of some very beautiful examples illustrate the extensive application of these materials.—W. A. C. N.

Nickel and Its Alloys for Decoration. Anon. (*Usine*, 1931, 40, (38), 27).—Summary of an article from *Rev. Nickel*, 1931, April, p. 35. See this *J.*, 1932, 50, 184.—H. W. G. H.

Nickel Alloys in Automobile Maintenance and Repair. Anon. (*Nickel Bulletin*, 1932, 5, 186–187).—A brief description of the use of nickel in aluminium alloys to reduce the high thermal expansion of the latter without impairing its usual advantages.—J. H. W.

Stable Mechanical Properties for Aircraft Design. Robert J. McKay and Robert Worthington (*Inco*, 1929, 8, 9–10).—A description of the developments made in the use of Monel metal in aircraft, for exhaust manifolds, pontoons, petrol tanks, &c. "Monel-plymetl" is used for instrument boards. The properties of various materials are given and their relative advantages discussed. —R. G.

Monel Metal in Trawlers. Anon. (*J. Commerce* (*Ship. and Eng. Edn.*), 1932, Sept. 15, 7).—A relatively new use for Monel metal is that of lining fish holds in trawlers. Most of the linings installed to date are of 22- or 24-gauge sheet, either one sheet of metal being used for the entire length of the hold or single sheets are lapped and soldered. Transverse members are lined with sheets secured by Monel metal nails. The installation of Monel metal linings has resulted in substantial savings in operating costs and reductions in losses from fish spoiled by the activity of micro-organisms harboured by the wooden linings.—J. W. D.

Improved [Monel Metal] Linings for [Trawler] Fish Holds. Anon. (*Fish Trades Gazette*, 1931, May 30; and (abstract) *Nickel Bulletin*, 1932, 5, 172).—Because of its high resistance to sea-water corrosion, fishing trawlers are now using Monel metal linings in the form of 22–24 gauge sheet secured by Monel metal nails.—J. H. W.

Aero Engine Valve Seats of Monel Metal. Anon. (*Nickel Bulletin*, 1932, 5, 217–218).—Describes the application of Monel metal to the manufacture of aero-engine valve seats.—J. H. W.

Monel Metal for Corrosion-Resisting Springs. Warren F. Manthei (*Machinery* (*N.Y.*), 1932, 39, 24).—Springs made from Monel metal resist corrosion well, do not soften at elevated temperatures as much as phosphor-bronze, and are free from season-cracking.—J. C. C.

Hipernik [Nickel–Iron Alloy]—Its Uses and Limitations. E. C. Wentz (*Electric J.*, 1932, 29, 227–229).—The use of Hipernik in place of silicon steel in a magnetic circuit invariably makes reductions in size and weight possible. It does not always reduce the cost. The general characteristics of Hipernik are outlined and its fields of use indicated, special reference being made to its use in current transformers and magnetic vane ammeters.—J. C. C.

Platinum Group Metals. George Frederick Kunz (*Mineral Ind.*, 1932, 40, 430–444).—Mainly statistical. Work is in hand to develop new uses for these metals and their alloys.—E. S. H.

Radium, Uranium, and Vanadium. Anon. (*Mineral Ind.*, 1932, **40**, 488–491).—Apart from its use in alloy steels, vanadium is used in several fields of chemical technology, particularly as a catalyst.—E. S. H.

Selenium- or Selenide-Rectifier? W. S. Gripenberg (*Physikal. Z.*, 1932, **33**, 778).—G. suggests that the rectifying action of an iron–selenium rectifier is attributable to the presence of iron selenide at the junction between iron and selenium.—J. S. G. T.

The German Standardization of the Precious Metals. H. Moser (*Mitt. Forschungsinst. Edelmetalle*, 1932–1933, **6**, 99–105).—The following standards are recommended: silver A (electrolytic) with a minimum of 99·9% silver; silver B (fire-refined) with a minimum of 99·6% silver; silver alloys containing 92·5 ± 0·5% silver and 83·5 ± 0·5% silver; gold A (electrolytic) with less than 0·04% of impurities and gold B with 99·9% gold; gold alloys with 33·3, 58·5, 75, and 90% gold; 10% platinum- or palladium–gold; platinum A, physically pure (99·99 + %); platinum B, chemically pure (99·9 + %); platinum C for apparatus (99·7% pure with less than 0·1% of metals other than iridium); platinum D, "technically" pure (99 + % platinum); platinum E, jewellery platinum (95–96% platinum); platinum–iridium alloys with 1, 3, 5, 10, 15, 20, 25, and 30% iridium.—A. R. P.

A Study of the Restoration of Tooth Structure with Silver Alloy Amalgam. Benjamin Kornfeld (*Dental Cosmos*, 1930, **72**, 815–825; and *Brit. J. Dental Sci.*, 1931, **76**, 105–122).—Includes a consideration of the properties and behaviour of silver alloy amalgams.—J. C. C.

Tantalum. Anon. (*Mineral Ind.*, 1932, **40**, 602–603).—Tantalum may be used as a backing for gold or platinum, for decorative or industrial purposes. Its high melting point offers the advantage that the other metal can actually be fused into contact. Tantalum is being more widely used in the construction of X-ray, radio, and neon tubes. The use of the carbide in cutting tools has made rapid progress.—E. S. H.

Uses of Tin in Modern Automobile. Anon. (*Canad. Mach.*, 1932, **43**, 76).—The uses of tin in protection, in joining, and in the electroplating of cylinders are summarized.—P. M. C. R.

Piston Practice. Anon. (*Tin*, **1932**, August, 13–14).—The advantages of coating cast iron pistons with tin, preferably by electrodeposition, to ensure true fit are discussed.—J. H. W.

Canning Research. Anon. (*Tin*, **1932**, September, 5–7).—An account of the applications of tin to the canning industry.—J. H. W.

"Strategic Metals." Anon. (*Tin*, **1932**, August, 3–4).—A brief description of the use of tin and antimony—called "strategic metals" by the U.S. War Department—especially as regards resistance to wear and to pounding.—J. W.

In Praise of Pewter. Anon. (*Tin*, **1932**, July, 4–6).—Describes the chemical composition and applications of pewter. This alloy consists essentially of tin alloyed with antimony and copper, the tin in modern British pewter running as high as 96%. Only virgin metal should be used in the manufacture of the alloy.—J. H. W.

Applications and Compositions of Babbitt Metals for Bearings. S.A.E. Standard Specifications. Anon. (*Machinery* (*N.Y.*), 1932, **39**, (Data Sheet 237), 200A).—J. C. C.

Steam Locomotive Design: Connecting Rods. E. A. Philipson (*Locomotive*, 1932, **38**, 209–211).—A continuous white metal bearing is stated to be essential for big-ends, and for coupling rod bushes, when working on crankpins of alloy steel. A tin-base alloy of the composition: tin 83, copper 11·5, and antimony 5·5%, is recommended.—P. M. C. R.

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(Continued from pp. 283–286.)

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***Hess, F. L.** *Tungsten in* 1931. (Mineral Resources of the United States, 1931, Part I.) Med. 8vo. Pp. 43–50. 1932. Washington, D.C.: Superintendent of Documents. (5 cents.)

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[Following a review of the concentration, metallurgy, uses, world's ore and metal production, prices of pig-lead, and principal mines, smelters and refiners in the British Empire, the publication deals very fully with lead in the British Empire and lead in Foreign countries, and concludes with 26 pp. of references of recent technical literature.]

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XXIV.—BOOK REVIEWS

(Continued from pp. 335–336.)

Hochschmelzende Hartstoffe und ihre technische Anwendung. (Metallisch leitende Carbide, Nitride, und Boride und ihre Legierungen.) Von Karl Becker. 6 in. × 8½ in. Pp. 227, with 99 illustrations. 1933. Berlin: Verlag Chemie, G.m.b.H. (Geb., R.M. 21.)

Extremely hard materials of high melting point are found amongst the carbides, nitrides, and borides of the metals of the 4th, 5th, and 6th groups of the periodic table. These materials have become of great importance during recent years, not only because of their scientific interest, but also because of their technical applications. Their melting points are comparable with those of the most refractory metals, their hardness only second to that of the diamond, they have a metallic conductivity, and alloy with each other in the same way as do the metallic elements. It is not surprising, therefore, that these substances have aroused considerable interest in connection with incandescent lighting, electrical heating, and the production of cutting tools such as Widia.

The scientific and technical investigation of these materials has developed with great rapidity during the short period of 10 years since the existence of their unusual properties was recognized. The literature dealing with them is very scattered, and a great deal of work has so far been disclosed only in the form of patents. The present volume, by one of those who has been most intimately connected with their development, is therefore most opportune. It deals in a comprehensive manner with the methods of preparation, physical, and chemical properties, and technical applications of all the materials in this class which have so far been investigated. These substances are so like metals in all their properties that they are of the greatest interest to metallurgists. The melting points of some of the carbides are actually higher than that of tungsten, and a maximum is often shown by alloys of two of them. For example, the melting points of zirconium carbide and tantalum carbide are 3805° K. and 4150° K. and a maximum of 4200° K. is reached by an alloy containing 1 molecule of the former to 4 molecules of the latter. Similar extremes are found in other of the properties.

The book is extremely well produced, well indexed, and well illustrated.

C. J. SMITHELLS.

A Comprehensive Treatise on Inorganic and Theoretical Chemistry. Volume XII.—U, Mn, Ma, Rh, Fe (Part I). By J. W. Mellor. Med. 8vo. Pp. xiii + 944, with 178 illustrations. 1932. London: Longmans, Green & Co., Ltd. (63*s*. net.)

The present volume of Mellor's treatise deals with the metals uranium, manganese, masurium, rhenium, and iron. The treatment runs parallel with that so successfully adopted in the earlier volumes. Uranium is dealt with in 38 pages, no space being devoted to the radioactive properties of the metal, since these were dealt with under radium in Volume IV. An account is given of the intermetallic compounds of uranium with copper, zinc, magnesium, mercury, aluminium, titanium, vanadium, molybdenum, and tungsten. The treatment of manganese, 328 pages, is similar to that of the other elements; a noteworthy point being the description of the intermetallic compounds. Nineteen pages are allocated to this topic, which is faithfully considered, alloys and intermetallic compounds of manganese with a very large number of metals being described, together with their phase diagrams. The two recently discovered metals of Group VII, rhenium and masurium, are considered together in 16 pages, where an entirely adequate description of the discovery, occurrence, and isolation of these elements is followed by an account of such compounds of the elements as have been prepared. The remainder of the volume, 437 pages, is devoted to the metallurgy of iron. The history of the metal is dealt with in some 38 pages, and this is followed by 60 pages describing the occurrence, distribution, and minerals of iron. The chemical reactions of the blast furnace and the reduction of iron oxides are next discussed, followed in order by (i) the manufacture of wrought iron and steel; (ii) annealing, hardening, and tempering of steel, (iii) cast iron; (iv) the allotropes of iron; (v) cementation of iron and steel; (vi) the preparation of pure iron; (vii) the microstructure of iron; (viii) equilibria in the iron–carbon system; (ix) the constitution of iron–carbon alloys; (x) heterogeneous iron alloys; (xi) the crystallization of iron and iron–carbon alloys.

The present volume, like its predecessors, is entirely successful in providing for the chemist and others, vast quantities of information not generally to be found in so accessible a form. The subjects dealt with have been treated exhaustively and accurately. When in 1922 the first volume of this gigantic work made its appearance, there were few who believed that 10 years would see it nearing completion. The rapid and regular publication of new volumes has, however, led the most sceptical of chemists to change his views and to believe that Mellor's Treatise, unlike so many large works, will be completed and in a comparatively short time.

—JAMES F. SPENCER.

Gmelin's Handbuch der anorganischen Chemie. Achte völlig neu bearbeitete Auflage. Herausgegeben von der deutschen chemischen Gesellschaft. Bearbeitet von R. J. Meyer. System-Nummer 59: **Eisen.** Teil A—Lieferung 4. Sup. Roy. 8vo. Pp. 587–846, illustrated. Berlin: Verlag Chemie G.m.b.H. (R.M. 41; subscription price, R.M. 35.50.)

The present section continues the treatment of the metallurgy of iron and opens with an account of the indirect processes for the manufacture of forgeable iron and steel, which are described with ample detail and include the puddling process, crucible steel process, the Bessemer steel process, the Thomas–Gilchrist process, and many others. The chemical and metallurgical changes involved and the method of working are fully treated, with the aid of numerous diagrams; while the various fuels, and the nature and composition of the slags connected with these processes are fully described. The manufacture of steel by means of electrical furnaces is also discussed. Induction and arc furnaces are dealt with under the following headings: (i) indirect arc furnaces, including the Stassano and Rennerfelt furnaces; (ii) direct arc furnaces, including those of Héroult, vom Bauer, Fiat, Greene, Ludlum, Moore, Stobie, Webb, Girod, and Nathusius; (iii) induction furnaces, where the low-frequency furnaces of Kjellen, Röchling-Rodenhauser, Frick and Hiorth, and high-frequency furnaces are described. The metallurgical and chemical changes occurring in both acidic and basic electric furnaces are considered. The section closes with a consideration of the electric steel furnace in its relation to other steel furnaces. The volume gives a very good account of the steel and wrought-iron industry and constitutes a valuable contribution to the literature of this subject.—James F. Spencer.

Magnetismus der metallischen Elemente. Von E. Vogt. Pp. 323–351, with 6 illustrations. **Elektronentheorie der Metalle.** Von R. Peierls. Pp. 265–322, with 10 illustrations. (Ergebnisse der Exakten Naturwissenschaften. Herausgegeben von der Schriftleitung der "Naturwissenschaften." Sonderabdruck aus Band XI.) Med. 8vo. 1932. Berlin: Julius Springer.

These two reprints of sections dealing with the magnetism of the metallic elements and the electron theory of the metals, contributed by the respective authors to Volume XI of the monumental *Ergebnisse der Exakten Naturwissenschaften*, deserve the attention of all who are interested more especially in theoretical aspects of the metallic state. The former discusses the significance of magnetic characteristics in the interpretation of atomic properties; the latter is a *résumé*, necessarily very mathematical in character, of modern electron theory. The purpose of this note will be sufficiently served if the contents of the respective reprints are briefly indicated.

Dr. Vogt discusses the approximation to the ideal metallic state exhibited by members of Group I of the periodic classification, as deduced from values of magnetic susceptibility, the values of the magnetic susceptibilites of the group of elements including copper, silver, gold, zinc, indium, antimony, tellurium, &c., and their interpretation in terms of homopolar combination, the transition series of elements and the rare earth metals.

Dr. Peierls treats of the kinematics of conducting electrons, thermal equilibrium, and the conduction of electric currents by metals at high and low temperatures, and the accompanying phenomena.

Within the limits set by the character of the work, viz. contributions to a general treatise on physics and astronomy, the reprints contain matter executed with characteristic Teutonic thoroughness, and are well printed on good paper. Each includes a valuable bibliography of the literature of their respective subjects. That accompanying Dr. Peierl's tract is characteristically prefaced with "ohne Anspruch auf Vollstandigkeit." Can the literature of electron theory ever be complete? I think not; it grows almost hourly. It remains only to remark that the matter of the reprints is not obtainable apart from Volume II of the treatise published at R.M. 35, unbound, or R.M. 36.60, bound. I note that this Volume contains a section on superconduction, contributed by Dr. Meissner.—J. S. G. Thomas.

Die Valenz der Metalle Fe, Co, Ni, Cu und ihre Verbindungen mit Dioximen. Von E. Thilo. (Sammlung chemischer und chemisch-technischer Vorträge. Begründet von F. B. Ahrens. Herausgegeben von H. Grossmann. Neue Folge Heft 13.) Pp. 70, with 2 illustrations. 1932. Stuttgart: Ferdinand Enke. (R.M. 6.40.)

A very interesting and useful discussion on the valency of the metals iron, cobalt, nickel, and copper from the point of view of the electronic theory, is followed by a description and discussion of the complex dioxime derivatives of these metals. The compounds considered include the dimethylglyoximes, methyl-ethylglyoximes, anisildioximes, and the diacetyl dioximes. The final section of the book presents the data for the calculation of the heat of formation of the halides of the above-named metals, and here are given tables of the radii of the atoms and the ions in each valency stage, and the lattice constants of the cuprous, ferrous, and ferric halides. The book concludes with a list of 55 references to the literature. The work constitutes a useful and clearly written account of the subject.—JAMES F. SPENCER.

Taschenbuch für metallurgische Probierkunde, Bewertung und Verkäufe von Erzen für Geologen, Berg-, Hutten-ingenieure und Prospektoren. Herausgegeben von C. Frick und H. Dausch. Roy. 8vo. Pp. xi + 250, with 51 illustrations. 1932. Stuttgart: Ferdinand Enke. (Geh., R.M. 12.40; geb., R.M. 14.40.)

This book is primarily intended for the use of mining students, engineers, and prospectors, particularly in the mining field; hence it is chiefly concerned with dry tests and dry assaying, only about 45 pages being devoted to wet assaying. One of the chief features of the book is the detailed list of apparatus and chemicals required for any particular assay or test, together with estimates of the cost; to such an extent has this feature been developed that parts of the book resemble pages from the catalogue of suppliers of chemical apparatus. The omission of all these details would very considerably reduce the volume of the book and, in the reviewer's opinion, in no way detract from its usefulness, since much of the information given rapidly becomes obsolete with changing market conditions and improvements in apparatus. The last 100 pages are concerned with the equipment of prospecting expeditions and the calculation of the market value of ores; this portion should be of value as a guide to prospectors, but here again conditions change so rapidly that much of the information must rapidly become out-of-date.

The sections on dry assaying are quite good, but those on wet assaying are decidedly scrappy in parts. From the number of references to the "Ausgewählte Methoden" (see this *J.*, 1932, 50, 286) it would appear that this section is intended to be in the nature of a supplement to that book, since only a page or less is devoted to some of the metals. This arrangement detracts considerably from the value of the section, especially as in some cases one part of a procedure is given and the reader is referred to the "Ausgewählte Methoden" for the remainder; the procedure given for the gravimetric determination of titanium is of little value. A number of misprints, especially in the names of non-German authors, has been noticed.

This book will doubtless prove of value to German mining men, but has little to recommend it to others; the price data are all based on the German market, and in these days of fluctuating exchanges, high tariffs, and unstable market conditions are of relatively little value to non-German nationals. As the book weighs well over 1 lb. and is 10 in. long by 6½ in. wide, it scarcely conforms to our ideas of a pocket-book, but it is well printed and arranged on good paper, and easy for reference in spite of the lack of an index.—A. R. POWELL.

Le Travail de l'Aluminium et ses Alliages. La Fonderie. Demy 8vo. Pp. 163, with 53 illustrations. Paris: L'Aluminium français, 23 bis rue de Balzac.

This little book contains, for foundrymen, more information of practical value than most of the expensive text-books on aluminium and its alloys. There are, however, many misprints, and the illustrations, especially the reproductions of photomicrographs, are poor. The section on moulding sand, although far more informative than one usually finds, is still too vague. No book on foundry work is complete without suggestions for sand specification, further than a sieve test. The temperature range given for the modification of Alpax (780°–800° C.) is higher than is necessary for many castings, and it is very doubtful whether stirring after modification is good practice.—H. W. G. HIGNETT.

Technologie der Maschinenbaustoffe. Von Paul Schimpke. Sechste Auflage. Sup. Roy. 8vo. Pp. xii + 348, with 243 illustrations. 1931. Leipzig: S. Hirzel. (Geh., R.M. 12.50; geb., R.M. 15.)

Within the compass of 348 pages Professor Dr. Schimpke, who is Director of the Staatl. Akademie für Technik at Chemnitz, compresses a succinct and up-to-date survey of the production, working, and properties of workshop materials—ferrous and non-ferrous, metallic and non-metallic.

The book is divided into four sections. The first, concerned with raw materials, deals successively with: combustion and application of the chief fuels; iron and steel, their production and protection from corrosion; non-ferrous metals and alloys; and, finally, other technically important materials of a non-metallic character, including lubricants.

The second section is devoted to the testing of materials, covering the industrial testing of iron and steel, non-ferrous and other materials, as well as specifications for ferrous products.

The third section, which covers nearly 200 pages, deals with the working processes used in fabricating metal into machines or structures. It comprises: foundry work; hot-shaping by forging both under the hammer or stamp and by the press; hot-rolling and tube-making; cold-shaping by rolling, drawing, bending, or pressing; and joining by soldering, welding, or riveting.

A fourth and concluding section surveys the production resources of Germany and of the main industrial nations in the mining and metal industries.

The book is well produced on good paper, illustrated with clear diagrams, and provided with an adequate subject index. Copious references to the technical journals for fuller detail are interspersed in the text. The scope being so wide, the detail in each section has naturally had to be rigorously curtailed. Nevertheless, the book remains a compact and up-to-date survey of materials and production methods, such as should prove valuable to engineering designers and students. The sections devoted to non-ferrous metals and alloys are clear, and the matter is well chosen on the whole, but the omission of any reference to the Mond process of refining nickel is rather surprising, as well as the statement that the nickel contents reported include cobalt.

Numbers of treatises in English dealing with various sections of its contents are extant, but an English book written from this precise comprehensive viewpoint appears to be lacking. —A. B. WINTERBOTTOM.

Il calcolo dei tempi nelle lavorazione meccaniche. By T. Bruzzone. Med. 8vo. Pp. 105, with 19 illustrations and 7 folding plates. 1932. Milano: Ulrico Hoepli. (Lire 15.)

The aim of this little book, which is freely illustrated with figures and tables, is to demonstrate to the engineer in mechanical workshops, the importance of the correct calculation of cutting speed, in relation to the depth of cut, to the properties of the metal to be cut, and to the nature of the cutting tools. The methods given, which are the result of the author's own experience in a large workshop, are described in simple and easily understood language, and the necessary mathematical data for turning, drilling and planing steel, iron and bronze with or without lubrication, with high-speed or simple tools, are given in tables and diagrams.

The methods of Taylor and of Denis are explained and discussed, and the results obtained by these methods are compared with those obtained by the author's method.

The individual chapters deal with the process of cutting metals, card-index systems for controlling the production of machines, calculation of the output and efficiency of machines, and slide rules for the workshop.

The author deals with this apparently dull and uninteresting subject in so interesting and readable a manner that the industrious reader will readily acquire such a familiarity with the subject as to incite him to apply the information given to his own problems in the machining of metals; in this way he will more fully appreciate the characteristics of the machines and will be able to use them in a better and more rational manner with especial regard to the cost of running them.—G. GUZZONI.

Darstellung der gesamten Schweisstechnik. Von P. Bardtke. Zweite, erweiterte, und vollständig erneuerte Auflage. 6 × 8 in. Pp. xi + 275, with 315 illustrations. 1931. Berlin: VDI-Verlag. (R.M. 12.50.)

The list of contents of this book provides an excellent summary of welding knowledge, lacking only a section on design to make it comprehensive. It is not possible, however, to cover so wide a subject at all adequately in less than three hundred pages, even when all "padding" is rigorously excluded.

In Part I, the welding methods, apparatus, and technique are discussed. Gas and electric arc fusion welding are dealt with thoroughly from the ferrous point of view, and an excellent review is given of their relative merits. The non-ferrous metals, however, are not treated so well. The section on copper is not up to date; in deoxidized copper, which is now most commonly used, an unhammered weld giving a strength only 50–60 per cent. of that of the parent metal, is very poor. For welding aluminium, the necessity for a certain proprietary flux is suggested; there are, of course, many suitable compositions which are no longer mysterious. Lead-burning, the sole subject of a recently published book, is dismissed in eight lines. The sections on hammer and electric resistance welding are concise and complete.

Part II deals with the applications and costs of welding by the various processes, and with testing methods. There are also short sections on accident prevention and flame-cutting. Non-destructive tests (appearance, Brinell, petrol, acoustic, magnetic, electric, electro-magnetic, and X-rays); destructive tests on samples machined for the purpose (tensile, bend, torsion, notch impact, macroscopy, and microscopy); and destructive tests on complete welded units, are discussed.

It is a pity that the author found it necessary so to limit the size of this book. So rarely can this be said of a text-book, that no further recommendation is necessary. One hopes, however, that in the next edition greater and more careful attention will be paid to the non-ferrous metals.—H. W. G. HIGNETT.

Chemical Plumbing, Lead-Burning, and Oxy-Acetylene Welding for Plumbers and Heating Engineers. By E. P. Partington. Second edition, fully revised and greatly enlarged. Cr. 8vo. Pp. 445, with 212 illustrations. 1932. London: The British Oxygen Co., Ltd., Angel Rd., Edmonton, N.18. (5*s*. net.)

In his preface the author says that no plumber who desires to be an efficient craftsman can afford to ignore the modern methods of his craft. It would be correct to add that he cannot afford to ignore this book, which, in spite of several defects, gives an admirable survey of these modern methods.

The first few chapters cover elementary science, the welding gases, the fundamentals of lead-burning and its technique. Three subsequent chapters deal with applications of lead-burning in chemical plant construction, details being given of an extensive range of examples. Then follow chapters on domestic plumbing, electrical work, and oxy-acetylene welding of iron, steel, and non-ferrous metals (other than lead), and finally, there is a miscellany in which the casting of lead flanges and their fitting, the chemical resistance of lead, homogeneous lead coating, and the B.N.-F.M.R.A. ternary alloys are discussed.

The most unsatisfactory part of the book is the chapter on non-ferrous welding, the information given being unreliable and far from up-to-date. If it were correct, for instance, that "hammering of any copper weld at the proper temperature practically doubles the tensile strength," one could not place much faith in the many unhammered welds which are used in practice. On the other hand, where lead is concerned, the author has obviously had a very wide experience, and gives generously of his knowledge, but his descriptions are not always too clear and his writing is careless. The book contains too many sentences such as "With lead there can be a plastic condition, but it cannot be wiped with a moleskin cloth." Some of the illustrations are unnecessary and convey little; Fig. 12, for example, might illustrate a dust-bin.

The book is excellently produced and, in spite of thick paper and wide margins, contains good value for the price asked. It can be recommended to all who are interested in the fabrication of lead.—H. W. G. HIGNETT.

Encyclopædia of Oxy-Acetylene Welding. Volume I—**Pipe Construction.** Pp. 83. Volume II—**Construction of Apparatus and Containers.** Pp. 80. 8¼ in. × 11¾ in. 1932. Geneva: International Advisory Committee for Carbide and Welding Technique; London: Raggett and Co., 30 Red Lion Sq., W.C.1. (10*s*. per volume; 50*s*. per set of six volumes.)

Except for a short foreword on technical considerations, each of these volumes consists of illustrated examples of welded units. Each leaf, printed on one side only, displays a photograph of a welded article, a diagram showing the method of fabrication, and a concise but thorough description in English, French, German, Italian, and Spanish. The photography is good, the diagrams are clear, and the descriptions form an admirable dictionary. The subject-matter for an encyclopædia is, however, missing. The books will be valuable as an indication of the scope of oxy-acetylene welding, but it is a pity that a body, which claims to be international, should forget that Great Britain has played a large part in extending that scope. Not one product of British manufacture is given mention, and we hope that the loose-leaf binding will enable this omission to be remedied speedily. These two volumes deal with ferrous applications only, but it is understood that the non-ferrous metals are to be considered in a future volume.—H. W. G. HIGNETT.

Die Korrosionsschwingungsfestigkeit von Stählen und ihre Erhöhung durch Oberflächendrücken and elektrolytischen Schutz. Von Ernst Hottenrott. (Mitteilungen des Wöhler-Instituts, Braunschweig. Heft 10.) Med. 8vo. Pp. 62, with 23 illustrations. 1932. Berlin: NEM-Verlag, G.m.b.H. (R.M. 3.60.)

This small volume is devoted principally to considerations of the influence of corrosive conditions on the fatigue strengths of different classes of steel. It has, therefore, only a general application so far as non-ferrous metals are concerned. Of particular interest are the results which have been obtained in the Wöhler Institute on the effect of surface pressure on the corrosion-fatigue strengths of steels. A preliminary survey of previous work by a variety of investigators, of the main principles of the experimental methods adopted, and of the initial work on steels leads up to the consideration of the major trials and of the results which arose therefrom. In general the conclusions arrived at are: (1) the work of previous investigators is confirmed; (2) by the application of pressure on the surface of test-pieces the effects of corrosion in diminishing fatigue strength may be reduced or even removed; (3) the use of electrolytic protective measures has features which may also be useful in the same direction.

—W. A. C. NEWMAN.

Tables of Cubic Crystal Structure of Elements and Compounds. By I. E. Knaggs and B. Karlik, with a Section on "Alloys" by C. F. Elam. Med. 8vo. Pp. 90. 1932. London: Adam Hilger, Ltd., 98, King's Rd., Camden Rd., N.W.1. (11*s.* 6*d.* net.)

This publication should prove of great value in any laboratory where methods of X-ray analysis are employed. Part I, which deals with inorganic and organic substances crystallizing in the cubic system, contains three tables. The first of these is an alphabetical list of inorganic compounds, giving their chemical symbols and a reference number to Table II, and to the bibliography. Table Ia is a similar list of organic compounds. In Table II the substances are arranged in ascending order of the parameter of the cubic cell. Part II, contributed by Dr. C. F. Elam, deals with alloys, and consists of two tables and a bibliography. The first of these, Table III, is an alphabetical list of alloy systems in which phases having a cubic structure occur, and contains a reference number to Table IV and to the bibliography. In Table IV the metals and alloys are arranged in ascending order of crystal cell parameter.

The authors and publishers are to be congratulated on having brought into a readily accessible form information which is scattered through nearly one thousand original papers.—G. D. Preston.

Colorimetry: Its Applications in Analytical and Clinical Practice. By Hugo Freund. Authorized English Translation by Frank Bamford. Demy 8vo. Pp. 255, with 7 illustrations. 1932. London: E. Leitz, 20 Mortimer St. 10*s.*)

After describing the construction and method of using various types of colorimeter based on the Duboscq principle, the use of colorimetric methods for the determination of p_H is described; then follow accounts of the use of colorimetric methods in biochemistry (9 pp.), medicine (120 pp.), food chemistry (33 pp.), agricultural chemistry (5 pp.), water analysis (10 pp.), and chemistry of metals (26 pp.). Only the last section is of interest to members of this Institute, and a considerable part of this deals with the colorimetric determination of the minor constituents of steels and ores. The metals included in this section are manganese, chromium, copper, titanium, vanadium, uranium, molybdenum, tungsten, bismuth, cobalt, nickel, iron, silver, and gold; in some cases several methods are described. On the whole the descriptions given are good, but the entire field is by no means covered. There are a number of vague statements, especially in the copper, titanium, tungsten and bismuth sections, and in one or two places it appears that the German text has not been quite correctly translated.

The book is well printed on good paper, and should be of value to those interested in colorimetry, but more particularly to organic chemists.—A. R. Powell.

Optical Instruments for Examining and Analyzing Metals. Pp. 125, illustrated. **Instruments for Spectrographic Analysis.** Pp. 48, illustrated. Rochester, N.Y., London, and Frankfurt-a.-M.: Bausch and Lomb Optical Co.

These two useful little catalogues provide a complete guide to all the latest types of metallographic and spectrographic optical apparatus which are the tools of the research and routine testing laboratories of the modern metallurgical works. The apparatus illustrated and described in detail comprises all types of microscopes, from the simple tube microscope used for measuring Brinell impressions to the most elaborate and up-to-date metallographic outfit; the second catalogue contains a description of two types of quartz spectrographs and a brief account of their use in the testing of metals and alloys. Three useful features of the microscope catalogue are the detailed description of the function of the individual parts, of which very clear photographs are reproduced, a large number of interesting photomicrographs of ferrous and non-ferrous alloys taken at magnifications up to 3000 diameters, and tables showing the magnifications obtained with various optical combinations. Both catalogues are well written, and the illustrations are extraordinarily clear; anyone contemplating the purchase of a metallographic or spectrographic outfit would do well to compare the instruments here described with those of other manufacturers before making a final selection.—A. R. Powell.

Business and Science: a Collection of Papers delivered in the Department of Industrial Co-operation of the British Association for the Advancement of Science at the Centenary Meeting, London, 1931, with Introductory Notes by B. S. Rowntree and Sir J. George Beharrell. Pp. xvi + 312. 1932. London: The Sylvan Press. (5*s.*)

It is generally agreed that British industry, and indeed industry generally, is in a parlous condition. Science and scientific method, in that they have made possible a maximum output with minimum labour, have been blamed for the existing state of affairs. Now, if ever, the business man should know something of science and be able to understand the methods of science. A book dealing with the inter-relationships of business and science, say a book dealing with science for the busy business man, is very much called for to-day, and I was very hopeful that this book, judging from its title, would meet that requirement. True, it makes very interesting reading, but I am afraid that the science of its title is scarcely the science of the scientific man. But that is not to be wondered at. For, after all, at rock bottom, the business man is out for profit, just as truly as the blind and howling mob, that cheered the guillotining of even the wrong people in the French Revolution, was out for blood. Profit-making, *pur sang*, is very definitely not the province of pure science. It is not surprising, therefore, that to me, as a scientist, there is a general air of unreality about the science referred to in these essays. For instance, is there, or can there be, a science of salesmanship? I doubt it. Salesmanship, pure and simple, is seen *in excelsis* in Petticoat Lane, the *ultima Thule* of the salesman, every Sunday morning. There is not much science about that! However, I am afraid I digress. Let me return to the book before me. It comprises five sections. The first is devoted to "The Study of Management," and deals with the international position, the British, the American, and the Austrian positions, and international retail management *research*. The use of the word research in the present connection does positive violence to the significance of the term as understood by the scientist. Here, it means organization, and reference to organization for business purposes, as explained in this book, gives me the impression that organization for business, if it has really been developed as explained herein, may very well have pushed business itself into the background, and itself be, in no small measure, responsible for the present state of affairs. Business can be over-organized, and if organization as explained in this book is at all widely applied, then business is very certainly over-organized. The second section deals with "Preparation for Management," and discusses the Manchester, Paris, Birmingham, and Harvard experiments. The third section, the most truly scientific of all the sections, contains papers on the effectiveness of labour incentives, the physiology and psychology of work, and economy and safety in transport. The paper by C. A. Lee, a small employer, dealing with labour incentives, in this section, is very interesting, and essentially practical in character. I commend it to the notice of employers generally. Other contributions in this section are made by such experts as E. P. Cathcart, C. S. Myers, and H. M. Vernon. Matters discussed in the fourth section include "Some Higher Management Problems" and "Trade Barometers." The last section deals with "The Development of Invention." This makes interesting though scarcely scientific reading. It is concerned principally with apparent anomalies and curiosities in patent law and procedure. A. G. Bloxam is most interesting when he discusses the necessity of "inventing the invention in the inventor's invention." How comes it about that the validity of a patent granted by the King to an inventor is so often subsequently upset by His Majesty's judges? Procedure on patent law and suggested improvements are also discussed by A. P. M. Fleming, W. H. Ballantyne, H. S. Hatfield, H. E. Potts, K. Swann, and the whole is summed up by James Swinburne. To sum up my impressions after reading every word in the book: It is an interesting five shillingsworth, and may possibly help to show the way out of present difficulties, although I very much doubt it. Did not Blake say, long ago, "great things are done where man and mountain meet, they do not come from jostling in the street"? Our organizers should remember that, and should train themselves in science, so as to be better able to assess the value of possibly obscure scientific researches. As A. P. M. Fleming points out in this book, 40 years elapsed between Maxwell's publication of his electromagnetic theory and its application to wireless communication. *Verb. sap.*—J. S. G. THOMAS.

Index Generalis. Tome I. The Year-Book of the Universities, Libraries, Astronomical Observatories, Museums, Scientific Institutes, Academies, Learned Societies. Issued under the direction of R. de Montessus de Ballore. Cr. 8vo. Pp. 1888. 1932. Paris: Editions Spes, 17, rue Soufflot.

This issue of the well-known Index to the personnel and functions of scientific and learned societies and seats of learning throughout the world contains about 2000 pages and more than 6500 entries, each in the language of the country of origin, except for the smaller countries, in which case it is in French. It is an invaluable work of reference to all interested in education and science in all its branches, and has been compiled with much industry and care; the information given is generally in respect of the year 1931, but in some cases refers to 1930 only.
—A. R. POWELL.

H. Offingers Technologisches Taschenwörterbuch in 5 Sprachen. II. Abteilung, 2 Band: **Französisch–Deutsch–Italienisch.** Neunte, veränderte und verbesserte Auflage. Bearbeitet von H. Krenkel. Pp. 216. 1932. Stuttgart: C. E. Poeschel Verlag. (Lw., R.M. 6.)

Although this volume of Offinger's handy pocket dictionary suffers somewhat from faults similar to those found in the other volumes of the series (cf. this *J.*, 1929, 41, 735), it will no doubt prove useful to the French, German, and Italian members of this Institute, but is scarcely likely to be much in demand by the English members. That this is the ninth edition of the work indicates that it has found considerable favour on the Continent; nevertheless, there are still a number of entries which are not quite "Academy" French, and others which are rarely used in scientific French periodicals, and might therefore be omitted to make way for many terms which have been overlooked. Chemical and metallurgical words and expressions are only fairly well represented, more attention being paid to engineering, electrical, and business terms, as is the case throughout the series.—A. R. POWELL.

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

1933 AUGUST Part 8

I.—PROPERTIES OF METALS

(Continued from pp. 337–343.)

On the Alleged Allotropy of Antimony. A. Schulze and L. Graf (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1933, 16, (2), 459–462).—Reprint from *Metallwirtschaft*, 1933, 12, 19–21; see *J.*, this volume, p. 177.—M. H.

Measurements Employing Liquid Helium. XV.—Resistance of Barium, Indium, Thallium, Graphite, and Titanium at Low Temperatures. W. Meissner, H. Franz, and H. Westerhoff (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1932, 16, 107–115).—Reprint from *Ann. Physik*, 1932, [v], 13, 555–563; see this *J.*, 1932, 50, 593.—M. H.

The Exact Measurement of the Specific Heats of Solid Substances at High Temperatures. XI.—On the Remarkable Behaviour of Beryllium after Preliminary Heating above 420° C. F. M. Jaeger and E. Rosenbohm (*Proc. K. Akad. Wet. Amsterdam*, 1932, 35, 1055–1061).—[In English.] Ordinary beryllium, heated at 100° C. and dropped into the calorimeter, behaves normally; but, if the metal has been heated previously at a temperature above 420° C., its rate of loss of heat when cooled from 100° C. is extended over a very long time interval. When beryllium is heated at 900° C., dropped into solid carbon dioxide, and then placed in liquid air, heat is developed for a period of 40–90 minutes. The metal reverts to its normal behaviour when kept for some months. There is no additional heat effect superimposed on the heat given up by the heated metal. No explanation of this thermal hysteresis is offered, but it is shown that allotropy or changes in thermal conductivity cannot account for it. No difference could be detected in the physical properties in the two states, other than in the transfer of heat.
—E. S. H.

On the Question of the "Transformation Points" of Bismuth and Copper. J. Arvid Hedvall, R. Hedin, and E. Andersson (*Z. anorg. Chem.*, 1933, 212, 84–90).—Dilatometric measurements have confirmed the work of Cohen (1913–1915) that transformations occur in bismuth and copper at 74·5°–75·1° C. and 68·2°–71·0° C., respectively. The "transformation" is not a polymorphic change, but seems to be due to alterations in the secondary (so-called "mosaic") structure of the crystals (see A. Goetz, this *J.*, 1930, 43, 521). These changes are occasioned by periodic fluctuations (contractions) of the lattice parameter; they can also be detected chemically, since the reactivity (determined by dissolution experiments in 1·84*N*-nitric acid and 0·13*N*-iodine for bismuth, and in 0·44*N*-nitric acid for copper) reaches a maximum during the transformation process.—M. H.

$\alpha \rightleftarrows \beta$-Transformation of Calcium. Fritz Ebert, Hellmuth Hartmann, and Hans Peisker (*Z. anorg. Chem.*, 1933, 213, 126–128).—The polymorphic transformation of calcium at about 450° C. found by Rinck (cf. *J.*, 1932, 50, 601) has been confirmed by X-ray analysis; β-calcium is stable above 450° C., has a hexagonal close-packed lattice: $a = 3{\cdot}98$ A., $c = 6{\cdot}52$ A., $c/a = 1{\cdot}639$, elementary volume$= 89{\cdot}4$ A.^{3} with two atoms in the elementary cell, $d_{\text{calc.}} = 1{\cdot}48$ at 450° C. (compared with $d_{\text{calc.}} = 1{\cdot}55$ for α-calcium at 18° C.).—M. H.

On the Hydrogen Content and the Hardness of Electrolytic Chromium. —— Guichard, —— Clausmann, —— Billon and —— Lanthony (*Compt. rend.*, 1933, 196, 1660–1663).—Chromium was deposited on the single face of a copper cathode from a solution of chromic acid and violet chromium sulphate, using a lead anode and a current of 26 amp./dm.^{2} at 4·8 v. The resultant deposit contained 99·5% chromium and had a Brinell hardness of 463 in one case and more than 500 in another. Hydrogen was fractionally extracted in a dry vacuum as previously described, and so extracted was very pure, but the process is very slow, requiring several days' heating at each temperature. The evolution of hydrogen is high at low temperatures and then slows down considerably, being nearly complete at about 500° C. In the first case, the hardness did not diminish until above about 380° C., at which temperature 96% of the total hydrogen had been evolved. In the second case, the hardness began to decrease a little below 300° C., but was still 463 at 320° C., 95% of the hydrogen having been eliminated. Above 485° C., no more hydrogen was evolved, but the hardness continued to fall with increasing temperature to 168. Thus, as in the case of iron, nickel, and cobalt, it is concluded that the high Brinell hardness of electrolytic metals is independent of their hydrogen content.—J. H. W.

The Solubility of Oxygen in Gold and in Certain Silver–Gold Alloys. F. J. Toole and F. M. G. Johnson (*J. Physical Chem.*, 1933, **47**, 331–346).—The solubility of oxygen in gold has been measured over the temperature range 300°–900° C. at pressures between 11·9 and 70·0 cm. of mercury, and found to be of the order 0·010 vol. per vol. of metal at the highest temperature and pressure used. The solubility of oxygen in three silver–gold alloys containing 5, 10, and 20% of gold has been measured between 200° C. and 850° C. and under pressures of from 5 to 80 cm. of mercury. Above a certain "critical" temperature, the solubility Q at $t°$ C. is given by $1/Q=K_1(A-t)$, A denoting the m.p. of the alloy; the solubility is a function of the percentage concentration, C, of gold in the alloy and is given by $1/Q=K_2(C+5·7)$. Below the "critical" temperature, the apparent solubility is related to the pressure, P, by the equation $Q=aP^K$, in which K diminishes with decreasing temperature; the relation between solubility and temperature and that solubility and concentration are complicated by the appearance of minima in the curves. Solubility phenomena below the "critical" temperature are explained in terms of surface effects. Nitrogen is insoluble in gold and in the alloys studied.—J. S. G. T.

Measurements Employing Liquid Helium. XVII.—Resistance of Lead in a Magnetic Field at Temperatures Below the Superconductivity Point. W. Meissner (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1932, **16**, 127–134).—Reprint from *Ann. Physik*, 1932, [v], **13**, 641–648; see this *J.*, 1932, **50**, 594.—M. H.

The Isotopic Constitution and Atomic Weight of Lead from Different Sources. F. W. Aston (*Proc. Roy. Soc.*, 1933, [A], **140**, 535–543).—Ordinary lead and a number of radiogenic leads have been analyzed with the mass-spectrograph by means of their volatile methyls and the abundance of their isotopes has been estimated. The mass numbers and relative abundances of the isotopes present in ordinary lead are: 203, 0·04; 204, 1·50; 205, 0·03; 206, 27·75; 207, 20·20; 208, 49·55; 209, 0·85; 201, 0·08, corresponding with a mean mass number 207·190. The present accepted international atomic weight of lead is 207·22. The mean mass numbers of samples of radiogenic leads containing only isotopes 206, 207, and 208 ranged from 206·067 to 207·895.—J. S. G. T.

Revision of the Atomic Weight of Selenium. Synthesis of Silver Selenide. O. Hönigschmid and W. Kappenberger (*Z. anorg. Chem.*, 1933, **212**, 198–208).—Analysis of silver selenide gave an atomic weight of 78·962 for selenium. —M. H.

Limitation of Our Fundamental Knowledge of the Properties of Metals. F. O. Clements (*Met. Ind.* (*Lond.*), 1932, **40**, 323–324, 353–354).—Abstract of a paper read before a joint meeting of the New York Metals District of the American Society for Testing Materials, and the Iron and Steel Division of the

Institute of Metals Division of the New York Section of the American Institute of Mining and Metallurgical Engineers with the co-operation of the New York Section, American Welding Society. The following points are discussed: The fundamental properties of metals and the possibilities of various alloy combinations, stress being laid on their infinite variety; the limited state of our knowledge of the properties and possibilities of alloys, in spite of the vast amount of research that is being conducted on them annually; "Automobileium," the ideal alloy; the necessity for further knowledge of the atomic arrangement of the alloy molecule and its application to the interpretation of test results; problems awaiting solution.—J. H. W.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 343–350.)

Measurement of Viscosity of Molten Light Alloys, Copper Alloys, and Cast Irons at High Temperatures by the Rotating Cylinder Method. Daikichi Saito and Tatsuo Matsukawa (*Mem. Coll. Eng. Kyoto Imp. Univ.*, 1932, 7, 49–114).—[In English.] The rotating cylinder method has been adapted to the measurement of the viscosity of molten metals and alloys. Data are given, representing the experimental results for aluminium and the alloys aluminium–copper, aluminium–zinc, aluminium–copper–zinc, aluminium–silicon, aluminium–copper–nickel, aluminium–copper–nickel–magnesium, Silumin, aluminium-bronze, bronze, phosphor-bronze, brass, gun-metal, and manganese-brass. Two change points were observed in aluminium and the light alloys at 765° and 855° C., respectively, and their existence was confirmed by thermal analysis and measurements of electrical resistance. The modification of Silumin appears to be connected with the change at 765° C.; by modification the change point is moved to a lower temperature.—E. S. H.

Research on the Preparation of Aluminium–Barium Alloys. E. Alberti (*Metall u. Erz*, 1933, 30, 231–233).—Alloys with up to 7% barium can be prepared by addition of metallic barium to molten aluminium at 900° C. under a layer of barium–potassium chloride flux. A Thermit reaction with a 3 : 1 mixture of barium peroxide and aluminium powder yielded an alloy with 46·5% barium; with a 2 : 1 mixture the alloy contained 47% barium, and with a 6 : 2 : 3 mixture of barium peroxide, baryta, and aluminium a 54%-barium alloy was obtained. Small amounts of barium can be introduced into aluminium by stirring the metal at 1000°–1100° C. under a eutectic flux of barium chloride and fluoride (83 : 17) and adding baryta.—A. R. P.

Occurrence of $CuAl_2$ in Duralumin. L. W. Kempf (*Phys. Rev.*, 1933, [ii], 43, 942–943).—A note. The conclusions of Clark and Smith (*J.*, this volume, p. 294) concerning the presence of $CuAl_2$ in an old Duralumin aeroplane propeller blade are criticized. Commercial heat-treated forgings of the 25ST alloy usually contain excess undissolved $CuAl_2$, and K. considers that further evidence is necessary before it can be concluded that $CuAl_2$ can be precipitated by stress alone.—W. H.-R.

Research on the Electrochemical Potential of Duralumin in Relation to the Heat-Treatment and Ageing. Hiroshi Imai and Masami Hagiya (*Ryojun Coll. Eng. Publ.* No. 36, 1933, 1–9).—[In German.] On quenching Duralumin from 510° C. the potential becomes electronegative and remains unchanged for 10 days at room temperature. On ageing the alloy at 100° C., the potential becomes electropositive, and after annealing the alloy at 200° C., the potential reaches its original value. No indication of the separation of an intermetallic compound or of any change in the solid solution was obtained after ageing for 10 days at 20° C.—A. R. P.

Beryllium. Developing Its Use in Industry. W. H. Bassett (*Min. and Met.*, 1933, 14, 227–228).—The properties of copper alloys with 2·5–2·75% beryllium are described.—A. R. P.

Hard Metals, Their Development and Importance. F. Pölzguter (*Schweiz. Verband für die Materialprüfungen der Technik, Diskussionsber.*, No. **24**, 1932, 23–32).—The preparation, properties, and uses of alloys of the Stellite type and of sintered carbide alloys of the Widia type are described.—A. R. P.

Structural Transformations in the Binary System Iron–Cobalt. A. Kussmann, B. Scharnow, and A. Schulze (*Z. Metallkunde*, 1933, **25**, 145–146).—Report of a paper published in *Z. tech. Physik*, 1932, **13**, 449–460. See *J.*, this volume, p. 182.—M. H.

Physical Properties and Structure of the Binary System Iron–Cobalt. A. Kussmann, B. Scharnow, and A. Schulze (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1933, **16**, (2), 437–448).—Reprint from *Z. tech. Physik*, 1932, **13**, 449–460. See *J.*, this volume, p. 182.—M. H.

On the Thermal Expansion of Manganin. A. Schulze (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1933, **16**, (2), 467).—Reprint from *Z. tech. Physik*, 1933, **14**, 89–90. See *J.*, this volume, p. 234.—M. H.

On the Nature of the β-Transformation in Copper–Tin Alloys.—II. Hiroshi Imai and Masami Hagiya (*Mem. Ryojun Coll. Eng.*, 1932, **5**, 77–89).—[In German.] Dilatometric investigation of the kinetics of the eutectoidal decomposition of β-bronze has confirmed the results obtained by electrical resistance methods (see *J.*, 1932, **50**, 224), but the curves obtained are more complex. On annealing quenched β-bronze at 250°–350° C., the resistance falls sharply to 60% of its original value, and at the same time the etching characteristics of the alloy undergo a sharp change, in that the individual crystals develop a striped appearance, probably due to the presence of layers in different stages of the transformation; on further annealing, the striped crystals are replaced by new small crystals. From these results it is suggested that the decomposition of β proceeds in three stages, as follows: $\beta \rightleftharpoons \beta' \rightleftharpoons \beta'' \rightleftharpoons \alpha + \delta$. The martensitic needle-like structure obtained by quenching β bronze with a low tin content disappears on annealing at 450°–500° C. and is therefore not α, but probably β′; this decomposition takes place very slowly, but at the same rate as the fall in electrical resistance. The unstable structure frequently observed in quenched α + β bronzes is explained on the assumption of a stepped decomposition of the β-phase.—A. R. P.

Enquiry into the Manufacture of Gold-Filled Spectacles. Anon. (*Joint Council of Qualified Opticians*, **1932**, Nov., 1–34).—From a complete study of the processes used in the manufacture of gold-filled spectacle frames supported by photomicrographic examination of the products, the following conclusions are reached: The best gold coating, from the point of view of hardness, colour, and resistance to acid, is 12 carat; gold solder, and not silver solder, should be used in all joints, which should be electrically soldered in preference to any form of gas soldering, and should be so made that the outer gold coating covers any exposed base metal to avoid corrosion; the internal core wire should be of non-corrosive material, and should be properly protected by internal and external wrappings of gold-filled wire, which should be consolidated by efficient mechanical treatment; the parts of the frame in contact with the skin should be made of better quality metal with a thicker gold covering; tumbling (barrel polishing) should be used for the final polishing, to avoid damage to the outer surface; testing of finished frames should be made by photomicrography as well as by chemical methods, and all soldered parts should be excluded in making an assay.—A. R. P.

Preparation of White Gold. Anon. (*Metallurgia*, 1933, **8**, 56).—An alloy is discussed which, in regard to physical properties, resembles platinum and has the advantage of a lower cost. It is manufactured by melting together 25% of a primary alloy and 75% of bright gold. Special care is required in the manufacture of the primary alloy, which consists of gold, nickel, zinc, copper, and manganese, the proportions of which vary according as a soft or hard 18-carat white gold is desired. The procedure adopted in preparing the primary alloy is briefly considered, and the influence of the various constituent metals on the physical properties referred to. The alloy also possesses all the physical properties which permit of it being readily worked or machined either in the hot or cold conditions.—J. W. D.

Dissolution Experiments with Single Crystals of Gold–Silver Alloys. E. Schiedt (*Z. anorg. Chem.*, 1933, **212**, 415–419).—No differences are observable in the rate of dissolution in 33 or 65% nitric acid at 25° C. of single-crystal and polycrystalline gold–silver alloys containing 37–44·6 atomic-% gold. The rate of dissolution of single crystals with 38 ± 5 atomic-% gold in 33% nitric acid at 25° C. is practically independent of the orientation.—M. H.

Tellurium Lead. Anon. (*Indust. Chemist*, 1933, **9**, 159–160).—A review of published work.—E. S. H.

On Lithium Alloys. I—Thermal and X-Ray Analysis of the System Lithium–Tin. A. Baroni (*Atti R. Accad. Lincei Rend.*, 1932, [vi], **16**, 153–158; *Chem. Zentr.*, 1933, **104**, I, 1002).—The system contains three compounds, Li_4Sn (m.p. 684° C.), Li_3Sn_2 (m.p. 483° C.), and $LiSn_4$. Eutectics occur at 458° C. and 35 atomic-% tin, at 320° C. and 58 atomic-% tin, and at 214° C. and 94 atomic-% tin. X-ray analysis confirms the existence of Li_4Sn and Li_3Sn_2, but not that of $LiSn_4$.—A. R. P.

Contribution to the Study of the Constitution of Ternary Alloys of Magnesium, Copper, and Silicon. Albert Portevin and Maurice Bonnot (*Compt. rend.*, 1933, **196**, 1603–1605).—An investigation of the ternary system magnesium–copper–silicon was made by studying the alloys corresponding with the intersections of lines joining the known compounds, Mg_2Cu, $MgCu_2$, Hg_2Si, and Cu_3Si, on the ternary diagram. A compound Mg_2Cu_3Si, melting at 927° C., was established, and the quadrilateral, $Mg–Mg_2Cu–Mg_2Cu_3Si–Mg_2Si$, was more particularly studied by thermal analysis and microscopically. In this region there are 2 quasi-binary systems, the one having a eutectic of $Mg_2Cu_3Si–Mg_2Cu$ with a composition closely approaching Mg_2Cu and melting at 565° C., and the other a eutectic of $Mg_2Cu_3Si–Mg_2Si$ containing 16% of Mg_2Si and melting at 857° C. The 2 sections formed by the diagonals of the quadrilateral have the one a peritectic at 508° C., and the other a ternary eutectic of $Mg–Mg_2Cu–Mg_2Si$ containing copper 32·5% and silicon 0·4%, and melting at 479° C. The peritectic reaction is always incomplete.—J. H. W.

New Nickel–Chromium Alloy [Inconel]. Anon. (*Found. Trade J.*, 1933, **48**, 410).—Inconel is a nickel alloy containing 12–14% of chromium and about 6% iron. It is said to have about the same working qualities as fine nickel, to be easily soldered and brazed, to be stainless, and highly resistant to corrosion.—J. H. W.

An Investigation of Methods of Decarburizing Iron–Nickel–Chromium Alloys. Russell Wendt Dayton (*Rensselaer Polytech. Inst. Eng. Sci. Ser. Bull.* No. 41, 1933, 1–28).—Decarburizing experiments on (A) Nichrome containing carbon 1·09, silicon 0·62, manganese 0·57, chromium 9·65, and nickel 60·50%, balance iron, and (B) KA2 steel containing the same elements in the following proportions 1·21, 0·22, 0·08, 16·88, and 10·22%, have been made in magnesia-lined graphite crucibles heated in an Ajax–Wyatt high-frequency induction furnace. The Nichrome was most effectively decarburized with ferrous oxide, whereas chromium sesquioxide is the most effective slag for KA2 steel. After removal of the carbon, deoxidation with aluminium or magnesium is necessary to obtain a workable alloy. The equilibrium constant for the removal of carbon by ferrous oxide from metal containing 0·038–0·375% carbon and 0·014–0·053% oxygen is 66×10^{-6} at 1500° C. In the Nichrome alloy the minimum carbon content attainable under a 100% ferrous oxide slag is 0·056% at 1400° C. and 0·032% at 1600° C. The use of oxide slags as decarburizers is preferable to blowing with oxygen, since the former method results in a much smaller loss of chromium by the metal.—A. R. P.

Characteristics of Monel Metal. Anon. (*Machinist* (*Eur. Edn.*), 1933, 77, 309–310).—Tables give the mechanical property ranges, minimum mechanical properties, the physical properties, and the results of mechanical tests of standard products.—J. H. W.

Some Nickel–Bronze Alloys. Anon. (*Nickel Bulletin*, 1933, **6**, 83).—A few notes on the use of nickel in copper–tin alloys.—J. H. W.

The Structure of the Iron–Nickel Alloys. W. Broniewski and J. Smolinski (*Compt. rend.*, 1933, **196**, 1793–1796).—Continuing previous experiments (cf. this *J.*, 1932, **50**, 351, 474 *et ante*), the following properties of the iron–nickel alloys from 0–100% nickel have been investigated: electrical conductivity; temperature coeff. of electrical resistance from 0° to 100° C.; e.m.f. at 0° C. compared with lead, and its variation between − 80° C. and + 100° C.; coeff. of expansion at 0° C., and its variation between 17° and 444° C.; loss in ergs/grm. for a cycle of hysteresis in a field of 150 gauss, and the coeff. of specific magnetism in fields of 5 and 800 gauss. Specimens, after melting *in vacuo*, were annealed for 100 hrs. at 950° C. *in vacuo* and slowly cooled. The most important single points occurred between 25% and 35% of nickel, and did not correspond with any compound. The compound $FeNi_2$ was confirmed. Up to 28% nickel, there is a solid solution of $FeNi_2$ in iron; from 28% to 32% nickel, a mixture of 2 solid solutions; from 32% to 67·8%, a solid solution of iron in $FeNi_2$, and above 67·8% a solid solution of nickel and $FeNi_2$.—J. H. W.

Equilibrium Diagram of the Iron–Nickel–Tungsten System. Kazimir Winkler and Rudolf Vogel (*Arch. Eisenhüttenwesen*, 1932, **6**, 165–172; *Chem. Zentr.*, 1933, **104**, I, 1993).—After briefly describing earlier work, a theoretical review of the system is given in which are discussed the primary crystallization, the equilibria in the secondary crystallization, and the transformations in the solid state. Finally, the equilibrium diagram has been investigated by thermal, magnetic, and micrographic methods. The four primary saturation surfaces, on which with falling temperature ternary α, ternary γ, Fe_3W_2, and a ternary solid solution (S) very rich in tungsten separate successively, have been determined. Two 4-phase equilibria occur, *viz.*, (1) liquid $+ \alpha \rightleftharpoons \gamma + Fe_3W_2$ at 1465° C. and (2) liquid $+ Fe_3W_2 \rightleftharpoons \gamma + S$ at 1455° C. The secondary saturation surface of S and of Fe_3W_2 as well as the $\alpha \rightleftharpoons \gamma$ transformation points in the solid state have been ascertained by examination of the structure of specimens annealed and quenched at various temperatures. and the magnetic transformation points of various ternary alloys have been determined by magnetometric measurements.—A. R. P.

Alloys of Praseodymium and Magnesium. G. Canneri (*Metallurgia italiana*, 1933, **25**, 250–252).—The system has been studied by thermal and micrographic methods. Two well-defined compounds exist: PrMg melting at 767° C. and $PrMg_2$ melting at 798° C., which form a continuous series of solid solutions; the existence of a third compound Pr_4Mg, stable only between 528° C. and 752° C., is determined from the behaviour of alloys containing up to 40 atomic-% magnesium. The physical and chemical properties of these alloys are similar to those of magnesium and lanthanum.—G. G.

Testing of [Dental] Amalgams. H. Sieglerschmidt and H. Arndt (*Deut. Zahnärztl. Woch.*, 1931, **34**, (23); *Mitt. Material.*, **1932**, 200–202; *C. Abs.*, 1933, **27**, 2536).—Compression, flow, and cutting tests and determinations of the change in length on ageing of silver–tin amalgams containing 68% silver indicate that these properties are subject to considerable variation according to the treatment used in grinding and mixing the constituents and in preparing the test-piece. By the use of sufficient pressure in forming the specimen, the expansion which occurs on hardening may be completely suppressed, and with very heavy pressures a contraction may occur. Maximum strength is obtained after grinding for 6 minutes. With a high forming pressure, higher strength and a smaller flow under constant pressure are obtained. Expansion tests beginning 15 minutes after amalgamation show that at first the amalgam contracts, generally for 30–60 minutes, and then expands during the following 24 hrs.; occasionally a small contraction takes place afterwards.—S. G.

Coefficients of Linear Expansion of Antifriction Metals. A. A. Botchvar and A. A. Maurakh (*Zvetnye Metally* (*The Non-Ferrous Metals*), 1930, 504–507; *C. Abs.*, 1933, 27, 689).—[In Russian.] Samples of antifriction metals were prepared in a hydrogen atmosphere and tested for their coeff. of expansion from 20° to 200° C. Sample No. 0 contained 100% tin and had α (linear coeff. $\times 10^{-6}$) $= 23 \cdot 50$; No. 1, tin 83, antimony 12%, $\alpha = 24 \cdot 20$; No. 2, tin 16, antimony 16, lead 65, copper 3%, $\alpha = 26 \cdot 50$; No. 3, tin 16, antimony 15, lead 70, copper 3%, $\alpha = 27 \cdot 40$; No. 4, tin 5, antimony 15, lead 77, copper 3%, $\alpha = 28 \cdot 40$; No. 5, antimony 17, lead 81·5, copper 1·5%, $\alpha = 26 \cdot 5$; No. 6, lead 98·9, calcium 0·6, sodium 0·5%, $\alpha = 36 \cdot 3$. The lowest critical points of these alloys are, in the order given above, 232, 235, 243, 243, 243, 243, and 325.—S. G.

Carbides in Carbon Containing Alloys of Tungsten and Molybdenum with Chromium, Manganese, Iron, Cobalt, and Nickel. V. Adelsköld, A. Sundelin, and A. Westgren (*Z. anorg. Chem.*, 1933, **212**, 401–409).—X-ray analysis of carburized alloys of tungsten with chromium, manganese, cobalt, and nickel and of molybdenum with iron, cobalt, and nickel has shown that double carbides of the type found in iron–tungsten–carbon alloys (Fe_3W_3C) also occur in the cobalt–tungsten–carbon, nickel–tungsten–carbon, and iron–molybdenum–carbon systems. No such carbide could be detected in the systems cobalt–molybdenum–carbon and nickel–molybdenum–carbon. On annealing at high temperatures the double carbides with tungsten decompose with separation of tungsten carbide, WC, whereas Mo_2C separates from the carbide Fe_3Mo_3C. In chromium–tungsten–carbon alloys a phase $(CrW)_4C$ having the cubic crystal structure of chromium carbide Cr_4C has been detected.—M. H.

On the Mutual Solubility of Molten Zinc in Molten Lead and Molten Bismuth. Karl Hass and Karl Jellinek (*Z. anorg. Chem.*, 1933, **212**, 356–361).—For the determination of the composition of the conjugate layers in a metal system an apparatus has been developed by means of which an exact separation can be made of the two liquid layers in equilibrium at a given temperature. The apparatus has been used in the study of the lead–zinc system at 420°–770° C. and of the bismuth–zinc system at 460°–735° C.; the percentage of zinc in the upper and lower layers in the first case is 98·7 and 2·0 at 420°, 94·0 and 5·0 at 575°, 89·5 and 7·5 at 675°, 83·2 and 11·5 at 750°, and 81·8 and 13·1 at 770° C., and in the second case: 95·5 and 16·8 at 460°, 93·4 and 21·2 at 545°, 90·0 and 24·0 at 620°, and 77·5 and 32·0 at 735° C. The critical points of the solubility curves lie at about 945° C., 47% zinc for the lead, and at about 820° C., 56% zinc for the bismuth system.—M. H.

The Age-Hardening of Alloys as a Dispersoid-Chemical Problem. K. Trettin (*Kolloid-Z.*, 1932, **60**, 101–110, 356–360; *Chem. Zentr.*, 1933, **104**, I, 1002–1003).—The mechanism of precipitation-hardening by heat-treatment of copper, iron, and other heavy metal alloys and of aluminium alloys is critically discussed with special reference to the decomposition of the compound Al_2Zn_3, the rate of which depends on the rapidity of nuclei formation. Recent work on the detection by X-rays of the structural changes which occur in age-hardening is also discussed with special reference to the bearing of the results on the precipitation theory.—A. R. P.

On the Detection of Small Quantities of Eutectic in Metals by Determination of the Tensile Strength as a Function of the Temperature. G. Tammann and H. J. Rocha (*Z. Metallkunde*, 1933, **25**, 133–134).—In the tensile strength–temperature curve of metals containing small amounts of a more easily fusible constituent the melting point of the latter is clearly indicated by an abrupt decrease in the tensile strength. This is shown by experiments with coarse-grained samples (cast or recrystallized) of zinc with 0·1% tin (representing 0·037% of eutectic), of cadmium with 0·1 and 0·05% bismuth, and of iron containing 0·5% iron sulphide. The curves for silver with 5% and 9% copper show distinct breaks at 860° C. (solidus temperature of the solid solution) and 780° C. (eutectic temperature), respectively. By this method it is possible to detect a smaller quantity of eutectic than can be detected microscopically. —M. H.

The Influence of Surface Energy in Disperse Systems. Chu-Phay Yap (*Phil. Mag.*, 1933, [vii], **16**, 80–95).—The extension of Gibb's phase rule to take into account the influence of surface is discussed. A system in which one of the phases is in a state of sub-division (particle-size not being constant, however) has an additional degree of freedom, and for such a system, with the usual notation $f = n - p + 3$. The phenomenon of under-cooling is discussed from the point of view of equilibrium particle size and its change with temperature. The stability of disperse states is discussed, and the application of the theory to metallic systems, *e.g.*, hardening and the determination of solid solubility curves, is briefly referred to.—J. S. G. T.

Some Errors Inherent in the Usual Determination of the Binary Freezing-Point Diagram. Evald L. Skau and Blair Saxton (*J. Physical Chem.*, 1933, **37**, 183–196).—The freezing-point (T)–composition (N) diagram for the system β-chlorocrotonic acid–β-chloroisocrotonic acid has been constructed by a method in which no correction is made for the amount of solid crystallizing, and curves derived from these data are compared with those obtained using accurate data. The errors involved cause a shift of the observed eutectic along both axes. False indications of compound formation are possible by use of the first method. The relation between the entropy of fusion and the shape of the T–N diagram of an ideal binary mixture is discussed.—J. S. G. T.

Propagation of Large Barkhausen Discontinuities. IV.—Regions of Reversed Magnetization. L. Tonks and K. J. Sixtus (*Phys. Rev.*, 1933, [ii], **43**, 931–940).—Describes experiments in which large Barkhausen discontinuities were made to travel in a stretched nickel–iron alloy wire by applying a small local field in addition to the main field, and were then stopped by the application of a local opposing field. The minimum reversed (stopping) field required to stop the propagation of the travelling discontinuity was determined in different main fields, and the flux and pole distribution in the stopped boundary were examined. The results confirm the view that reversal in the wire proceeds only when the total field exceeds the critical field. The details of the boundary surfaces are discussed, and experiments described in which the regions of reversed magnetization were made to vary in shape, by altering the exact conditions under which propagation was stopped. —W. H.-R.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 350–354.)

Report of Committee E 4 [of A.S.T.M.] on Metallography. C. H. Davis and O. E. Harder (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–3).—A progress report of the activities of certain Sub-Committees. A standard grain-size chart having, however, special reference to steels is proposed.—W. A. C. N.

Crystal Structure and Morphology of Gallium. F. Laves (*Z. Krist.*, 1933, **84**, 256–298).—Gallium forms rhombic, pseudotetragonal crystals, having $a = b = 4·506$, $c = 7·642$; $c/a = 1·697$. The elementary cell contains 8 atoms.—E. S. H.

Fine Structure of Electron Diffraction Beams from a Gold Crystal and from a Silver Film on a Gold Crystal. H. E. Farnsworth (*Phys. Rev.*, 1933, **43**, 900–906).—The diffraction of low-speed electrons from a gold crystal has been studied by the method previously used for silver (Farnsworth, *ibid.*, 1932, **40**, 684). Additional maxima which could be grouped as components of fine structure of the main diffraction beams were again observed, but many details of position, structure, and intensity were different for the two metals, although the lattice constants are nearly identical. A very thin film of silver, deposited by evaporation on the gold crystal, gave results closely agreeing with those obtained for massive silver. F. concludes that the details of the fine structure are determined at least to some extend by the nature of the atoms, and not by the size of the lattice or by surface irregularities.—W. H.-R.

Crystal Structure of Indium. Francis P. J. Dwyer and David P. Mellor (*J. Proc. Roy. Soc. New South Wales*, 1932, **66**, 234–239).—Indium has a face-centred tetragonal lattice, $a = 4{\cdot}588$, $c = 4{\cdot}946$ A., $c/a = 1{\cdot}078$, the unit cell contains 4 atoms and $d = 7{\cdot}28$ (calculated), 7·27 (actual). The distances between the atomic centres of the atoms at the centre and corners of the faces are 3·28 A. for the (001) face and 3·89 A. for the (010) face. The symmetry of the lattice indicates that it is made up of close-packed prolate spheroids with an axial ratio of 1 : 1·078.—A. R. P.

Magnetic Dipole Fields in Unstrained Cubic Crystals. L. W. McKeehan (*Phys. Rev.*, 1933, [ii], **43**, 913–923).—Theoretical. Calculations are made, by two different methods, of the magnetic field components at selected points due to infinite cubic arrays of equal parallel dipoles. Detailed tables of results are given for the simple cubic, face-centred cubic, body-centred cubic, and diamond types of lattices. The observed directions of easy magnetization cannot be predicted from these results, which may, however, be of use in theories of ferromagnetism Previous calculations by Boumann (*Arch. Néer.*, 1931, [3.A.], **13**, 1) are carried out more accurately, and the general qualitative conclusions are confirmed.—W. H.-R.

Magnetic Dipole Fields in Dislocated Cubic Crystals. L. W. McKeehan (*Phys. Rev.*, 1933, [ii], **43**, 924–930).—Cf. preceding abstract. Theoretical. Calculations are made to see whether magnetic stability can be predicted in cubic arrays of parallel dipoles subjected to dislocations of two sorts. (1) The dipoles are supposed to depart from a strictly cubic arrangement, and to acquire a lower symmetry in which the dislocation is homogeneous throughout. (2) Parts of the crystal are supposed to slip relatively to one another, so that each individual part retains cubic symmetry, and the dislocation is sharply localized. The results of the calculations do not account for the observed directions of easy magnetization in crystals of nickel and iron, and the methods fail to explain magnetic stability in nearly perfect crystals as the result of the above types of dislocation, although type (2) may account partly for the effects of cold-work on magnetic properties.—W. H.-R.

Magnetic Dipole Energy in Homogeneously Strained Cubic Crystals. L. W. McKeehan (*Phys. Rev.*, 1933, [ii], **43**, 1022–1024).—Theoretical. The magnetic potential energy per dipole in homogeneously strained, originally perfect, cubic arrays of parallel equal dipoles is calculated in two ways which are essentially modifications of methods used by Becker (*Z. Physik*, 1930, **62**, 253) and by Akulov (*ibid.*, 1928, **52**, 389), and discussed by Powell (*Proc. Camb. Phil. Soc.*, 1931, **27**, 561).—W. H.-R.

Magnetic Dipole Energy in Hexagonal Crystals. L. W. McKeehan (*Phys. Rev.*, 1933, [ii], **43**, 1025–1029).—Theoretical. Calculations previously made (McKeehan, cf. preceding abstracts) for cubic arrays of parallel dipoles are extended to simple hexonal and close-packed hexagonal arrays with the axial ratio 1·633 required by close-packed spheres. The results are also applicable in cases where the axial ratio is slightly different. The calculations indicate that the hexagonal close-packed arrangement is magnetically stable by a very small margin, when magnetization is along the hexagonal axis, but the fluctuations to be expected in a real crystal would completely mask so small a stabilizing field. The simple hexagonal arrangement is, however, highly unstable for magnetization in this direction.—W. H.-R.

IV.—CORROSION

(Continued from pp. 365–358.)

Lead Alloys Resistant to Sulphuric Acid. B. Garre and H. F. Mikulla (*Z. anorg. Chem.*, 1933, **212**, 326–328).—Determinations of the loss in weight in concentrated sulphuric acid at 15°, 100°, and 200° C. and in 10% sulphuric acid of sheets of lead (99·90%) and quenched lead alloys containing 0·1–2·0% AgCd$_4$ (see Garre and Vollmert, *J.*, this volume, p. 124) have shown the high superiority of the alloys. It is suggested that the cadmium passes into solution leaving a protective coating of silver on the surface. Quenched lead alloys with 0·5–5% AgCd$_4$ age-harden at room temperature.—M. H.

Corrosion of Magnesium Alloys. W. Kroenig and G. Kostylev (*Z. Metallkunde*, 1933, **25**, 144–145).—Cf. *J.*, this volume, p. 195. Magnesium corrodes in a 3% sodium chloride solution with evolution of hydrogen which is accelerated by contact with other metals. The evolution of hydrogen at the cathode (foreign metal) and anode (magnesium) depends on the nature of the foreign metal, and increases with a decreasing hydrogen overvoltage at the cathode. A study of the corrosion of a large number of magnesium alloys in solutions of salts, tap-water, and distilled water has shown that the pure metal is more severely attacked than its alloys except those containing 2% copper, 5% nickel, or 1–3% lead. The corrosion resistance of magnesium is considerably increased by addition of manganese, and still further by aluminium and zinc. The best results have been obtained with an alloy containing 6–8% aluminium, 1–1·5% zinc, and 0·3–0·4% manganese, and magnesium–cadmium alloys show severe intercrystalline corrosion. Heat-treatment does not result in an increase of the corrosion resistance. A detailed report will be published elsewhere. —M. H.

Corrosion Phenomena in the Interior of [Domestic] Hot Water Boilers and Pipes. P. Schläpfer (*Elektrizitäts-Verwertung, Sonderheft* 4–5, 1932, Reprint, 1–8).—[In German, with lengthy French summary.] The causes and prevention of corrosion in galvanized domestic boilers and hot water systems are discussed. Corrosion is favoured by the slow speed of circulation of the hot water, the high oxygen content of the usual feed water, and the use of soft iron, which takes only a thin zinc coating, for the construction of the apparatus. Soft water is usually more corrosive than hard, since the aggressive action of the dissolved carbon dioxide is increased by removal of the alkaline-earth bicarbonates in the water. Small quantities of chlorides in the water augment the corrosive action, whilst adherent carbonate–sulphate films on the metal surface tend to retard it.—A. R. P.

On the Importance of Chemical Reactions in the Corrosion of Metals. Gerhard Schikorr (*Korrosion II.* (*Bericht über die Korrosionstagung*, 1932), **1933**, 1–5; discussion 5–6).—A review of recent work on the chemical reactions which occur during the corrosion of metals in acid, alkaline, and neutral salt solutions.—A. R. P.

The Theory of Metallic Corrosion in the Light of Quantitative Measurements. VI.—The Distribution of Corrosion. G. D. Bengough and F. Wormwell (*Proc. Roy. Soc.*, 1933, [A], **140**, 399–425).—Experiments show that there is no close correlation between the rate of oxygen supply to a given area of a metal subject to corrosion and the intensity of corrosion at that area; intensity of corrosion is actually controlled by the distribution of protective films which are not necessarily confined to highly aerated regions nor absent from less aerated regions. The spread of alkali, the presence of reactive areas in the metal, gravity, and other factors affect film distribution, which often undergoes important changes with time, although the character of the oxygen supply has not been altered. Certain deposits of corrosion products usually assumed to act as oxygen screens do not actually so behave; others which do so, cut down corrosion locally instead of stimulating it. Certain types of crevice do not stimulate corrosion by differential aeration as supposed; others stimulate corrosion by interference with the formation of protective films. A convenient way of expressing the facts is outlined as a " film distribution view " of corrosion.—J. S. G. T.

The Electrochemical Theory of Corrosion of Metals. M. Straumanis (*Korrosion u. Metallschutz*, 1933, **9**, 1–11, 29–36).—The electrochemical theory of corrosion is critically reviewed, and an account is given of its development. The expression for the rate of dissolution of metals in acids derived by Aurén and Palmær from their local element theory does not take into account the change in the overvoltage of the local cathodes during the dissolution process as the current density changes, nor the change of potential of the base metal with the change in the conductivity of the acid during the dissolution. The great importance of the dissolution potential for evaluating the corrodibility of a metal is discussed on the basis of Akimov's theory (*J.*, this volume, p. 357). Methods of determining the potential of alloys, the e.m.f. of local elements, and the overvoltage at local cathodes are described; the values obtained for the last-named are very high and approach the potential of the anode as the current density and p_H of the solution increase. The effect of small quantities of more noble metals on the rate of dissolution of numerous base metals is discussed, and it is shown that for zinc the activity of the second metal increases in the order: bismuth, silver, antimony, gold, cobalt, copper, nickel, platinum, whilst thallium, cadmium, tin, lead, and mercury are without effect owing to their high overvoltage. No definite relationship between the activity of a metal in this respect and decreasing overvoltage is to be expected, since the number of local elements and their internal resistance play an important part in the dissolution process. The Aurén–Palmær corrosion formula is applicable to all the cases yet investigated of corrosion in oxygen-free acidic and basic solutions; the formula also applies when access of oxygen is regular and constant over the whole surface of the metal. With irregular access of oxygen, however, the activity of the local elements may be considerably reduced. Many other aspects of the corrosion problem are discussed and 148 references to the literature are given.—A. R. P.

A Modern Theory of Corrosion, and Methods of Testing Metals for their Resistance to Chemicals. N. A. Isgarischev (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1930**, 328–347).—[In Russian.] See this *J.*, 1932, **50**, 231. —S. G.

V.—PROTECTION

(Other than Electrodeposition.)

(Continued from pp. 358–360.)

The M.B.V. Process. Anon. (*Aluminium*, 1933, **15**, (5), 2–3).—The modified Bauer–Vogel system of protecting aluminium and its alloys with an oxide film is briefly outlined. The standard process consists in immersing the article in a 5% solution of sodium carbonate containing 1·5% of sodium chromate and maintained at 90° C. Further protection is afforded by subsequent treatment for 15 minutes at 90° C. in a 3–5% solution of sodium silicate. In special cases protection can be obtained by painting the article at room temperature with a paste of sodium chromate 10, sodium carbonate 4, caustic potash 4, and water 10–15 parts, and washing in cold water after 10–15 minutes.—A. R. P.

" Pantarol " as Protection Against the Oxidation of Metals. Walther Roething (*Apparatebau*, 1933, 45, 66–67).—Polished sheets of brass, copper, aluminium, iron, and chromium-plated iron which were either unprotected or protected by varnish and "Pantarol," were subjected to attack by acid vapours, water sprays, combustion gases, &c., over a period of 2 years. Only the samples coated with "Pantarol" remained unattacked. "Pantarol" is a colourless, neutral liquid which dries within 15 minutes of application. The film is about 0·01 mm. thick, contains no pores, is an insulator and is stable up to about 110° C.—M. H.

Anodic Treatment and Dyeing of Aluminium Castings. N. D. Pullen (*Met. Ind.* (*Lond.*), 1933, **42**, 633–636; and *Found. Trade J.*, 1933, **48**, 423–424).—Read before the Institute of British Foundrymen. Discusses the preparation of castings for non-decorative and for decorative anodic treatment, the effect of foundry treatment, range of alloys available, types of finish and their permanency, degree of protection against corrosion and abrasion furnished by the films, and the cost and limiting size of the work.—J. H. W.

A New Method of Hot-Galvanizing. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 131)—The articles, *e.g.*, sheet iron, are cleaned, after pickling in acid and washing, by immersion in a 40% alcoholic solution of zinc chloride, then dried in a current of air and immersed directly in the molten zinc.
—A. R. P.

British Standard Specification for the Testing of the Zinc Coating on Galvanized Wires. —— (*Brit. Eng. Stand. Assoc.*, No. **443**, 1932, 1–5).—This specification deals only with inspection of the zinc coating, and has no reference to the wire itself. Two sets of samples are taken, one set being straightened and cleaned in benzene and the other set wound on a mandrel and unwound again before similarly cleaning. The samples are subjected to a copper sulphate dipping test. The solution is made by dissolving 33 grm. of crystalline copper sulphate in each 100 c.c. of distilled water and is shaken with excess copper carbonate or hydrate and allowed to settle. The samples are partly dipped in the solution at 60° F., rinsed, wiped dry, and re-dipped, the time of dipping being one minute or half a minute and the number of dips being varied according to the size of the wire. After the dips specified the samples are required not to show any adherent red deposit of metallic copper on the base metal, except that any deposit within 1 inch from the end is disregarded.
—R. G.

Production, Structural Peculiarities, and Properties of Sprayed Metal Coatings. H. Reininger (*Metallwaren.-Ind. u. Galvano-Tech.*, 1933, **31**, 89–98, 110–112, 130–131, 174–175, 194–196).—A series of articles containing similar matter to that in a series by R. published in *Z. Metallkunde* (see *J.*, this volume, pp. 247, 310).—A. R. P.

The Dry Galvanizing of Iron Articles in the Metal Industry. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 70–71).—A brief description of the sherardizing process is given.—A. R. P.

The Influence of the Base on the Behaviour of Paints. Erich K. O. Schmidt (*Korrosion II.* (*Bericht über die Korrosionstagung*, 1932), **1933**, 7–20).—The adherence of paint and varnish films to Elektron and Duralumin alloys is very considerably enhanced by roughening the surface or by coating it with an adherent oxide or similar film by one of the chemical or electrochemical oxidation processes. Cellulose acetate lacquer films show an adhesive strength of 42 grm./cm.^{2} on polished Duralumin, 100–155 grm./cm.^{2} on Duralumin roughened by polishing with emery, and 3700 grm./cm.^{2} on sand-blasted Duralumin.—A. R. P.

Developments in the Formulation and Testing of Paint Protective Films. D. G. Darroch (*Chem. Eng. and Min. Rev.*, 1932, **25**, 60–63).—Read before the Sydney Section of the Society of Chemical Industry. The term "paint protective films" includes all materials used for the protection and decoration of surfaces. The oxides of lead, particularly red lead, are of pre-eminent value. For each pigment, there is a mean particle size which determines the value of the pigment. The comparative opacity is, to a certain degree, judged by the difference in the refractive index. Liquids used in protective film formation are described under the heading of "vehicles." Failure of film surfaces applied to metals is due to improper cleaning of the metal or to unbalanced qualities of the finish. Finishes are tested for (1) water resistance, (2) flexibility and adhesion, (3) grease resistance, (4) yellowing resistance, (5) mar resistance, and (6) opacity.—J. H. W.

VI.—ELECTRODEPOSITION

(Continued from pp. 360–362.)

Cadmium and Its Value in Electroplating Practice. Paul Gerhardt (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 10–11, 31–32, 50–52).—The concluding articles of a series (see *J.*, this volume, p. 197). The subjects discussed are the technique of cadmium plating, the colouring of cadmium, and the value of cadmium plating in industry.—A. R. P.

Cadmium-Plating Technology. The Importance of Deposit Thickness. Anon. (*Chem. Trade J.*, 1933, **92**, 279–280).—A minimum deposit of 400 mg. of cadmium per dm.^{2} is necessary to afford any protection to iron in the salt-spray test; with increasing thickness above this minimum the time required for the iron to rust in the salt-spray test is approximately a linear function of the thickness of the coating. To determine the amount of cadmium on a plated article, a measured portion is treated with concentrated hydrochloric acid containing either an inhibitor to prevent dissolution of the iron or about 2–3% of antimony trichloride. A table is given showing the average thickness of cadmium on some commercial articles.—A. R. P.

On the Technique of Cadmium Plating. F. Pietrafesa and E. Lotti (*Metallurgia italiana*, 1933, **25**, 167–173).—The best operating conditions have been determined for a cadmium cyanide bath 0·75N in cadmium, N in free cyanide and 0·75N in sodium chloride, and containing an organic colloidal brightener. Deposits of cadmium 15μ thick were made from this bath on polished copper cathodes, 9 cm. apart from the anodes. The best plates were obtained at 20° C., with a current density of 2 mg./dm.^{2}. Photomicrographs of the deposits are shown.—G. G.

Cadmium Plating Instead of Zinc Plating. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 107–108).—Brief details are given of cadmium-plating baths and of the advantages of cadmium plating over zinc plating as a rust preventative for iron.—A. R. P.

On a New Form of Electrolytically Deposited Chromium. B. Rassow and L. Wolf (*Angew. Chem.*, 1933, **46**, 141–142).—The plates obtained on copper and brass under identical conditions of current density, voltage, and time from a chromic acid bath have different chemical properties according to the nature of the "foreign" acid present. When this acid is sulphuric, heating of the plated articles at 330° *in vacuo* results in almost complete diffusion of the chromium into the copper or brass in 2–4 hrs. when the plate is 4–7 × 10^{-6} cm. thick. If, however, a complex fluorine acid, *e.g.* hydrofluosilicic acid, is added to the bath, the deposit obtained is extraordinarily resistant to diffusion under the above conditions, and has a much higher resistance to corrosion than ordinary chromium plate. Further work is in hand to elucidate the nature of the differences between the two plates.—A. R. P.

Chromium Deposits of High-Corrosion and Heat-Resistance. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 48).—Strongly adherent chromium deposits having a high resistance to corrosion and to scaling at high temperatures can be obtained on iron or copper articles by plating the articles first with a thin layer of nickel or cobalt, then with a thicker layer of chromium, and annealing in pure dry hydrogen at 1100°–1300° C. (for iron) or 1000° C. (for copper) until the nickel or cobalt has diffused both into the base metal and into the chromium layer.—A. R. P.

The "Panzer" Chromium Bath. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 47–48).—The bath (composition not given) operates at 10°–20° C. with a current efficiency of 30% at 18° C. compared with 14% at 45° C. for the usual baths. The voltage required is less than 4 v. and the current density can be as low as 2·5 amp./dm.^{2}. The throwing power is stated to be very good and the porosity of the deposits very low.—A. R. P.

Should Chromium Plating Be Done Hot or Cold? Langbein-Pfanhauser-Werke (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 67–69).—It is pointed out that warm chromium baths operate at higher current density than cold baths, and are therefore more economical, even if the higher efficiency of cold baths is taken into account.—A. R. P.

Cold Chromium Plating. —— Birett (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 69–70).—Cf. preceding abstract. The cold chromium bath can be used only in special cases of which examples are given.—A. R. P.

What Rôle Does the "Panzer" Chromium Bath Play in Cold Chromium Plating? [Elektrochem. Fabr. Friedrich Blasberg] (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 88).—The "Panzer" bath is totally different from the usual bath in that it contains neither sulphuric acid nor sulphates. It is claimed to have a larger range of usefulness, in that bright plates can be obtained from it at a higher current yield over a wide range of temperature. —A. R. P.

What is the Value of the "Panzer" Chromium Bath in Chromium Plating Technique? R. Bilfinger and G. Elssner (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 147–149).—Tests on the operation of the "Panzer" bath have failed to substantiate the claims for its superiority over the ordinary chromium bath made by the patentees. To obtain any deposit at all, a minimum of 3·2 v. is required at a minimum current density of 1·6–1·7 amp./dm.^{2}, the current yield only slightly exceeds 10%, the range of bright plating is very narrow at 20° C., the throwing power is not as good as that of the ordinary bath, and the deposits are more porous.—A. R. P.

On the Value of Cold Chromium Plating. W. Kampschulte (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 127).—Comparative tests on plating spoons with chromium in (I) the C.I.G. bath (chromic–sulphuric acid bath) and (II) the Panzer bath (composition not given) have been made. In I at 38° C. with 10 amp. 0·0685 grm. of chromium was deposited in 20 minutes, whereas in II at room temperature with 4·3 amp. only 0·0154 grm. was deposited, hence I has double the current efficiency of II. The deposit from I was stripped in 1 : 1 hydrochloric acid in 1 minute, whereas that from II disappeared in a few seconds. The superiority of the warm bath containing sulphuric acid is thus demonstrated.—A. R. P.

Production of Copper Sheets by Electro-Deposition. Anon. (*Engineering*, 1932, **133**, 697).—Description of the Cowper-Coles process for production of copper sheets, strip, and wire by electro-deposition on a rotating steel cylinder. —W. P. R.

The Use of Bimetallic Anodes in the Electrolytic Synthesis of Alloys. C. Béchard (*Compt. rend.*, 1933, **196**, 1480–1482).—An investigation has been carried out on the composition of the brass deposited from anodes consisting of copper and zinc plates, having relative surface areas of 5 : 1, 4 : 2, 3 : 3, 2 : 4, and 1 : 5, an ordinary brass (66 : 33 copper–zinc) anode being used as reference. The tests lasted 96 hrs., the anodes and the bath being analyzed every 24 hrs. It was found: (1) that with a brass anode, the anodic solution of the copper does not keep up with the cathodic deposition, and the bath becomes impoverished in copper, whilst the anode becomes zinc-like in appearance. After a certain time, the zinc on the anode dissolves, the anode again becoming brassy, and the process is repeated; (2) that this auto-regulation occurs similarly with the double anodes, but the amplitude is much greater; (3) that the amplitude is greater when the ratio of the 2 metals of the anode differs more from the composition of the alloy normally deposited in the given conditions; (4) that the mechanism in the case of the bimetallic anodes is not one of simple solution of the excess metal, as in the case of the alloy anode, but is the formation of local couples between the 2 metals and the deposition of one of them on the other. In a copper- and zinc-free cyanide bath, the copper and zinc were deposited on the cathode in the ratio of the respective surface areas of the metals at the anode.—J. H. W.

On the Cause of Rough and Black Deposits during the Nickel-Plating Process and Method of Avoiding Them. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 33).—Some types of nickel anodes do not dissolve with 100% efficiency, since they tend to become somewhat passive, and a thin tenacious film forms on the surface, below which an accumulation of finely-divided graphite, silica, and a black nickel oxide (said to be Ni_3O_2) gradually builds up until eventually the outer film breaks and falls to the bottom of the vat, liberating a large amount of the black slime behind it. Some of this slime becomes attached to the cathode, and gives rise to a rough or black plate. The formation of this slime reaches a maximum with a certain chloride content which varies with the composition of the bath, then falls with more chloride. Further work is being done to throw more light on this problem. —A. R. P.

Problems in Modern Nickel-Plating. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 29–31).—A review of modern methods of controlling the operation of nickel-plating baths with special reference to p_H, throwing power, anodic corrosion, and testing of the plate.—A. R. P.

Rhodium Plating. Colin G. Fink and George C. Lambros (*Electrochem. Soc. Preprint*, **1933**, May, 107–112; and (abstract) *Met. Ind.* (*N.Y.*), 1933, **31**, 208–209).—The plating characteristics of baths prepared by dissolving rhodium hydroxide in various acids and adding neutral salts as buffering agents have been examined. Sulphate and phosphate baths containing sodium sulphate or phosphate give good bright plates at about 50° C. Citric or nitric acid may be added to sulphate baths, but the presence of chlorides prevents plating. The most useful bath was obtained by dissolving rhodium hydroxide in sulphuric acid, diluting to 4 grm./litre of rhodium, and adding 80 grm./litre of sulphuric acid and 3% of ammonium sulphate; at 50° C. with a current of 0·5 amp./in.^{2} a deposit of 0·18 mg./cm.^{2} is obtained in 15 seconds. The deposit is dense and of a brilliant white colour and requires no polishing. —A. R. P.

Rhodium Plating. A New Method of Protection and Beautification of Silver and Material Resembling Silver. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 108–109).—The operation of the Wieland rhodium-plating bath is described, but no details of its composition are given.—A. R. P.

Notes on the Efficiency of Rhodium Plating Baths. V. L. Bigsby (*Met. Ind.* (*N.Y.*), 1933, **31**, 132–133).—High efficiency baths give the most protective deposit, hence warm sulphate baths are considered the most satisfactory. —A. R. P.

The Correction of Silver Baths. Karl Bihlmaier (*Mitt. Forschungsinst. Edelmetalle*, 1933, **7**, 24–28).—Numerous examples are given of the methods used in the correction of the composition of silver-plating baths from the analytical figures for silver, free cyanide, and potassium carbonate. The adjustment of the bath may be made by addition of silver cyanide or other silver salt, potassium cyanide, or barium cyanide, by suitable dilution or by a combination of these.—A. R. P.

A Further Study of Anodes for Zinc Plating. A. K. Graham, G. B. Hogaboom, and L. E. Graham (*Met. Ind.* (*N.Y.*), 1933, 31, 195–197).—The experiments were made in a bath containing zinc cyanide 8, sodium cyanide 3, and sodium hydroxide 7 oz./gall. with the following anodes: (A) 100% zinc, (B) 99·5% zinc, 0·5% mercury, and (C) 99% zinc, 0·5% aluminium, and 0·5% mercury. At room temperature C has the lowest efficiency and B the highest, but at 120° F. (49° C.) all three anodes show about the same efficiency, the efficiency of C remaining almost constant with rise in temperature, whilst that of the others falls. The efficiency in all cases decreases almost hyperbolically with increase in current density between 15 and 30 amp./ft.^{2}. The polarization voltage of C is 2·9 v. in hot and cold solutions at all current densities, whilst that of B and C is 3·1 in hot and 3·0 v. in cold solutions. B and C produce a fair amount of anode sludge, especially in intermittent plating, whereas C is absolutely free from sludging tendency. Since the roughness of the cathode deposit varies with the sludging tendency, C is considered to be superior to A and B, taking all things into account.—A. R. P.

Electroplating Zinc on Aluminium. Harold K. Work (*Met. Ind.* (*N.Y.*), 1933, 31, 169–170).—See *J.*, this volume, p. 254.—A. R. P.

Notes on the Metal Plating of Glass and Porcelain. F. Franceschini (*Ind. Silicati*, 1932, 10, (4), 7–9; *Ceram. Abs.*, 1932, 11, 436).—Methods are given for covering objects of glass, porcelain, terra cotta, plaster, or wax with a layer of metal. Directions for copper plating are as follows: By means of a brush the object is covered with a layer of conductive material composed of a solution of gold chloride or platinum chloride reduced with a balsam of sulphur or oil of turpentine in which sulphur is dissolved. The object is heated slightly and again coated to make the layer thicker; it is then heated in a muffle kiln until a bright metal layer is formed which makes it suitable for copper plating. The object is placed in a copper bath, where it serves as an electrode and is subjected to the action of a current at 3 v. for a short time. It is well washed, placed in boiling water for a moment, dried with sawdust, and given a coat of transparent lacquer to prevent the copper from oxidizing. The copper bath must be alkaline and contain potassium cyanide, which makes precipitation gradual and homogeneous. The following recipe is given for a copper bath: 8 kg. of potassium copper cyanide are dissolved in 30 litres of hot water; 200 grm. of cyanide of potassium 99% are added, then 100 grm. of powdered soda. The mixture is filtered, the solution diluted with 100 litres of water, and 200 grm. of crystallized ammonium chloride are added. This bath works well at a temperature of 20°–25° and with a current of 2·5–3 v. For light copper plating the following bath is advised: 3 kg. of neutral acetate of crystallized copper are dissolved in 25 litres of hot water; 1·85 kg. of pulverized soda are gradually added, stirring continuously, and then 3·75 kg. of sodium bisulphate. In the greenish solution thus obtained, 3·75 kg. of 99% cyanide of potassium are sifted until the bath becomes clear, when 1·5 kg. of crystallized ammonium chloride are added. This solution is then diluted with up to 100 litres of water and the bath is used at 20°–25° with a current of 2·7–3·5 v. For a small quantity, earthenware basins are used; for a large bath, wood vats. The following processes are also described: (1) silver plating according to the method of Böttger, Wood, Brozette, Bory, Kayser, and Lumiere, (2) gold plating by the method of Böttger, (3) the methods of Vasserot, Dode, and Kundt for platinum plating, and (4) Kattaway's method of copper plating.—S. G.

Low Tension Generators for Plating Plants. R. Schmid (*Metallwaren-Industrie u. Galvano-Tech.*, 1933, 31, 129).—The construction of modern generators giving a high ampère output at a low voltage is briefly described.—A. R. P.

Practical Plating. Preparation of Work. III.—Pickling (concluded). E. A. Ollard (*Met. Ind.* (*Lond.*), 1933, 42, 643–644).—Describes pickling with the cyanide dip and the pickling of dissimilar metals. **The Deposition of Nickel. I.—General** (*Ibid.*, 644–645).—Discusses the relative suitability of nickel sulphate and nickel ammonium sulphate solutions and the function of boric acid, chlorides and fluorides in the nickel solution. Cf. *J.*, this volume, p. 362. —J. H. W.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-Refining.)

(Continued from pp. 362–363.)

Researches on the Electrolysis of Molten Binary Aluminium Alloys and the Degree of Solubility of Iron in Aluminium at Various Temperatures. Robert Kremann, Ester Inge Schwarz, and Sidy Le Beau (*Monatsh.*, 1933, 62, 47–60). —The linear distribution of the constituents along a capillary tube when molten aluminium–copper and aluminium–tin alloys are electrolyzed at various current densities, has been determined at various temperatures. The iron electrodes dissolve in the molten metals partly by true solution and partly by anodic action.—A. R. P.

Researches on the Electrolysis of Aluminium-Tin Alloys Containing Iron, as a Model for the Electrolytic Purification of Molten Aluminium from Iron. Robert Kremann and Ludwig Lammermayr, Jr. (*Monatsh.*, 1933, 62, 61–67). —Experiments on the electrolysis of molten aluminium–tin alloys containing iron have shown that it is unlikely that this method will prove of value for the elimination of iron from aluminium, since the rate of migration of the iron decreases rapidly with increase in aluminium content of the alloy.—A. R. P.

On the Electrolysis of a Molten Beryllium–Copper Alloy with 10% Beryllium. Ludwig Lämmermayr, Jr. (*Monatsh.*, 1933, 62, 67–70).—Electrolysis of molten 10% beryllium-copper alloy with a current density of 6 amp./mm.^{2} at 1050° C. in a capillary tube causes the beryllium to migrate towards the cathode and copper towards the anode.—A. R. P.

On the Theory of Electrolysis Phenomena in Metallic Solutions. Karl Schwarz (*Z. physikal. Chem.*, 1933, [*A*], 164, 223–230).—The assumption that the migration of the ions in molten metal solutions in an electric field is determined only by the resultant of the electrostatic force and the electrohydrostatic buoyancy leads to a relation between the transport number, the density of the charge, and the mobility. This theory has been proved by tests on zinc and cadmium amalgams. Mercury is practically completely dissociated into electrons and $Hg^{\cdot}$ ions, although the possibility of dissociation into $Hg^{\cdot\cdot}$ ions cannot be completely excluded. Cadmium and zinc are dissolved by mercury as $Cd^{\cdot\cdot}$ and $Zn^{\cdot\cdot}$ ions. Mass displacement and conduction of current in liquid metals are two phenomena which are related only in so far as both depend on the field strength of the current. The diffusion constants of cadmium and zinc in mercury have been determined as follows: at 25° C., $D_{Cd} = 1{\cdot}77$ cm.^{2}/day, $D_{Zn} = 1{\cdot}73$ cm.^{2}/day; at 35° C. $D_{Cd} = 1{\cdot}89$ cm.^{2}/day, $D_{Zn} = 1{\cdot}84$ cm.^{2}/day.—B. Bl.

On the Interpretation of the Electrolytic Portion of Conduction in Amalgams and other Alloys.—II. Carl Wagner (*Z. physikal. Chem.*, 1933, [*A*], 164, 231–233).—Theoretical note on the paper of K. Schwarz (see preceding abstract). —B. Bl.

Electrical Conductivity in Aqueous Solutions. A. C. D. Rivett (*Chem. Eng. and Min. Rev.*, 1932, 25, 17).—Short abstract of a lecture delivered to the A. and N.Z.A.A.S. Describes the work of Sir David Orme Masson on the conducting power of solutions. Variability of both dissociation and mobility of ions is recognized. Conductivity is shown to be the sum of 2 factors, one operative over the whole range of concentration, and the other only in the more dilute solutions, becoming negligible at about the same point with all electrolytes.—J. H. W.

International Congress of Electricity. L. Jumeau (*Science et Industrie*, 1933, 17, 143–144).—Section VII. Report No. 13: "Evolution of the Accumulator Industry." An historical survey, with special reference to recent developments in iron–nickel accumulators.—P. M. C. R.

VIII.—REFINING

(Including Electro-Refining.)

(Continued from p. 363.)

Silver Extraction by Electrolysis. Present-Day Practice. Anon. (*Chem. Age*, 1932, 37, Metallurgical Section, 23).—A brief description of the Moebius system for the electrolytic refining of silver.—A. R. P.

The Influence of Metallic Impurities in Technical Zinc Electrolysis. P. Röntgen and R. Buchkremer (*Metall u. Erz.*, 1932, 29, 449–456).—The intensity of the corrosion of the cathodic zinc caused by the co-deposition of impurities depends on the p.d. between the zinc and the impurity, on the critical current density of the latter, and on the number of nuclei present. Copper and cobalt are readily deposited from very dilute solutions, and give rise to slime formation; with about 1 grm./litre of either metal in the electrolyte the rate of dissolution of the zinc is equal to its rate of deposition, and hence practically no zinc is deposited. The tendency of nickel to deposit is smaller than that of copper, and hence the number of corrosion centres produced is smaller, but their radius of action is greater; the presence of nickel therefore tends to produce a streaky deposit by alternate dissolution and deposition of the zinc. Arsenic and antimony in the electrolyte give rise to warty deposits, since they have a low critical current density and a strong tendency to produce protective films. Antimony reduces the current yield more than any of the metals tested, but this effect is to some extent overcome by addition of colloids. Cadmium also produces warty deposits, but this is due to the preferential deposition of zinc on the cadmium crystals as they are deposited. Iron is found in the zinc deposit only when its concentration in the electrolyte exceeds 5 grm./litre.—A. R. P.

The Causes of Formation of Zinc Dust [in Zinc Distillation]. R. Brosius (*Rev. Univ. Mines*, 1932, [viii], 8, 317–324).—In the distillation of zinc from mixtures of roasted ore and carbon the proportion of zinc dust formed can be greatly increased by increasing the rate of passage of the metal through the condenser and reduced by addition of 2% of sodium chloride to the charge; in the latter case the dust will be contaminated with chloride. The mechanism of the production of zinc dust has been investigated by distilling pure zinc (99–96%) from an electrically heated retort at 950° C. into a condenser heated at 425°–430° C. and passing various mixtures of hydrogen and carbon dioxide through the apparatus meanwhile. In pure carbon monoxide small quantities of carbon dioxide and zinc oxide are formed which lead to the formation of zinc dust, but no dust at all is formed in hydrogen. The results indicate that zinc distillation can be carried out on the commercial scale without the formation of dust if a high content of zinc vapour is maintained in the gas stream, which should be kept free from gases which react with zinc, and if the condenser is kept at a temperature somewhat above the melting point of zinc. Commercial zinc dust frequently contains cyanide. A yield of 90% of metallic zinc from commercial zinc dust can be obtained by melting it carefully with ammonium chloride in a special furnace, the construction of which is described. —A. R. P.

IX.—ANALYSIS

(Continued from pp. 361–371.)

Spectrographic Analysis. E. van Someren (*Met. Ind.* (*Lond.*), 1933, **42**, 331–332).—Abstract of a paper read before the Co-ordinated Societies (Birmingham Local Section of the Institute of Metals, Birmingham Metallurgical Society, and Staffordshire Iron and Steel Institute). A brief history of the development of emission spectra to the qualitative and quantitative determination of metals is given and its modern applications to metallographic analysis are described.—J. H. W.

Spectrographic Analysis. H. V. Churchill (*Met. Ind.* (*Lond.*), 1933, **42**, 132).—Short abstract of an address to the American Society for Testing Materials Committee E-2 on Spectrographic Analysis. Outlines the importance of this method of analysis to metallurgy and the rôle of the spectrograph in industry.—J. H. W.

A Method for Determining the Quality of the Tinning on Tinned Conductor Wires Insulated with Rubber. [A. R.] Matthis (*Technique moderne,* **1933,** (1), 18).—See *J.*, this volume, p. 94.—R. B. D.

On a Sensitive Detection of Gold with α-Naphthylamine Hydrochloride. H. Holzer and W. Reif (*Z. anal. Chem.*, 1933, **92**, 12–15).—As little as 1 p.p.m. of Au (sensitivity 0·008 mg.) can be detected by the violet to rose-red colour produced in the $CH_3 \cdot CO_2C_2H_5$ layer when the $AuCl_3$ solution is shaken with 5 c.c. of dilute solution of $\alpha\text{-}C_{10}H_7 \cdot NH_2,HCl$ and 2–3 c.c. of $CH_3 \cdot CO_2C_2H_5$. Fe produces a similar colour due to oxidation of the reagent; its effect can be overcome by addition of tartaric acid. Under similar conditions $PdCl_2$ produces a yellow colour; no other metal interferes.—A. R. P.

Detection and Separation of the Chemical Elements of the Second Group (Pb, $Hg^{\cdot\cdot}$, Bi, Cu, Cd). C. Candea and L. I. Sauciuc (*Bul. Soc. Chim. Romania,* 1932, **14**, 69–71).—The Hg is removed directly from the *aqua regia* solution of the sulphides by addition of $SnCl_2$, Pb, and Cr are then precipitated with $K_2Cr_2O_7$, Cu is removed with KCNS and Na_2SO_3, and Cd detected in the final filtrate by $(NH_4)_2S$. The chromate precipitate is treated with NaOH for the separation of Pb from Bi.—A. R. P.

On the Detection and Separation of the Chemical Elements of the Third Analytical Group. C. Candea and L. I. Sauciuc (*Bul. Soc. Chim. Romania,* 1932, **14**, 72–75).—Minor modifications are made in the well-known procedure. —A. R. P.

The Precipitation of Rhenium Sulphide from Ammoniacal Solution. A Separation of Rhenium and Molybdenum. J. H. Müller and W. A. La Lande (*J. Amer. Chem. Soc.*, 1933, **55**, 2376–2378).—Ammoniacal mixtures of solutions of Re and Mo, treated with H_2S for 48–72 hrs. at room temperature, give an approximately quantitative precipitation except when the proportion of Mo is large.—R. G.

On a New Source of Error in the Precipitation of Potassium Chloroplatinate. R. Strebinger and H. Holzer (*Z. anal. Chem.*, 1932, **90**, 81–86).—The C_2H_5OH used to complete the precipitation of the K_2PtCl_6 must be free from aldehyde, otherwise there is danger of reduction to K_2PtCl_4, which is soluble.—A. R. P.

Colorimetric Determination of Aluminium with Aurintricarboxylic Acid. Paul S. Roller (*J. Amer. Chem. Soc.*, 1933, **55**, 2437–2438).—In the normal quantitative procedure the reaction mixture is made alkaline. The test is improved by adoption of a fixed acid p_H of 6·3.—R. G.

On the Determination of the Antimony Content of Commercial Copper. Herbert Blumenthal (*Z. anal. Chem.*, 1932, **90**, 118–121).—Polemical against Böhme and Raetsch (this *J.*, 1932, **50**, 674) who obtained good results with NH_4OH, as their samples contained much Pb. In the absence of Pb the $Fe(OH)_3$ precipitate does not collect all the Sb_2O_5, but by the method previously recommended by Blumenthal (this *J.*, 1930, **43**, 547) all the Sb passes into the ammonia precipitate.—A. R. P.

Determination of Arsenic, Antimony, Tin, and Zinc in Minerals and Alloys by Titration with Potassium Iodate. I. I. Lurie (*Mineral Suirie*, 1931, 6, 731–742: *Chim. et Ind.*, 1932, 27, 1080; *Ceram. Abs.*, 1932, **11**, 638).—[In Russian.] L. studied the application of Jamieson's titrimetric method of potassium iodate for determining As, Sb, Sn, and Zn in minerals and alloys. The titration is made in the presence of chloroform which is coloured by I_2 liberated during reaction. The disappearance of the coloration of the chloroform layer shows the end of the titration. The experiments showed that this method is suitable for determining Sb and As and gives excellent results. Sn, however, must be reduced to stannous chloride and titrated in a current of CO_2 or with iodate. For determining Zn, this method gives good results in the absence of Fe. Zn is precipitated in the form of double sulphocyanide of Zn and Hg and then titrated with iodate. In the presence of Fe, L. suggests the following method: 1 grm. of tartaric acid and several drops of a potassium sulphocyanide solution are added to the acid solution containing Zn and Fe. The liquid becomes red. A concentrated solution of sodium carbonate is carefully added until the colour changes to lemon-yellow, 15–20 c.c. of mercuric chloride and potassium sulphocyanide are added, and the mixture is shaken. A white precipitate of double sulphocyanide of Zn and Hg is formed. The solution is left to rest, filtered, and washed with cold water. The determination is made gravimetrically or by titration.—S. G.

Bismuth in Copper. A. J. G. Smout and J. Lester Smith (*Metallurgist* (Suppt. to *Engineer*), 1933, 9, 45–46).—In view of the importance of the bismuth content of copper, and of the accuracy of determination by analysis, the matter has been examined by the Technical Sub-Committee of the Fiscal Policy Committee of the Brass and Copper Industries. A set of principles is enunciated which should, in the hands of competent analysts, produce reliable and reproducible values. Within these principles there is ample scope for variation according to individual preference.—R. G.

On the Simultaneous Electrolytic Determination of Lead and Copper. Heinrich Biltz (*Z. anal. Chem.*, 1932, **90**, 277–288).—A claim for priority over Bjørn-Andersen (cf. this *J.*, 1932, **50**, 631).—A. R. P.

The Determination of Manganese, Iron and Titanium with B. Lange's Photo-Electric Colorimeter. M. Bendig and H. Hirschmüller (*Z. anal. Chem.*, 1933, **92**, 1–7).—The use of the colorimeter in the determination of Mn as $HMnO_4$, Ti as TiO_3, and Fe as $Fe(SCN)_3$ is described.—A. R. P.

A Rapid Colorimetric Method for the Determination of Nickel in Alloys. V. P. Ochotin and A. P. Sytschoff (*Z. anal. Chem.*, 1932, **90**, 109–111).—For the analysis of Ni–Cu alloys 0·01–0·015 grm. is dissolved in 10 c.c. of HNO_3 and the solution is diluted to 25 c.c., treated with NH_4OH until blue, then with 15 c.c. of 1% dimethylglyoxime solution, and shaken with 15 c.c. of $(C_2H_5)_2O$. All the Ni passes into the upper layer, which is separated, washed twice with H_2O, and treated with 5 c.c. of C_2H_5OH and 5 c.c. of collodion solution. The red colour of the solution is then compared with that of a standard.—A. R. P.

A New Volumetric Determination of Small Quantities of Sodium. Stefan Rusznyak and Ella Hatz (*Z. anal Chem.*, 1932, **90**, 186–189).—The Na is precipitated as $NaZn(UO_2)_3(CH_3{\cdot}CO_2)_9$, which is dissolved in hot H_2O and the UO_2 precipitated by addition of an excess of Na_2HPO_4. After filtration, the excess of Na_2HPO_4 is titrated with $(CH_3{\cdot}CO_2)_2UO_2$.—A. R. P.

Iodometric Determination of Sodium as Sodium Zinc Uranyl Acetate. Rudolf Lang and Gottfried Mück (*Z. anal. Chem.*, 1933, **93**, 100–102).—The Na is precipitated as the triple salt (cf. Kolthoff, this *J.*, 1927, **37**, 570), the precipitate is dissolved in dilute H_2SO_4, 5 grm. of $(NH_4)_2SO_4$ are added, followed by 2 grm. of KI and starch, and the Zn is titrated with $K_3Fe(CN)_6$ and $Na_2S_2O_3$ (cf. R. L.'s method described below).—A. R. P.

On the Colorimetry of Titanium. III.—A Contribution to the General Technique of Colorimetry. H. Ginsberg (*Z. anorg. Chem.*, 1933, **211**, 401–411).—Measurements with the Leitz universal colorimeter show that the coloured solutions produced by adding H_2O_2 to $Ti(SO_4)_2$ solutions obey the Lambert–Beer law when the Ti concentration is within the range 0·2–4 mg./100 c.c. The colorimetric determination of Ti by the absolute method is described; the results obtained are of a satisfactory degree of accuracy.—M. H.

Use of 8-Hydroxyquinoline for the Quantitative Determination of Tungsten. Siegfried Halberstadt (*Z. anal. Chem.*, 1933, **93**, 86–89).—On treatment of an alkaline or neutral solution of Na_2WO_4 with a 4% alcoholic solution of 8-hydroxyquinoline, boiling, and adding $CH_3{\cdot}CO_2H$, the W is precipitated completely as yellow $WO_2(C_9H_6ON)_2$, which is collected in a porous filter crucible, washed with hot water, dried at 120° and weighed; it contains 36·50% W.—A. R. P.

On the Quantitative Determination of Some Metals with Anthranilic Acid. I.—A Simple Method for the Quantitative Determination of Zinc and Cadmium and for the Separation of These Metals from the Alkaline Earths. H. Funk and M. Ditt (*Z. anal. Chem.*, 1933, **91**, 332–340).—The cold solution of the metal is treated with NaOH to slight alkalinity, then with $CH_3{\cdot}COOH$ until neutral or very feebly acid. Addition of a 3% solution of Na anthranilate effects complete precipitation of the Cd or Zn. The precipitate is washed first with a 0·2% solution of the reagent, then with alcohol, dried at 105°–110° C., and weighed. The Zn compound contains 19·37% Zn and the Cd compound 29–23% Cd. The precipitates can be determined volumetrically by dissolving in 4*N*-HCl and titrating with $KBr–KBrO_3$ solution using indigo-carmine–styphnic acid as indicator.—A. R. P.

Determination and Separation of Zinc from Metals of the Ammonium Sulphide Group as Sulphide by the Use of the Chloroacetic Acid-Sodium Acetate Buffer. C. Mayr (*Z. anal. Chem.*, 1933, **92**, 166–174).—Zn can be separated from Mn, Ni, Co, Fe, Al, Cr, and V by precipitation with H_2S in solutions of p_H 2·6–2·7. The following procedure gives excellent results in the analysis of brasses, bronzes, and nickel silvers; the alloy is dissolved in HNO_3 and the Cu removed by electrolysis, any MnO_2 deposited on the anode is dissolved in HCl and added to the spent electrolyte, and the combined solution is evaporated to dryness to expel all free acid; the residue is dissolved in 20 c.c. of H_2O, 10 c.c. of $2N\text{-}CH_2Cl{\cdot}CO_2H$ and 10 c.c. of $N\text{-}CH_3{\cdot}CO_2Na$ are added, the solution is diluted to 150 c.c. with hot H_2O and saturated with H_2S, and the granular ZnS is collected in a porous crucible, washed with 150 c.c. of H_2O containing 20 c.c. of the buffer solution, dried, mixed with S, ignited in H_2 until the excess S is expelled, and weighed.—A. R. P.

On the Iodometric Determination of Zinc by the Ferricyanide Process. Rudolf Lang (*Z. anal. Chem.*, 1933, **93**, 21–31).—(Cf. this *J.*, 1930, **43**, 561).—The Zn solution free from Cl′ is treated with 3–5 c.c. of H_2SO_4, neutralized with NH_4OH, made slightly acid with H_2SO_4, diluted to 100 c.c., treated with 2 grm. of KI and a little starch, and titrated with $0{\cdot}2M\text{-}K_3Fe(CN)_6$ and

$Na_2S_2O_3$ alternately until no further blue colour develops on the addition of the former: 1 c.c. *N*-$Na_2S_2O_3$ = 0·009965 grm. Zn. If Mn is present, this may first be determined by conversion to $HMnO_4$ with $K_2S_2O_8$ and $AgNO_3$; 10 grm. of $(NH_4)_2SO_4$ are added to the titrated solution and the Zn is determined as above. HPO_3 must be added if Mo is present.—A. R. P.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

(See also "Testing" and "Pyrometry.")

(Continued from pp. 371–373.)

Improvements in Prytherch's Capacity Dilatometer. John L. Haughton and Frank Adcock (*J. Sci. Instruments,* 1933, **10**, 178–180).—Improvements in the Prytherch dilatometer (*ibid.*, 1932, **9**, 128) are described, and enable the instrument to be used at temperatures up to 1300° C. in a strictly controlled atmosphere.—W. H.-R.

Repairs and Adjustments to Assay Balances. H. R. Hillman (*Chem. Eng. and Min. Rev.*, 1933, **25**, 209–210).—Abstract of a paper read before the Chemical Society of Western Australia. Inaccuracy in assay balances is usually due to bluntness of the central knife edges, and the method of sharpening them is described. Fifteen sources of error and the methods of correcting them are given, the testing of the sensitiveness being described in detail.—J. H. W.

General Considerations on Illumination in Microscopy. E. Lihotzky (*Z. wiss. Mikroskopie,* 1933, **49**, 446–450).—The characteristics and uses of the various illuminating devices for microscopy are described.—B. Bl.

Improved Apparatus for the Measurement of Poisson's Ratio. W. A. Zisman (*Rev. Sci. Instruments,* 1933, [N.S.], **4**, 342–344).—A simple form of lever device fitted with a reflecting mirror, to determine the change of diameter of a strained cylinder, is described. The instrument is capable of detecting a change of the order 10^{-7} cm. Values of Poisson's rates for a sample of soft Bessemer steel were found to be 0·296, 0·303, 0·304.—J. S. G. T.

Moving Film Cameras in X-Ray Analysis. B. Wheeler Robinson (*J. Sci. Instruments,* 1933, **10**, 165–169).—Describes the construction of two X-ray cameras of the type in which the film moves uniformly as the crystal rotates. The first is very simple to construct, but can be used only for equatorial reflections; the X-ray film is wrapped round a cylinder which rotates at the same speed as the crystal, about an axis perpendicular to the X-ray beam and to the axis of rotation of the crystal. The second is of the Weissenberg type in which the cylindrical film moves parallel to its own axis, which is also the axis of rotation of the crystal.—W. H.-R.

Apparatus for the Comparison of the Electromotive Forces of Standard Cells. P. Vigoureux (*Phys. Rev.*, 1933, **10**, 182–183).—Describes an apparatus for comparing the e.m.f.'s of standard cells by a method in which the small resultant e.m.f. of two cells in opposition is measured.—W. H.-R.

An Isothermal Calorimeter for Slow Reactions. E. D. Coon and Farrington Daniels (*J. Physical Chem.*, 1933, **37**, 1–11).—An isothermal calorimeter capable of measuring continuously for many hours reactions which evolve less than a calorie/hr. is described. Evolution of heat is compensated by evaporating carbon tetrachloride or other liquid, absorbing the vapour in silica gel, and weighing. Absorption of heat is compensated by measured electrical heating. The accuracy possible is of the order 1%.—J. S. G. T.

XI.—PHYSICAL AND MECHANICAL TESTING AND RADIOLOGY

(Continued from pp. 373–375.)

Anomalies of the Elasticity of Metals. Damping of Torsional Oscillations. Louis Filliatre and Pierre Vernotte (*Compt. rend.*, 1933, **196**, 1374–1376).—The methods of investigating the torsional damping of rubber has been applied to the study of fusible alloys. Wires 3 m. long were acted on for 8 hrs. by an oscillating weight, which caused an extension of 20 cm. The damping coeff., k, is equal to the ratio $\alpha_{n+1}A_{n+1} : \alpha_n A_n$ of 2 successive maximum elongations, α being the (unknown) position of the nul azimuth at the end of successive semi-oscillations and A the extremes of elongation. By trial, the value $k = 0{\cdot}810$ was found to be the value required. Modifications of the classic hypothesis and an explanation of the differences observed in the measurements of Young's modulus are suggested.—J. H. W.

Recovery of Steel after Fatigue Testing. R. A. Stephen (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 36–38).—Broken Wöhler test-pieces stored for 10 months showed on X-ray examination indications that large unstrained grains had developed. The results suggest that in a polycrystalline aggregate, subjected to stress of a particular kind, a process of recovery or grain-growth can take place at ordinary temperature.—R. G.

On the Bending and Torsion Vibrations of a Thin Cylindrical Crystal Rod of any Desired Crystallographic Orientation. E. Goens (*Wiss Abhandl. Physikal.-Tech. Reichsanst.*, 1933, **16**, (2), 407–436).—Reprint from *Ann. Physik*, 1932, [v], **15**, 455–484. See *J.*, this volume, p. 144.—M. H.

Cupping Test by the Method of Siebel and Pomp. Henri Fournier (*Compt. rend.*, 1932, **195**, 142–144; and (abstract) *Technique moderne*, 1932, **24**, 603).—A systematic study of the method of Siebel and Pomp has been undertaken, the characteristics determined being: cupping elongation $A_E\ \% = \frac{d' - d}{d} \times 100$, the breaking stress at cupping $R_E = \frac{C}{e(D + e - d)}$, and the deflection f, d being the initial diameter of the hole, d' the final diameter, C the maximum load, D the diameter of the cupping tool, and e the thickness of the specimen. The tests were carried out with a number of variable factors. A comparison of this method with those commonly used led to the conclusion that the Siebel and Pomp method is superior to the methods of Persoz and Erichsen, its sensitiveness increasing with metals having greater percentage elongation; but it is of less general application and cannot be used in all cases. Cf. following abstract.—J. H. W.

Results Furnished by Cupping Tests and Their Relation to Tensile Tests. Henri Fournier (*Compt. rend.*, 1932, **195**, 327–329; and (abstract) *Technique moderne*, 1932, **24**, 670).—The methods of Siebel and Pomp, Persoz and Erichsen have been compared using an ordinary semi-hard steel, an austenitic steel (18% chromium, 8% nickel), a 67 : 33 brass, commercial aluminium (99·5%), Duralumin and magnesium. For the Siebel and Pomp method, the relation $R = \frac{R_E}{\pi} = \frac{1}{\pi} \cdot \frac{C}{e(D + e - d)}$ was used, where R is the tensile breaking stress, R_E the cupping breaking stress, D the diameter of the punch, d the initial diameter of the hole, and e the thickness of the specimen. The ratio R/R_E is appreciably affected by the state of the metal in some cases. For the Persoz and the Erichsen methods, the relation $R = \frac{C}{Kef}$ was used, C being the maximum load, f the deflection at the moment of fracture, and K

a coeff. depending on the nature of the metal the thickness, and the treatment. It was concluded that the Siebel and Pomp method is preferable for metals having large elongations and showed small diminutions of properties of a given material. The Persoz and Erichsen methods are preferable for metals with small elongations and for investigating wide variations of properties of a metal as a function of the treatment. None of these methods has a simple, rigorous relation with the tensile test, but approximate relationships exist in individual cases. Cf. preceding abstract.—J. H. W.

A New Method of Testing Hardness. T. Matsumara (*Mem. Coll. Eng. Kyoto Imp. Univ.*, 1933, 7, 159–176).—[In English.] A diamond ball of 4 mm. diam. is used as the stamp, and while the material under test is being indented, the loads at two definite depths of indentation are measured. The apparatus is described and the theory is worked out in detail. The results obtained are compared with those gained by other methods.—E. S. H.

The Standardization of the Scleroscope Test for Specification Use. R. Genders (*Metallurgist* (Suppt. to *Engineer*), 1933, 9, 46–47).—The scleroscope test, although limited in scope, has certain advantages which render it valuable for certain types of mixture testing, and it has been frequently included in specifications. The "magnifier" hammer, which is desirable for use with non-ferrous alloys, is liable to give erroneous results owing to wear and to variations in contour of the nose between different hammers. A new form of magnifier hammer, in which constant contour of the nose is ensured by the use of a hardened steel ball of 3 mm. diameter, has been adopted as standard by the British Government Services, and has been included in British Standard Specifications. The method of preparing the 3 mm. ball hammer and the standardization and calibration of scleroscopes are described.—R. G.

RADIOLOGY

X-Ray's Place in Non-Ferrous Metal Industry. Herbert R. Isenburger (*Met. Ind.* (*N.Y.*), 1933, 31, 121–122).—The value of X-ray examination in the production and selling of non-ferrous metals is briefly described.—A. R. P.

X-Rays in the Metal Industries. R. A. Stephen (*Metallurgia*, 1933, 8, 35–36).—The scope of the X-rays in industry in the detection of gas and other inclusions and cracks in castings, forgings, and welds; and in the investigation of crystal structure, effects of heat and mechanical treatment, and alloy phase systems is briefly discussed. Some apparatus is described which has been developed to meet the stringent working conditions, and includes small and medium-size X-ray plant for the examination of steel up to ¾ in. in thickness, and aluminium up to 4 in. in thickness, large shock-proof plant with which up to 4 in. of steel can be examined, and shock-proof plant for X-ray crystal analysis.—J. W. D.

The Radiographic Examination of Welds. R. A. Stephen (*Welding J.*, 1932, 29, 299–303; discussion 331–336; and (abbreviated) *Eng. Rev.*, 1933, 46, 452–454).—Read before the Institution of Welding Engineers. The useful field of application of X-rays for testing welds: the type of defects which can be detected; and the apparatus used, are discussed. It is stated that, in steel up to 2½ in. thick, flaws of dimensions down to 1·5% of the parent metal can easily be detected. Shock-proof equipment, giving a high-tension supply of at least 180,000 v. is recommended for general engineering work.
—H. W. G. H.

An Industrial X-Ray Laboratory. Anon. (*Engineer*, 1933, 155, 583).—A laboratory equipped with modern X-ray apparatus for examination of metals has been extablished by Messrs. Philips Metalix in London. There are equipments for dealing with large and small articles and mobile equipment for examination of boilers, &c., at manufacturers' works.—W. P. R.

XII.—PYROMETRY

(Continued from p. 376.)

The Effect of Temperature on the Permeability of Gases through Pyrometer-Protecting Tubes. W. Miehr (*Ber. deut. keram. Ges.*, 1932, **12**, 29–38; *C. Abs.*, 1933, **27**, 2344).—The penetration of gases through pyrometer-protection tubes is less at high than at low temperatures. For example, it takes 40·5 minutes for 13·4 litres of air to pass through a tube at room temperature, whereas it requires 117 minutes at 1000° C. with the same pressure.—S. G.

Pyrometric Economies. W. Bowen (*Gas J.*, 1933, **203**, 48).—A thermocouple composed of Nichrome and another (unspecified) metal or alloy, which is not deteriorated after immersion for some hours in a lead bath at 1350°–1400° C., is referred to. The couple is resistant to oxidizing atmospheres and to CO, SO_2, &c. Twelve months' life is guaranteed when the thermocouple is used in furnaces at temperatures up to 1000° C. The e.m.f. generated at 800° C. is 20 m.v. Resistance coils of the new material are available for use in resistance pyrometers.—J. S. G. T.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 376–382.)

Non-Ferrous Foundry Ingot Shapes.—I, II. Pierce Barker (*Met. Ind.* (*N.Y.*), 1933, **31**, 166–167, 204–205).—A description of the characteristics demanded of ingots for foundry use and practical reasons for the various shapes.—A. R. P.

Choosing Aluminium Fluxes. James Brian (*Met. Ind.* (*N.Y.*), 1933, **31**, 129).—Cryolite is recommended in cases where zinc chloride cannot be used for fear of contaminating the metal with zinc.—A. R. P.

Recent Advances in Silumin Castings. Development Work by the Metallgesellschaft A.-G. Anon. (*Chem. Age*, 1933, **38**, Monthly Metallurgical Section, 21–22).—A review.—A. R. P.

Casting Hiduminium Alloys. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 576).—The casting alloys "RR 50" and "RR 53" are said to have marked advantages over ordinary aluminium alloys and to remain stable and not age further after casting. Up to 75% scrap, and even more, may be used in the charge. —J. H. W.

Treatment of Thick Copper Boiler Plate and Red Merchant Copper. V. G. Serdyukov (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1930**, 516–530; *C. Abs.*, 1933, **27**, 690).—[In Russian.] In order to avoid cracks in copper sheets, caused by an excess of oxides, it is necessary to put a sample of copper from the furnace through a bending test, before the copper is poured. Absence of cracks in the bent piece insures against cracks in rolling. Clipping and cleaning of the ingots before rolling are necessary. The ingots should be heated before rolling in a slightly oxidizing atmosphere to prevent absorption by the copper of reducing gases which is an even greater cause of brittleness than oxides; at the same time a smoky flame should be avoided. To prevent super-heating of the copper, the ingots should be heated between 900° and 950° C. The sheets should not be heated above 850° C.—S. G.

The Casting of Two Large Doors in Bronze. F. H. Landolt (*Met. Ind.* (*N.Y.*), 1933, **31**, 90).—A description is given of the procedure adopted in casting two ornate bronze doors, 22 × 13½ ft. × 4 in. weighing 5000 lb. —A. R. P.

Some Brass Foundry Problems. F. Dunleary (*Found. Trade J.*, 1933, **48**, 221–222, 232).—Abstract of a paper read before the Lancashire Section of the Institute of British Foundrymen. Full details of moulding, coring, melting, and casting a number of brass castings requiring special precautions or presenting novel features are given. Special points in casting aluminium alloys as compared with brass are discussed and illustrated by examples. —J. H. W.

Fluxes in Brass Melting. Werner Fröhlich (*Met. Ind.* (*N.Y.*), 1933, **31**, 91–92, 123–124).—The functions of the following fluxes are described: charcoal, boric acid and borates, glass, sodium carbonate, mixed borate-carbonate, sodium chloride, reducing fluxes.—A. R. P.

Birmingham Small Wares. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 561–564, 585–586).—A detailed description is given of the manufacture of repetition articles in brass and steel as carried out in a modern Birmingham factory. —J. H. W.

Non-Ferrous Metal Mould Castings. F. R. Francis (*Chem. Age*, 1933, **38**, Monthly Metallurgical Section, 3–4).—Modern practice in the die-casting of lead, tin, zinc, aluminium, and copper–zinc alloys is briefly described.—A. R. P.

XIV.—SECONDARY METALS, SCRAP, RESIDUES, &c.

(Continued from p. 382.)

The Oxidizing Melting of Gold, Silver, and Copper Residues. E. Raub (*Mitt. Forschungsinst. Edelmetalle*, 1933, **7**, 4–8).—The recovery of gold and silver from scrap by melting the scrap with nitre or other oxidizing flux to remove base metals leads usually to serious loss of values in the slag as well as to an unsatisfactory metal containing much oxide, especially if copper is present. It is preferable to treat the scrap with acids to remove soluble impurities, then to melt it with reducing agents and fluxes to dissolve the non-metallic impurities.—A. R. P.

The Smelting of Complex White Metal Residues. Difficulties Overcome by Present Day Technique. Anon. (*Chem. Age*, 1933, **38**, Metallurgical Section, 17–18).—Modern practice in working up white metal scrap and residues is briefly described with special reference to the construction of the necessary furnaces. —A. R. P.

XV.—FURNACES AND FUELS

(Continued from pp. 382–384.)

Melting Equipment in the Non-Ferrous Industry—I, II. R. H. Stone (*Met. Ind.* (*N.Y.*), 1933, **31**, 162–165, 201–203).—The advantages and disadvantages of crucible, open-flame, indirect arc rocking, vertical ring induction, coreless induction, and cupola furnaces for melting non-ferrous metals are discussed.—A. R. P.

Forced-Air Circulation Furnaces. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 617–618).—Describes the "Birlec" forced-air circulation furnace, for which are claimed absolute uniformity of temperature, precise control of temperature and time, simplicity of operation, low running and maintenance costs, and safe and clean working conditions.—J. H. W.

Electric Furnace for Melting Aluminium. E. Fr. Russ (*Aluminium*, 1933, **15**, (7), 3–4).—An electrically heated crucible furnace for melting aluminium and zinc is described and illustrated; it is heated by a series of superimposed nickel–chromium wire elements heavily heat insulated on the outside, and surrounding a steel melting crucible which can be raised out of the furnace by depressing a foot pedal which moves upwards the pedestal on which the crucible stands. The current consumption is 45 kw.-hr. for 100 kg. of metal, and the furnace is made in three sizes to hold 10, 25 or 50 kg. of aluminium or 26, 66, or 132 kg. of zinc.—A. R. P.

XXI.—INDUSTRIAL USES AND APPLICATIONS

(Continued from pp. 406–419.)

The Most Recent Types of Lagging for Tank-Cars. A. Karsten (*Maschinenkonstrukteur*, 1932, **65**, (9/10), 59–60).—The importance of perfectly dry lagging is emphasized. K. finds that Bohlite, a slag-wool preparation, combines lightness with good insulating and mechanical properties and freedom from moisture. Curves are given showing the rates of cooling of tanks fitted with insulation of Bohlite, Alfol (aluminium foil), and Lambda; also for heat losses through identical thicknesses of these materials at ranging temperatures.—P. M. C. R.

Popularity of Copper Cooking Vessels increases as Manufacturers offer New and Improved Kitchen-Ware. Anon. (*Bull. Copper and Brass Research Association*, **1932**, (73), 2–3 and 4–11; and *Daily Metal Reporter*, 1932, **32**, (192), 3).—There appears to be a definite trend in U.S.A. towards the more extensive use of copper cooking utensils. Pages 4–11 are devoted to specific cooking operation in copper vessels.—J. S. G. T.

Canadian Architects Specify Brass and Copper Pipe for Building Improvement. Anon. (*Bull. Copper and Brass Research Association*, **1932**, (73), 13).—The use of copper and brass in the reconstruction of the Toronto General Hospital is referred to.—J. S. G. T.

Water is "Incurably Pure." Anon. (*Bull. Copper and Brass Research Association*, **1932**, (73), 14).—The imperviousness of copper and brass pipe to hard, corrosive water supplies is exemplified.—J. S. G. T.

Underground Lawn Sprinkler Systems Defeat Corrosion by Soil and Water through Use of Rust-Proof Copper Tubing. Anon. (*Bull. Copper and Brass Research Association*, **1932**, (72), 2–3).—Examples of the use of copper subsurface pipes for distributing water are given.—J. S. G. T.

Pretreatment of Woven-Moulded Brake Lining Controls Quality. Joseph Geschelin (*Automotive Ind.*, 1932, **67**, (24), 745–746).—A flexible brake-lining, consisting of a woven wire and asbestos fabric treated with a plastic rubberless filler, is claimed to show increased efficiency and longer life as compared with various standard linings. The wire employed is of brass, unless zinc is used to give a lower friction coefficient. A metallic powder of unspecified composition is present in the filler in proportions which again can be varied according to the coeff. of friction desired. The thermal conductivity of the wire strands is believed to be responsible for the rapid heat transference in the lining: results of conductivity and friction testing are given.—P. M. C. R.

Building Owners Discover Bronze Window Frames no more Expensive than Rustable Construction due to Complete Elimination of Cost by Upkeep. Anon. (*Bull. Copper and Brass Research Association*, **1932**, (72), 10–11).—The use of bronze window frames in large buildings in U.S.A. is illustrated, and economies effected by their use are referred to.—J. S. G. T.

Bronze Applied for Frames and Structural Bars in Two Fine Stained-Glass Windows. Anon. (*Bull. Copper and Brass Research Association*, **1932**, (73), 15).—Two artistic stained-glass windows mounted in bronze, recently erected in Philadelphia and Princeton, are illustrated.—J. S. G. T.

B.N.F. Ternary Alloys of Lead. Their Use in Buildings. Anon. (*Dept. Sci. Indust. Research, Building Research, Special Rept.*, No. **19**, 1–25; and (brief abstract) *Met. Ind.* (*Lond.*), 1933, **42**, 470).—For roofing purposes and flashings, ternary lead alloys give equal service to pure lead when only two-thirds as thick. The coeffs. of thermal expansion of these alloys are of the same order of magnitude as the coeff. of pure lead.—A. R. P.

B.N.F. Ternary Alloys of Lead. Their Application to the Manufacture of Pipe for Domestic Water Service and of Sheet, &c. Anon. (*Brit. Non-Ferrous Metals Res. Assoc. Development Rept.*, No. **D 3** (Fourth Edition) Aug. 1932;

D.S.I.R. Building Research Special Report, No. **19**, 1933, 7–25).—The alloys consist of lead with (1) 0·25% cadmium and 0·5% antimony and (2) 0·25% cadmium and 1·5% tin. Both alloys have a tensile strength of about 1·68 tons/in.^{2} with an elongation of about 60%, and a much higher resistance to fatigue than pure lead, hence pipe made from ternary alloy will withstand a higher hydraulic pressure before bursting or, alternatively, a thinner pipe of ternary alloy can replace the ordinary thickness of lead pipe. In hard water no tin, cadmium, or antimony is dissolved, and the quantity of lead dissolved is slightly less than with pure lead pipe. In soft water small amounts of antimony are dissolved from alloy (1) and the rate of dissolution of lead is accelerated, but still does not exceed that of pure lead pipe. The bending and joining properties of the alloys are excellent.—A. R. P.

Ternary Alloys of Lead Pipe. Advice as to Its Permitted Use. (*Report of Sub-Committee of the Standing Committee on Water Regulations. Official Circular of the British Waterworks Assoc.*, No. 97, Dec. 1931, **13**, 850–854; *D.S.I.R. Building Research, Special Rept.*, No. **19**, 1933, 28–32.)—Two-feet lengths of various sizes of lead pipes were joined by a wiped joint to similar lengths of ternary alloy (2) pipes (cf. preceding abstract) having wall thickness about 30% smaller than those of the lead pipes, and the composite pipe was subjected to hydraulic pressure until a burst occurred. In all cases this happened in the lead section, and the alloy section showed only a relatively small increase in size. The results are tabulated for pipes of internal diameters from ⅜ to 1½ in. The Standing Committee on Water Regulations have therefore permitted the use of ternary lead alloy pipes of 30% less weight per yard than ordinary lead pipes for use above ground and in buildings.—A. R. P.

Titanium and Zirconium. F. H. Driggs (*Mineral Ind.*, 1932, **40**, 546–554). —Statistics are given and recent research on these metals is reviewed. Reference is made to the age-hardening of certain alloys of titanium. A new use for titanium has been found in arc welding; the use of ferro-titanium in the electrodes in place of silicon or manganese assists the deoxidation of the weld. The titanium dioxide produced forms a slag which can readily be removed. Patents have been applied for to cover the use of zirconium in detonating compositions, but this work is in an incomplete state of development. Ductile zirconium sheet and wire are now available commercially, but no extended use for the sheet has yet been found. Zirconium spinnerettes appear to be promising in the rayon industry. The wire is used to some extent in radio valve grids. It has been recommended to use zirconium for soldering tungsten and other difficultly fusible metals.—E. S. H.

Tungsten. Colin G. Fink (*Mineral Ind.*, 1932, **40**, 555–565).—Mainly statistics. Reference is made to a patent for the moulding of articles from powdered tungsten by mixing with the powder a small amount of copper, compacting, heating, and forging at gradually decreasing temperatures. —E. S. H.

The Manufacture of Incandescent Lamps and Their Uses. J. W. Bateman (*Building Maintenance*, 1932, **6**, (2), 6–10).—An historical survey of the development of the incandescent filament lamp. The making of tungsten wire and "Dumet" wire, and the methods of making modern electric lamps for various purposes, are described, and the principal uses of such lamps are classified and enumerated.—P. M. C. R.

[Widia] Electric Rotary Drilling. H. Mühlhaus (*Colliery Eng.*, 1932, **9**, (95), 27–30).—The preparation, properties, and advantages of Widia tips for drilling bits are discussed, and design, maintenance, and performance are considered.—P. M. C. R.

Working Glass with Widia Tools. A. Fehse and B. Kindt (*Glastech. Ber.*, 1932, **10**, 193–200; *Ceram. Abs.*, 1932, **11**, 523).—F. and K. describe (1) difficulties appearing during the working of glass; (2) the difference between the working of metal and that of glass; (3) Widia as a material for working glass; (4) glass boring, and (5) glass cutting.—S. G.

A Few Words on [Telephone] Ground Rods. Anon. (*Telephone Eng.*, 1931, **35**, (2), 16).—Hot-galvanized iron rod or pipe is recommended for telephone earths.—H. F. G.

Tentative Specifications for Zinc-Base Alloy Die-Castings (B 86–31 T). —— (*Amer. Soc. Test. Mat. Tentative Standards,* **1932**, 295–297).—See this *J.*, 1932, **50**, 108–109.—S. G.

Irish Rail Car Powered with Drumm Zinc–Nickel Battery. Anon. (*Automotive Ind.*, 1932, **67**, (15), 440).—An account is given of the Drumm zinc–nickel alkaline storage battery. The positive plates are grids of nickel or Monel metal, pre-treated in caustic soda solution; the electrolyte is caustic soda (sp. gr. 1·22–1·25 at 60° F.) in which zinc oxide is dissolved to saturation. The positive plates are either flat or tubular, the active material being nickel or silver oxide, or a mixture of the two; to increase the conductivity, graphite is added or a nickel grid introduced. For long-period use a little aluminium hydrate or beryllium hydrate may advantageously be added. The cell has a high e.m.f. (1·9 volts) and a much lower internal resistance than other types of alkaline storage cell.—P. M. C. R.

Report of Committee A–9 [of A.S.T.M.] on Ferro Alloys. N. B. Hoffmann and Charles McKnight (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 134–135).—See this *J.*, 1932, **50**, 497–498.—S. G.

Report of Committee B–2 [of A.S.T.M.] on Non-Ferrous Metals and Alloys. William Campbell and E. E. Thum (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 198–200).—See this *J.*, 1932, **50**, 495.—S. G.

A Thermostatic Bi-Metal [Wilco]. C. Clément (*Électricien*, 1932, **48**, 413–418).—A description of the properties and applications of Wilco thermostatic metal. This consists of two closely welded strips; one of Invar (expansion coeff. $7{\cdot}2 \times 10^{-7}$) and one of a special brass (expansion coeff. $1{\cdot}73 \times 10^{-5}$).—E. S. H.

Thermostatic Metal—or Bimetal; Nature and Utility. H. Scott (*Metal Progress*, 1932, **22**, (5), 29–33).—The method of making bimetal strip is described, and a formula is given for calculating the degree of deflection for materials of known coeff. of expansion. The selection of suitable materials is discussed: brass–Invar forms the most sensitive practicable combination, but at temperatures above 100° C. certain alloy steels are substituted. Monel metal is used under certain conditions. The necessity for careful treatment prior to calibration, and the use of bimetals in the study of creep, are discussed. —P. M. C. R.

The Behaviour of Metals in Buildings. W. Wiederholt (*Tonind.-Zeit.*, 1931, **55**, 936; *Building Sci. Abs.*, 1931, [N.S.], **4**, 351).—An abstract of a paper read at the Building Exhibition, Berlin, 1931, in which W. discussed generally the corrosion-resistance of metals used in building. Durability when exposed to the atmosphere, resistance to water and water vapour are essential properties. Two metals should not be used in juxtaposition unless good insulation is provided in order to avoid the action of local electric currents. Lead is not attacked by ordinary tap water, but by water containing little or no carbon dioxide, and by lime and cement mortar; protection is provided by bitumen or tar paint. Zinc is durable in a normal atmosphere, but is very sensitive to sulphurous acid and chlorine compounds, also to alkalis, and should not be used in contact with cement or lime mortars. Aluminium behaves similarly, but in air becomes coated with an oxide layer which prevents further attack. Copper forms a patina; it is coloured black by exposure to hydrogen sulphide and ammonia.—S. G.

Drainage and Sanitary Work. H. H. Clay (*Indian Eng.*, 1932, **102**, 506).—Abstracted from a lecture. The materials, setting, form, and protection of drain-pipes are considered. Lead is recommended for branch pipes, for

connections to iron pipes in order to avoid damage in possible settling, and as a caulking material; copper appears likely to replace lead in the construction of soil pipes. All vent piping below 1½ in. in diameter should be non-ferrous, as the gases vigorously attack iron, whether galvanized or not.
—P. M. C. R.

The One-Pipe System of Drainage. W. Draper (*Architect*, 1932, **132**, 117–118).—Materials for waste pipes in such a system are of especial importance, as both hot and cold water are carried by the same pipes. Cast iron is suggested for the main soil pipes, with a lead or copper branch pipe for household wastes. Copper is preferred to lead as being less liable to puncture and temperature effects. D. considers galvanized wrought iron, a piping material much in use in North America, too easily corroded by sewage gases to be suitable for waste or vent piping. In the discussion on the paper, the liability of lead pipes to creep and brittleness in the one-pipe system was confirmed.—P. M. C. R.

Modern Metals for Decorating a Modern Play House. George Kester (*Metal Progress*, 1932, **21**, (5), 25–29).—Chromium plate, aluminium foil, and "18–8" alloy are extensively used in the decoration of the Earl Carroll Theatre, New York. The selection of these materials is influenced by their permanence, reflecting qualities, method of cleaning, and weldability; the matching of colour and of surface lustre is also of great importance.—P. R.

Metals in Modern Shop Fronts. Anon. (*Met. Ind.* (*Lond.*), 1932, **41**, 607–609).—Describes the application of bronzes, Monel metal, oxidized silver, stainless steel, nickel-bronzes, and silicon-aluminium alloys to shop front construction.—J. H. W.

Metals Used in Chemical Industry Plant. Chas. J. Elliott (*Met. Ind.* (*Lond.*), 1932, **41**, 511–513 and 562).—Elementary considerations governing the selection of metals to be used for various purposes in industrial plant are given.—J. H. W.

Materials Used in Chemical Engineering Operations. B. E. Roetheli and H. O. Forrest (*Indust. and Eng. Chem.*, 1932, **24**, 1018–1027).—Information regarding the materials in use at the present time for such of the unit operations as are involved in the handling of corrosive substances is tabulated under two headings, *viz.*: (1) inorganic chemicals and (2) organic chemicals. Frequently, a slight impurity content markedly affects the corrodibility of a material; so that when a choice is made, it is advisable to consider not only the limiting conditions defined in the tables, which have been compiled from information from all possible sources, but also the factor of purity. The lists are intended as a guide in the choice of materials for preliminary investigations before making the final choice. A number of illustrations of chemical plant equipment accompany the tables.—F. J.

The Relation of Food to Disease. Stanley Dixon (*Institute of Chemistry*, 1932, 1–38).—Discusses the toxic effects of arsenic, antimony, lead, zinc, tin, copper, and their compounds. Zinc-coated iron vessels should never be used for cooking purposes. Reference is made to poisoning due to leaving beverages in contact with enamelled metal containers, the enamel containing antimony or lead compounds.—E. S. H.

Metal as Material for Cellar and Transportation Vessels [in the Brewery]. W. Kluger (*Brauer-Hopfen-Zeit. Gambrinus*, 1932, **59**, 102–107).—An address.
—S. G.

Chemical Engineering Problems in Hardwood Distillation. R. S. McBride (*Chem. and Met. Eng.*, 1932, **39**, 604–608).—In the refining of wood chemicals, the equipment used for the chemical treatment, distillation, and fractionation is of the most modern chemical-engineering type. Copper equipment is general, but for highly-refined acid products, silver is also commonly used.
—F. J.

Heat Transmission from Metal Surfaces to Boiling Liquids. I.—Effect of Physical Properties of Boiling Liquid on Liquid Film Coefficient. D. S. Cryder and E. R. Gilliland (*Indust. and Eng. Chem.*, 1932, 24, 1382–1387).—An experimental evaporator consisting of an electrically-heated brass tube suspended in the boiling liquid is illustrated and described. In it, direct measurements of boiling-liquid film coeffs. of heat-transmission were made, the temperatures of both pipe and liquid being measured by means of suitable thermocouples at widely varying temperature differences, for each of 11 different liquids. Equations have been developed correlating the heat-transmission coeff. so obtained, with the physical properties of the boiling liquids.—F. J.

Designing Heads for Tanks and Heat Exchangers. C. O. Sandstrom (*Chem. and Met. Eng.*, 1932, 39, 668–672).—The design of heads or covers of pressure vessels used in the chemical industries assumes increasing importance with the definite tendency to use higher pressures. All phases of head design are discussed in 3 articles, of which this is the first.—F. J.

Pumps. Chas. W. Cuno (*Indust. and Eng. Chem.*, 1932, 24, 1109–1115).—There is no all-purpose corrosion-resisting material. Acid-proof stoneware, porcelain, and glass come first, and, although used for pumps, they have certain disadvantages, and are expensive. Duriron comes next, but is hard and brittle, unmachineable, and has high thermal expansion. Lead is used because of its resistance to sulphuric acid, but is very soft and is soluble in many other reagents and is used only in certain kinds of pumps. The use of rubber has been almost wholly limited to centrifugal pumps. Copper and copper-base alloys are used extensively, chiefly because of their cheapness and excellent machineability. Iron-base alloys with chromium and nickel are chiefly used in thermal equipment, owing to their resistance to corrosion at high temperatures. Monel metal finds considerable use because of its strength, workability, and resistance to many solutions. Tin, aluminium, aluminium-base alloys, and magnesium alloys are also used. The uses of pumps are classified and discussed, and the various types of pumping equipment described and illustrated.—F. J.

Cooling and Condensing Units. Anon. (*Chem. and Met. Eng.*, 1932, 39, 571).—Cast-metal cooling and condensing units of novel design intended for use in petroleum refineries, coke plants, and other process industries, have recently been put on the market. Some of their advantages are mentioned, including resistance to corrosion, when made of special cast-irons or non-ferrous alloys.—F. J.

Careful Installation Pays in Plant Piping. Fred D. Hartford (*Chem. and Met. Eng.*, 1932, 39, 254–256).—The designer of chemical plant is fortunate in having a wide variety of piping materials from which to choose. Steel, wrought iron, cast iron, silicon–iron, lead, aluminium, nickel, brass, copper, rubber, glass, fused silica, wood, and vitrified clay are all familiar to him. Lined pipe is also a possibility for some purposes. The designer is rarely limited to one sort of piping for any particular service. Usually he must weigh first cost, mechanical strength, life, maintenance, and the quantity of impurities which will be introduced by the corrosion of the pipe, if he is to secure the most economical installation. Pipe joints, overhead and underground positions for piping, overhead piping supports, and other details are discussed.—F. J.

Use of Arc-Welded Alloys to Arrest Corrosion. R. S. Hoffman (*Oil and Gas J.*, 1932, 31, (15), 10; *J. Inst. Petrol. Eng.*, 1932, 19, 440*A*).—The protection of pipe-joints on cracking apparatus by the application of selected alloys by electric arc welding is described. Considerable savings have been effected because of the increased resistance to corrosion. The alloy used is a chromium–nickel alloy available on the open market, and referred to as KA2 or NCT3. Illustrations are given of the type of weld applied to different kinds of fittings—flanges, valves, crosses, ties, and other carbon steel fittings. The extent of the saving effected and the method of calculating this figure are given in each case. It is shown that the savings in some cases amount to over 80%.—S. G.

Materials Available for Manufacture of Equipment for Oil Industry. R. J. Allen and F. B. Applegate (*Oil and Gas J.*, 1932, **31**, (21), 12; *J. Inst. Petrol. Tech.*, 1932, **18**, 472*A*).—Deals mainly with the question of the correct selection of material for use in the construction of various parts of pumps and compressors. The physical properties and resistance to corrosion of a number of metals and alloys used are stated. The general problem of corrosion is discussed.—S. G.

Requirements in Materials for Valves and Fittings for High-Temperature, High-Pressure Field. J. J. Kanter and H. W. Maack (*Oil and Gas J.*, 1932, **31**, (23), 13–14, 16; *C. Abs.*, 1933, **27**, 253).—Cast iron changes in size and shape through permanent "growth"; malleable iron resists temperature but not chemicals; brasses, bronzes, and nickel–copper compounds do not resist high temperatures. Steel has been made to serve for a majority of valves and fittings. By alloying and by suitable treatment its properties have been modified to suit each requirement.—S. G.

A Metal Element Filter for Cleaning Oils and Liquors. Anon. (*Mech. World*, 1932, **91**, 567).—The greatly increased demand for an efficient form of metallic filter to replace the usual fabric, gauze, or perforated metal type has resulted in the production of the "Purolator" metal element filter, metallic ribbon of taper cross-section being wound on a former, constructed to withstand pressure without damage or loss of efficiency. The effect of the tapered cross-section of the ribbon renders it impossible for wedging to take place behind the edge, thereby obviating difficulty in cleaning by back pressure or agitation. The ribbon may be of brass, copper, stainless steel, or other metal, and can be wound so as to prevent the passage of particles as small as 0·0005 in. The designs of the ribbon and filter are illustrated.—F. J.

The Development of Auto-Klean Strainers. W. R. Beldam (*Queen's Eng. Works Magazine*, 1932, (29), 95–96).—Hollow metal discs are assembled in series on a spindle rotated by an external handle, a cleaner blade being inserted between each pair of discs. The viscosity and degree of contamination of the oils to be cleaned determine individual adjustments. Very accurate machining is demanded by high-grade lubricants. For fuel and lubricating oils, steel plates are used, but the cleaning of petrol necessitates the use of phosphor-bronze, and Monel metal is employed for corrosive liquids. Various applications of the principle are briefly stated.—P. M. C. R.

Metallurgy and the Electrical Industry. Colin J. Smithells (*Met. Ind.* (*Lond.*), 1933, **42**, 71–73, 79).—A review of recent metallurgical research and development in the electrical industry, including heat-resisting materials, electric furnaces, bimetallic strip, electric lamps and valves, electrical welding, rolling mill practice, and high-purity metals.—J. H. W.

Communication Conduits and Cables. A. J. Egan (*Engineers and Engineering*, 1932, **49**, 17–19).—Precautions in placing, arranging, and racking cable for underground plant are described, together with suitable insulation methods and details of inspection routine. The testing of soldered joints, and the detection of minute flaws in these, are particularly discussed.—P. M. C. R.

Non-Ferrous Metals in Railway Electrification. Francis A. Westbrook (*Met. Ind.* (*Lond.*), 1932, **41**, 515–516).—The use of non-ferrous metals, especially copper and aluminium, in railway electrification is discussed.
—J. H. W.

Low-Capacity Fuses in Telephone Plant. Anon. (*Telephone Eng.*, 1932, **36**, (3), 17–18).—A description of a type of enclosed wire fuse suitable for protecting milliammeters, relays, &c.; capacities down to 0·01 amp. are available.
—H. F. G.

Development of Metal Construction in Aircraft. A. Koppenhöfer (*Z. Flug. u. Motor.*, 1931, **22**, 421–425).—Abbreviated from a paper read before the Wissenschaftliche Gesellschaft für Luftfahrt. Steel, Elektron, or Duralumin can advantageously replace wood in beams and ribs; the time needed in varnishing wood is an economic disadvantage. Tests on the alloys mentioned led progressively to the adoption of Elektron or Duralumin, the form of members being modified to suit the material as investigations proceeded. Although liable to corrosion, Elektron is preferred on account of its lightness and machinability, but Duralumin is superior for channels. Composite light alloy members are easily assembled, by riveting rather than welding, since the latter often sets up local brittleness. Methods of testing beams and ribs are described. Further applications of Elektron as casing, seats, fuel and oil containers, wheels, spurs, and various small cast fittings, are enumerated in the discussion on the paper.—P. M. C. R.

Materials for Aircraft Construction. Paul Brenner (*Z. Flug. u. Motor.*, 1931, 22, 637–648).—After a preliminary section on wood, a list of metals and alloys used in aircraft construction is given. It includes Duralumin, Lautal, Elektron, Magnalium (an aluminium alloy with 5% magnesium. used for rivets), and certain steels. Comparative curves for certain mechanical properties are given. The effect of corrosion on tensile strength, elongation and resistance to fatigue is discussed. B. indicates positions specially liable to attack and the desirability of minimizing its effects by the use of thick material where possible. Other methods of protection are anodic oxidation, plating, and selection of suitable materials for use in combination, as in the case of Duralumin rivets and Duralplat sheet. Methods of joining are considered; spot-welding causes the least coarsening of structure among welding methods. Localized stresses due to rivet-holes may easily cause failure. —P. R.

On Economy in Various Processes of Aircraft Construction. H. Herrman (*Z. Flug. u. Motor.*, 1930, 21, 553–563, 580).—H. considers all-metal construction appreciably more expensive than the suitable combination of wood and metal. In reviewing the economic construction of body, wings, engines, and other parts he considers in various connections the possibilities of Elektron, Silumin, aluminium, Duralumin, copper, brass, steel and wood; the two latter in combination being preferred to Duralumin in certain cases where extra strength is required. Considerations of safety and efficiency point to rather heavier construction and more powerful engines, even at enhanced cost, but care in the detailed selection of materials partially counteracts this. —P. M. C. R.

Experiences in the Construction of Aero Engines. Oskar Kurz (*Z. Flug. u. Motor.*, 1932, 23, 691–701, 721–730).—A summarized description of certain types of air-cooled and water-cooled engine assemblages is followed by detailed consideration of materials and construction of cylinders, blowers, gearing-down apparatus, pistons, valves, bearings, crankshafts, engine casings, and Diesel installations. Light alloys find application as cylinder heads, "Y"-alloy being commonly used. For pistons heat-resisting light alloys, usually containing copper or nickel, are generally employed: strengthening insets are often made of Invar. "Y"-alloy pistons give better service in the die-cast than in the forged condition. Aluminium, Duralumin, Lautal, Silumin, and Elektron are favoured materials for engine casings. White metal appears to be replaced to a great extent by ball bearings for heavy work—or by leaded bronze; a typical analysis of copper 66, lead 33, iron 1% is given. Where white metal is still used, a lead–antimony–tin–nickel–cadmium alloy, Thermit bearing metal, is recommended. "Aluminium–bronze" is found satisfactory for valve-seats, and Kuprodur bronze for guides. The use of mercury-cooled valves has been practically superseded by modifications in valve structure and material; copper insets in valve stems have already increased working efficiency, and developments in heat-resisting materials should effect further improvements. In the discussion, *W. Stieber* stated that careful workmanship obviated certain disadvantages of the white metal bearing, especially those due to the influence of copper–tin crystals.—P. M. C. R.

Reconditioning Valve Seats in I.C. Road Engines. R. Wake (*Mech. World*, 1932, 92, 296–297).—The erosion of internal-combustion valve seats causes loss of power, heavy fuel consumption, and, finally, complete engine failure due to burning of the valve. The essential requirements of a renewable valve seat are enumerated, *viz.*: (1) a gas-tight joint between the insert and the housing; (2) tightness and freedom from slackness at all temperatures of the engine; (3) ease of fitting and renewing; (4) facility for being secured by a safe and positive locking device; (5) applicability of the locking device to valve seats of material other than special iron alloy. "Aluminium–bronze" makes a much better valve seat than any other known material, and details of a renewable valve seat of this alloy held in place in the cylinder block by means of a ductile metal connection or locking device are illustrated and described. The composition of the alloy is as follows: aluminium 10·5–11·5, nickel 4·0–6·0, iron 4·0–6·0, magnesium 0·10, and copper 81·4%. Its mechanical properties are in the "as cast" and "as forged" conditions, respectively: tensile strength, 25·4, 35·5 tons/in.^{2}; elastic limit, 16·5, 20·3 tons./in.^{2}; elongation, 22·0, 22·0%; impact strength, 5·0, 2–3 kg./cm.^{2}. It has high resistance to corrosion by acids, sea-water, and hot gases, and retains its hardness at temperatures as high as 1200° F. (649° C.) if heat-treated. Toughness, as well as Brinell hardness increase by heat-treatment.—F. J.

Automobile Machinery in 1931. —— Capère (*Science et la Vie*, 1930, 38, 503–512).—A section of this review is devoted to light alloys and the conditions governing their maximum performance. The alloys considered are Hiduminium, "F.L." (aluminium–boron–titanium–nickel–silicon), Elektron, Duralumin, and Alugir.—P. M. C. R.

Non-Ferrous Metals in Railway Engineering. Brian Reed (*Met. Ind.* (*Lond.*), 1933, 42, 35–38).—A review of the applications of copper and aluminium and their alloys in railway engineering.—J. H. W.

Steam Locomotive Design; Piston Heads. E. A. Philipson (*Locomotive*, 1932, 38, (475), 90).—Drop-forgings of an aluminium–silicon alloy are in use on the Continent instead of forged steel piston heads; corrosion is decreased and weight reduced while maintaining the necessary strength. A rim of ferrous material, normally provided to facilitate repair in cases where head and rod are forged together, is replaced in certain South American railways by a bronze of the approximate composition copper 86–89, phosphor–tin and tin each 4·6%.—P. M. C. R.

Metallurgical Problems of the Diesel Engine. R. J. Allen (*Amer. Soc. Mech. Eng. Preprint*, 1932.)—Deals in a general way with use of light alloys, bronzes, white bearing metals, chromium plating, and welding in Diesel engine practice.—W. P. R.

Metals in Ships. W. R. G. Whiting (*Met. Ind.* (*Lond.*), 1933, 42, 31–34, 38).—A review of the applications of non-ferrous metals in shipbuilding.
—J. H. W.

The Trend in Naval Engineering. C. Huey (*J. Amer. Soc. Naval Eng.*, 1932, 44, 206–213).—In an article dealing with various devices for improving efficiency a section is devoted to substitutes for brass. It is pointed out that modern warships require hundreds of measuring and indicating devices such as pressure gauges, speed indicators, annunciators, recorders, &c., and that limitation of weight is an important factor. The recent development of corrosion-resisting aluminium alloys has supplied a light-weight substitute for brass which is fairly acceptable for these many devices. Corrosion-resisting properties of such alloys are better reinforced with a coating of lacquer, paint, or enamel, and on account of the electrolytic effect of aluminium in contact with dissimilar metals special knowledge is required in the application and choice of material for the securing screws, clamps, bolts, nuts, and washers.—J. W. D.

Metallurgical Problems on Naval Construction. J. Chaintreuil (*Science et Industrie*, 1932, **16**, (Special Issue 218B), 57–61).—The warship constructor is faced with problems of corrosion, wear, easy replacement, weight reduction, and enhanced and reliable performance, in their most urgent form. Proper facilities permit the modern metallurgical laboratory to approach the practical solution of these problems. C. outlines 3 main methods of attack: (1) study of failures in service, with careful observation of working conditions, combined with chemical and micrographic analysis; many corrosion problems have thus been elucidated; (2) improvement of existing plant, notably by introducing more suitable alloys as these become available, *e.g.* the increasing use of light alloys, with concomitant advances in protective methods; (3) adaptation of materials to developing technique, as with superheat alloys. The metallurgical laboratory must also act as a centre of information and a repository of accurate records.—P. M. C. R.

The Strachan Half-Drop Window. Anon. (*Tram. and Rail. World*, 1931, **70**, 63).—The metal frames for this type of carriage window are 4 standard types: (1) a brass frame for painting; (2) a brass frame for nickel, chromium, oxidized, or enamel finish; (3) a Duralumin frame for painting, and (4) a frame of polished Duralumin.—P. M. C. R.

Turbines. A Report of the Prime Movers, Committee, Engineering National Section, National Electric Light Association [U.S.A.]. —— (*Nat. Elect. Light Assoc.* (*U.S.A.*) *Publ.* No. **234**, 1932, 1–38; and (abstract) *Power Plant Eng.*, 1933, **37**, 121).—The report covers the following—a summary of operating records from a number of firms, the effect of age on turbine efficiency, a survey of blade erosion, miscellaneous factors in turbine operation, the results of tests on a 50,000-kw. turbine, and an indication of recent developments. Statements indicating the nature of erosion troubles and suggesting remedies are given. Technique has been developed for the removal of deposits of material from turbine blading.—W. A. C. N.

Problems in Steam Turbine Design. C. Richard Soderberg (*Power Plant Eng.*, 1932, **36**, 526–527).—The high temperatures and pressures, and wide temperature intervals, involved in modern turbine practice have imposed additional strain on blading materials, especially on those of the units composing the last row of blades. Modern requirements call for materials capable of retaining their elastic properties at the operating temperatures. Resistance to erosion may be increased by improvements in blading material. These may be effected by (1) the use of stainless steel and similar alloys, (2) the welding or soldering of shielding strips to ordinary blading. Tantalum and Stellite have been found satisfactory for this purpose. Chromium plating is expensive, and is believed in some quarters to be accompanied by embrittlement. Graphs are appended showing the results of erosion and corrosion tests.
—P. M. C. R.

Possibilities in Steam Turbine Development. W. Kaiser (*Maschinenkonstrukteur*, 1931, **64**, 170–171).—(Part only.) Reference is made to the possibility of effectively protecting turbine blading from erosion by electrodeposited metallic coatings. A more promising development is the recent introduction of mercury vapour as prime mover; the results obtained at the South Meadow installation are discussed: the mercury-driven turbine shows a 15% better performance on a 10 months' run than the corresponding steam-driven plant, and the amount of mercury required is comparatively small.—P. M. C. R.

The Selection of Worm-Gearing. W. A. Tuplin (*Mech. World*, 1932, **92**, 248–250).—The advantages of employing reduction gears for the transmission of power from high-speed electric motors are discussed, as well as the materials used, choice of types, and main features of worm-gearing. The working surface of the worm-thread must be very hard to resist wear and very smooth to reduce friction. Experience has shown that the best material is case-hardened steel with a nickel content of about 3½%, which gives a hard-wearing surface in conjunction with high core-strength. The wheel must be made of phosphor-bronze, centrifugally-cast to improve density and resistance to crushing, and must be produced under strict metallurgical control, since the load-capacity of the bronze is extraordinarily sensitive to slight variations in composition or casting conditions.—F. J.

The Vatican Coinage. Anon. (*Rev. Nickel*, 1931, 2, 87).—The recent new coinage—none has previously been issued for more than 60 years—consists of the following denominations—100 lires in gold, 5 and 10 lires in silver, 2 and 1 lires, and 50 and 20 centesimi in pure nickel, 10 and 5 centesimi in bronze. Some of the pieces are illustrated.—W. A. C. N.

Recent Trends in Alloy Steels. Richard Tull (*Blast-Fur. and Steel Plant*, 1932, **20**, 422–424).—A review of properties conferred on steels by the addition of other metals, such as chromium, nickel, and manganese. Cromansil steel, which contains chromium, manganese, and silicon, is referred to in particular. —R. Gr.

Applying Metallic Decorations on Glass and Pottery Ware. Roessler & Hasslacher Chemical Co. (*Ceram. Ind.*, 1932, 18, 170–173; *Ceram. Abs.*, 1932, **11**, 287).—For affixing metal to glass, glaze, or enamel, two general methods are in use: (1) actual deposition of the metallic coating on the ware, as in electrodeposition or precipitation (this method is now of small importance in decoration), and (2) the firing method by which the powdered metal is fixed to the ware. A discussion is given of these preparations and the general methods of applying or fixing them to ceramic ware.—S. G.

Metallic Mirrors. Anon. (*Met. Ind.* (*Lond.*), 1932, 41, 330).—Short note on the manufacture of parabolic mirrors by depositing metal on to glass formers or moulds.—J. H. W.

Manufacture and Use of Powdered Metals. Charles Hardy (*Metal Progress*, 1932, **22**, (1), 32–37, 80; also (reprint) *Met. Ind.* (*Lond.*), 1932, **41**, 345–347, and (summary) *Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 127–128).—Methods for powdering metal are outlined. A recent application for powdered metal is its consolidation under pressure into useful shapes; rough-surfaced particles, of the type normally obtained by electrolysis, are most suitable for this, and a high degree of purity is necessary for proper incorporation. Electrolysis is found to be the cheapest method of production. The carefully graded deposits may be used in the production of alloys which, owing to differences in melting-point, cannot be made in the ordinary way. The degree of pressure and the size of the particles determine the strength of the finished product. Powdered metal is much used for "capillary lubrication" of oil-less bearings. It can also be treated after being sprayed or painted on other surfaces. The main advantages of its use are controlled porosity and grain-size, high purity, constant composition, small loss in manufacture; saving of raw material, and the possibility of producing alloys from constituents with widely different melting points, or from metals and non-metals. Heat-treatment is cheap, but must be carefully controlled. An important limitation of the method is in respect of size; dies and plungers require most accurate fitting.—P. M. C. R.

Powder Metallurgy. Charles Hardy (*Met. Ind.* (*N.Y.*), 1932, **30**, 179–180). —The production of articles from powdered metals or metal mixtures by pressing and sintering below the melting-point is briefly outlined.—A. R. P.

Powdered Metals by Electrolytic Methods. J. Rossmann (*Met. Ind.* (*N.Y.*), 1932, **30**, 321–322, 396–397, 436, 468–469).—A lengthy review of the patent literature.—A. R. P.

Metallization of Wood Opens New Uses. M. Naphtali (*Chem. and Met. Eng.*, 1932, 39, 269).—This process makes it possible to open the microscopic pores of the wood and, through them, to fill the individual cells with molten metal, whilst retaining the original form of the cells. Thus the finished product is a wooden structure each of the cells of which has an isolated charge of metal. The wood is first dried and then immersed in molten metal, *e.g.* tin, lead, or alloys, and then subjected to moderate pressure in a closed vessel. Impregnation can be confined to the surface or continued to the interior. A considerable increase in sp. gr. occurs, as well as in hardness and compressive strength. The material resists moisture, it being possible to prevent swelling or warping in moist atmosphere or water. It also resists prolonged intense heating, and only when the metal has flowed from the surface does the wood begin to glow like charcoal. The workability of the material is similar to that of wood.—F. J.

Cathode Sputtering—A Commercial Application. Hal. F. Fruth (*Bell System Tech. J.*, 1932, **11**, 283–292; and (lengthy abstract) *Met. Ind.* (*N.Y.*), 1932, **30**, 428–431).—Reprinted from *Physics*, 1932, **2**, 280. See this *J.*, 1932, **50**, 694.—S. V. W.

Cathode Sputtering. F. H. Newman (*Phil. Mag.*, 1932, [vii], **14**, 1047–1049).—A more rugged mirror results if the glass to be " mirrored " is heated before introduction into the sputtering chamber, which is preferably made of quartz. A suitable form of sputtering chamber and the necessary technique are described.—J. S. G. T.

Photo-Electric Cells Having Cathodes in the Form of Thin Deposits of Alkali Metals. Rudolf Sewig (*Z. Physik*, 1932, **76**, 91–105).—It is shown that the photosensitivity of photo-electric cells having cathodes of alkali metals can be increased considerably by the use of diffusion cathodes of the kind described by Asaa and Suzuki, but using nickel, tungsten, or tantalum as intermediate metal in place of the gold or silver used by A. and S.—J. S. G. T.

Photo-Electric Cells and Their Application. H. R. Ruff (*Proc. Rugby Eng. Soc.*, 1930–31, **25**, 40–69).—An account is given of the discovery, early development, and modern and possible future applications of the photo-electric effect. The metals most suitable to the construction of photo-electric cells are enumerated, and their relative emissions normal and selective, are considered. The effects of the high vapour pressure of cæsium, originally the cause of electrical leakage between electrodes, can be obviated by methods of cathode manufacture by which only a very thin film of alkali metal is retained on the cathode. The gas-filled cell and the Thyratron valve are described.—P. M. C. R.

XXII.—MISCELLANEOUS

(Continued from p. 220.)

The Installation and Organization of a Modern Metallurgical Laboratory. Pierre Chevenard (*Mem. et compt. rend. Soc. Ing. civils France*, 1932, **9**, 1109–1158).—Describes the general progress of research, the installation and organization of the laboratories, and the methods of testing as carried out at Imphy (France), with special reference to dilatometric measurements and thermo-magnetic analysis of ferrous alloys and alloys of nickel and chromium, giving typical results. Future prospects in the matter of metallurgical research are discussed.—J. H. W.

Science and Technique in the U.S.S.R. [P.] Rosbaud (*Metallwirtschaft*, 1933, **12**, 3–5).—The scientific and technical laboratories, especially those concerned with metals, in Soviet Russia, the scientists working in them, and their sphere of work are enumerated.—v. G.

Sealing Porous Castings. Anon. (*Eng. and Mining J.*, 1933, **134**, 172).—A note on the use of a special sealing liquid, made by the Bakelite Corporation, which is forced into the weak section of the casting at a pressure of 250 lb./in.^{2}. This is followed by baking for 1–2 hrs. at 275°–300° F. (135°–149° C.). The treatment may be applied to castings made from aluminium, nickel, silver, brass, bronze, and similar materials. When properly treated, the solution cannot be melted or dissolved. It is unaffected by cold water, steam, and by temperatures up to 400° F. (204° C.), and is resistant to most chemical reagents.—R. Gr.

The Metal Industries. A Symposium on Their Record in 1932 and Prospects for 1933. —— (*Met. Ind.* (*N.Y.*), 1933, **31**, 5–14).—Reviews of the year 1932. *Copper* (Anon.), p. 5. *Zinc* by A. E. Mervine, pp. 5–6. *Tin* by C. E. Mantell, p. 6. *Lead* by F. E. Wormser, pp. 6–7. *Aluminium* by S. K. Colby, pp. 7–8. *Nickel and Its Alloys* by Robert C. Stanley, pp. 8–9. *The Precious Metals*, by G. H. Niemeyer, p. 10. *Secondary Metals* by T. A. Wright, p. 10. *The Brass Foundry* by H. M. St. John, p. 11. *The Brass Rolling Mill* by William J. Pettis, pp. 11–12. *Jewelry Making* by C. M. Hoke, p. 12. *Plating and Finishing* by A. K. Graham, pp. 13–14.—A. R. P.

The Output of Work in the Metallurgical Industries of Great Britain. F. Magri (*Metallurgia Italiana*, 1932, **24**, 654–655).—A discussion of statistical data with the object of obtaining an exact estimate of the output.—G. G.

The Heavy Non-Ferrous Metals in Italy. L. Cambi (*Giorn. Chim. Ind. Appl.*, 1932, **14**, 341–348).—Recent extensions and developments in the Italian non-ferrous metal industry are broadly discussed.—G. G.

The Metal Manufacturing and Finishing Industries of the United States. Adolph Bregman (*Met. Ind.* (*N.Y.*), 1933, **31**, 1–4, 51–53).—Data on the uses of copper, zinc, lead, silver, aluminium, and tin in the U.S.A. are tabulated.
—A. R. P.

A Bird's-Eye View of the [Canadian] Metal-Working Industry. Anon. (*Canad. Mach.*, 1932, **43**, (11), 47–71).—After the presentation of a general survey, for the years 1923–1930 inclusive, the industry is considered under 13 primary classifications, which receive detailed analysis. With the exception of 1924, the years 1923–1929 have shown a continuous expansion in all branches; the non-ferrous metal group leading with a 90·3% increase. The depression of 1930–1931 affected the respective sections to a varying degree, the regression being least in the case of electrical apparatus and supplies.—P. R.

Self-Ignition of Metals. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 230–231).—Some examples of spontaneous combustion of metal turnings and dust are briefly discussed.—A. R. P.

Receiving and Classifying Sheet Iron, Cast Iron, and the Principal Non-Ferrous Metals. Gérard de Smet (*Aciers spéciaux*, 1932, **7**, 182–190).—The principal points to be considered in specifications of industrial metals and alloys are: (1) micro-examination and chemical analysis, (2) physical tests, (3) macro-examination, (4) classification, (5) method of manufacture, (6) tolerances and number of tests, (7) appearance of product, (8) reasons for rejection. These points are discussed in the cases of copper and copper alloys, light alloys, antifriction alloys, zinc, tin, and lead.—J. H. W.

Variable Pressure Regulated to Prevent Rebound of Molten Metal During Casting [of Dental Plates]. Raymond E. Myers (*J. Dental Research*, 1932, **12**, 327–338; and *Brit. J. Dental Sci.—Prosthetic Section*, 1932, **77**, 216–223, 240–245).—Causes of failure in casting dental plates are discussed and a machine for casting plates under gradually increasing pressure is described; this procedure is shown to eliminate failures caused by rebound of the metal from the base of the sprue and partial or complete blockage of the sprue by freezing.
—A. R. P.

The Aluminium Industry. L. Manfredini (*Alluminio*, 1932, **1**, 213–236).

—A review, in which are discussed: the present status of the world's aluminium industry; the principal producers, their production and capacity; the Haglund process for making alumina; recent theories on the electrolysis of alumina, and recent progress and improvements in this branch; Hoope's method for obtaining very pure aluminium; anodic oxidation as applied to aluminium and its alloys; synthetic view on the output and the consumption of aluminium in the world and in Italy, with special regard to the problem of making aluminium from leucite and to the danger of over-production. It is concluded that the present Italian organization is ample as regards actual consumption, and is more than sufficient, for many years, to face the present and future demands of domestic and foreign markets.—G. G.

The Aluminium Industry of the World. Anon. (*Met. Ind.* (*N.Y.*), 1933, **31**, 18–19).—A classified list of the world's producers of aluminium and aluminium products with output statistics.—A. R. P.

The German Metal [Aluminium]. Anon. (*Oberflachentechnik*, 1933, **10**, 5).—A review of the aluminium industry in Germany.—A. R. P.

Standard Terms in the Aluminium Industry. F. H. (*Aluminium Broadcast*, 1932, **3**, (28); and *Light Metals Research*, 1932, **2**, (7), 2 pp.).—A list of terms in English, German, and French, standardized by collaboration between leading aluminium producers, describing crude and semi-manufactured products.—J. C. C.

Bauxite and Aluminium. V. Charrin (*Industrie chimique*, 1932, **19**, 646–650).—Discusses the history of aluminium, its manufacture from bauxite, statistics of production, and applications.—E. S. H.

The Research Laboratories of the Aluminium Industrie, A.G., Menhausen. A. von Zeerleder (*Alluminio*, 1932, **1**, 377–387).—An illustrated article.—G. G.

Beryllium Metal from the Oxide. G. D. Fitzpatrick (*Chem. Trade J.*, 1932, **90**, 403).—Some tests on the aluminothermic production of beryllium metal are briefly described. The reaction between aluminium and beryllia cannot be started in the usual way with a fuse but proceeds to completion if the mixture is strongly heated although the metal remains disseminated as fine prills throughout the slag. A mixture of beryllia, aluminium, and barium peroxide can be fired readily with a fuse and if sodium fluoberyllate or fluoaluminate is added as a flux a button of beryllium–aluminium alloy containing 60–83% beryllium can be obtained; the yield of beryllium metal is however equivalent to only 25–40% of the oxide used.—A. R. P.

Cadmium. Anon. (*Mineral Ind.*, 1932, **40**, 597–599).—Statistical.—E. S. H.

Copper. Percy E. Barbour (*Mineral Ind.*, 1932, **40**, 114–144).—A discussion of statistics and economics.—E. S. H.

The Metallurgy of Copper in 1931. Carle R. Hayward (*Mineral Ind.*, 1932, **40**, 152–172).—An outstanding feature is the production in commercial quantities of oxygen-free copper of high conductivity. This has been achieved by the United States Metal Co., not by the use of a deoxidizer, but by keeping the product free from oxygen throughout the whole process. The cathodes are melted in an electric furnace and the copper is protected from oxidation during melting and casting. Annealing in hydrogen has only a slight effect on this copper, indicating that bright-annealing in reducing gases is possible with this product, although not with ordinary copper. The ductility of oxygen-free copper as hard-drawn and soft-annealed wire, respectively, is 80% and 88%, as compared with 55% and 76% for ordinary electrolytic copper. A large amount of literature published during 1931 is reviewed. The main fields of work discussed are: properties (including the effects of impurities on copper), roasting, smelting and smelting plants, refining, leaching, cupola melting of brass, use of high-frequency furnace in melting bronze, alloys of the copper–titanium and copper–silver series, thermal conductivity of copper alloys, effects of strain and heat-treatment.—E. S. H.

Descaling Copper Surfaces. A. P. Harrison (*Chem. and Met. Eng.*, 1932, **39**, 455–466).—It is customary in certain industries to cool tanks of liquid by means of evaporation of films of water running down the sides of the vessels. A film of scale of considerable thickness is deposited on the sides of the tanks, largely mitigating the cooling effects. The deposit, apparently consisting mainly of iron oxide, is difficult to remove. Saturated ammonium chloride solution, however, poured over the scale, while the tank is steaming hot will penetrate it and loosen it, facilitating its removal by means of a strong jet of water.—F. J.

Surface-Hardening Copper. Walter J. May (*Mech. World*, 1932, **91**, 254).—Occasionally it is required to harden the surface of copper articles without affecting the general body of the metal, and if the metal is not thick this is not difficult. This is done by rubbing tin into the surface, heated to 750° C., until a regular degree of alloying is secured. Surplus tin must be wiped off with a wad of tow. Depth of penetration depends on the duration of heating. —F. J.

Copper and Brass Industry in Greece Use Hand Labour. Anon. (*Daily Metal Reporter*, 1932, **32**, (206), 6).—A short account of the copper and brass products industry in Greece. About 500 tons of imported copper sheet and 1000 tons of brass, much of which is old metal purchased locally, are used each year. Apart from the use of small electric motors for certain processes, hand labour is employed throughout; the product is considered superior to imported machine-made pieces.—P. M. C. R.

On the Copper Age in Ancient China.—I. Tsurumatsu Dōno (*Bull. Chem. Soc. Japan*, 1932, **7**, 347–352).—[In English.] Analysis of three ancient Chinese spear heads showed them to consist mainly of copper with a certain quantity of lead and practically no tin. The date of manufacture of these implements is prior to that of the oldest known Chinese bronze materials, hence it is believed that the Copper Age preceded the Bronze Age in China. —E. S. H.

On the Copper Age in Ancient China. II.—On the Transitional Period Between the Copper and Bronze Age in Ancient China. Tsurumatsu Dōno (*Bull. Chem. Soc. Japan*, 1933, **8**, 133–136).—[In English.] Analysis of an ancient spear head showed it to contain copper 88·85, lead 5·85, and tin 2·19%. It thus appears to be intermediate in composition between those of the Copper and Bronze Ages.—E. S. H.

Excavations in Persia Yield Remarkable Collection of Bronze Objects. Anon. (*Bull. Copper Brass Res. Assoc.*, 1932, (73), 12).—The Luristan bronzes, dating from 1000 to 200 B.C., and consisting of objects of personal adornment, tools, household utensils, weapons, chariot fittings and horse trappings, acquired by the Museum of Fine Arts, Boston, are illustrated.—J. S. G. T.

Gold and Silver. H. N. Lawrie (*Mineral Ind.*, 1932, **40**, 185–257).—Mainly statistics and economics. A brief description of the more important advances in the hydrometallurgy, pyrometallurgy, and amalgamation of gold and silver is given. Recent literature on alloys of gold is reviewed.—E. S. H.

Porosity of Cast Gold [for Dentistry] and Other Defects. Anon. (*Brit. J. Dental Sci., Prosthetic Section*, 1932, **77**, 202–203).—Porosity in dental castings may be due to insufficient feeding, the use of insufficient casting pressure (a pressure of 10–15 lb./in.^{2} is recommended), or the incomplete removal of carbon residue from the mould. To secure ample feeding, a reservoir of molten metal should be provided by attaching to the sprue a ball of wax somewhat thicker than the thickest part of the casting.—J. C. C.

One-Piece [Dental] Casting Technique. Anon. (*Brit. J. Dental Sci., Prosthetic Section*, 1930, **75**, 27–32, 51–57).—A detailed illustrated account of the method of making one-piece gold-alloy castings of bridge or partial dentures, using a centrifugal or an air-pressure casting machine.—J. C. C.

Efficient Pig-Lead Stacker. Anon. (*Eng. and Min. J.*, 1933, **134**, 23).—Illustrates a pig-lead hoist capable of stacking 3 loads of 35 pigs in one pile. —R. Gr.

Lead. R. M. Santmyers (*Mineral Ind.*, 1932, **40**, 321–350).—Mainly statistics of production and consumption. The report includes a reprint on "Metallurgy of Lead in 1931" from the Editorial summary in *Min. and Met.*, 1932, Jan.—E. S. H.

A Note on the Prevalence of Lead Poisoning in India. R. H. Candy (*Indian Med. Gaz.*, 1933, **68**, 136–137; *C. Abs.*, 1933, **27**, 2505).—Plumbism is by no means uncommon in India. The principal source of the intoxication is the habit of "tinning" vessels, the metal being frequently adulterated with lead.—S. G.

Manganese. Chas. H. Behre, Jr. (*Mineral Ind.*, 1932, **40**, 360–371).—Mainly statistical. No important development in the technology of manganese production or in the uses of the metal occurred during 1931.—E. S. H.

My Impressions of Development of Scientific Research in the Nickel Industry in America. Masawo Kamo (*Japan Nickel Rev.*, 1933, **1**, 10–16).—[In English and Japanese.]—S. G.

Nickel–Iron Sponge Produced at Sudbury. Anon. (*Blast-Fur. and Steel Plant*, 1932, **20**, 647); **Nickel–Iron Sponge Made Direct from Ore by New Process.** Anon. (*Compressed Air Mag.*, 1932, **37**, 3853).—A note on the news that nickel–iron sponge has been produced by a direct process from Sudbury ore. The production figures of nickel of the various producing countries are given for 1930.—R. Gr.

Rhenium. Anon. (*Mineral Ind.*, 1932, **40**, 600).—Rhenium is being produced in kilogram quantities by the Vereinigte Chemische Fabrik, Leopoldshall.—E. S. H.

The Technical Recovery of Rhenium and Gallium. Anon. (*Metallbörse*, 1932, **22**, 690–691).—The recovery of these metals from certain residues obtained in working the Mansfield copper schist is described. Rhenium is leached out as potassium perrhenate from the product obtained by a low-temperature roasting of residues containing molybdenum sulphide; the perrhenate is reduced to metal by hydrogen in the presence of sodium chloride. Gallium is recovered from residues rich in aluminium phosphate; about 60 kg. per annum are obtained from this source at a cost of M.10 per grm. The metal has been used for thermometers for use up to 1000° C. and for making non-poisonous dental amalgams.—A. R. P.

Tin. E. Baliol Scott (*Mineral Ind.*, 1932, **40**, 526–545).—Discusses the economic position during 1931, particularly the formation of the International Tin Pool and the system of compulsory restriction of production. The consumption of primary tin in U.S.A. during 1927, 1928, and 1930 is listed under the various consuming industries. No new uses are reported.—E. S. H.

Special Possibilities of Arsine Poisoning [in Tin Refining]. —— Nuck and —— Jaffe (*Arch. Gewerbepath. Gewerbehyg.*, 1932, **3**, 496–508; *C. Abs.*, 1932, **26**, 5520).—Cites cases of arsine poisoning which were caused by fumes given off during tin refining.—S. G.

The Osram Museum. Anon. (*Automobiltech. Z.*, 1932, **35**, 257–258).—An account of the Osram Museum, Berlin. Here are demonstrated the development, manufacture, applications, and testing of the modern electric glow-lamp. —P. M. C. R.

The Metallurgy and Uses of Zinc. Stanley Robson (*Met. Ind.* (*Lond.*), 1933, **42**, 369–372, 421–424, 475–478).—Address to the London Local Section of the Institute of Metals. Early methods of production of zinc and the manufacture of zinc alloys are described. Details are given of the modern Belgian practice of extraction, including descriptions of the English, Belgian, Silesian, Horizontal, and Rhenish distillation furnaces, and the refractories used in the construction of the retorts. The production of refined zinc by electrolysis, by blast-furnace melting, and by electrolysis of the fused chloride are discussed. The economic aspects of the metal are reviewed, and its applications as protection against corrosion and its use in alloys are described. —J. H. W.

Zinc in 1932. Julian D. Conover (*Met. Ind.* (*N.Y.*), 1933, **31**, 54).—A brief review.—A. R. P.

Zinc. S. D. Strauss (*Mineral Ind.*, 1932, **40**, 566–590).—Statistical and economical.—E. S. H.

Metallurgy of Zinc in 1931. W. R. Ingalls (*Mineral Ind.*, 1932, **40**, 591–593).—No important innovations are reported, but improvements in distilling practice are described briefly.—E. S. H.

American and Canadian Producers of Electrothermic and Electrochemical Products. Anon. (*Electrochem. Soc. Preprint*, **1933**, May, 39–44).—A classified list of the names and addresses of producers of various metals, alloys, and chemical and refractory products produced by electrochemical and electrothermic methods.—A. R. P.

New Materials Laboratory at Berkeley. Anon (*Eng. News-Record*, 1932, **109**, 284–286).—A description of the layout and equipment of the new Engineering Materials Laboratory of the University of California.—J. C. C.

Standard Samples : General Information. Anon. (*U.S. Bur. Stand. Circ.*, No. **398**, 1932, 1–11).—An account of the function, selection, preparation, and uses of standard samples, with ordering and shipping regulations.—P. M. C. R.

Research in the U.S.A. Anon. (*Aircraft Eng.*, **1932**, (38), 104).—Work done by the [U.S.] National Advisory Committee for Aeronautics is reviewed. Under the heading " Structural Materials " reference is made to research on high-frequency fatigue testing of metals, to the study of the fatigue limit/ultimate tensile strength ratio of light alloys, to protection of aluminium against corrosion, to light alloys for use at elevated temperatures, and to stainless steels.—H. S.

Chemical Refrigeration. Influence of Freon on Non-Ferrous Metals. Anon. (*Met. Ind.* (*Lond.*), 1932, **41**, 83–84).—An abstract from an article in the *Manchester Guardian Commercial*, **1932**, July 9, describing the use of a new refrigerant called Freon, consisting of dichloro-difluoro-methane (CCl_2F_2), and its action on non-ferrous metals.—J. H. W.

The Story of Early Metallurgy. IX.—The Bronze Age in Europe (contd.). R. T. Rolfe (*Met. Ind.* (*Lond.*), 1932, **41**, 123–126).—Discussion of the significance of bell-beakers, the origin of European metal working, the chronology of the Bronze Age in Europe, and the connection between the bronze industries in various parts of the Continent.—J. H. W.

The Story of Early Metallurgy. X.—Irish Gold. R. T. Rolfe (*Met. Ind.* (*Lond.*), 1932, **41**, 341–344).—An account of the occurrence of gold in Ireland in early times and of the mining of the metal in Wicklow in the eighteenth and nineteenth centuries.—J. H. W.

Early Babylonian Jewelry. Sidney Smith (*Brass World*, 1932, **28**, 115–116).—An account of metal work known to have been made in Babylon as early as 3500–2500 B.C. and of the early use of cloisonné and *cire perdue* casting is given.—J. H. W.

Exploiting Ideas. Zay Jeffries (*Gas Age-Record*, 1931, **68**, 909–910, 914). —Industrial uses of gas, temperature control of furnaces, bimetallism, and international trade are amongst the topics briefly discussed. The development of cemented tungsten carbide cutting tools has rendered many machine tools obsolete.—J. S. G. T.

Some Properties of Pure Silicon. R. L. Templin (*Metals and Alloys*, 1932, **3**, 136–137, 150).—Analysis of the purest available silicon showed the presence of 0·29% iron, 0·15% aluminium, 0·05% chromium, 0·05% titanium, 0·02%

manganese, and 0·01% copper, vanadium, and magnesium. Spectroscopic traces of beryllium, calcium, silver, lithium, lead, and sodium were also found. Compression tests were made on a specimen roughly 1 × 1 × 3½ in. made by grinding a casting to shape; the breaking load is 13,470 lb./in.^{2} and Young's modulus (assuming the value in compression is the same as the value in tension) 16,350,000 lb./in.^{2}. The material breaks up into large fragments on failure by compression. The Rockwell C hardness exceeds 105. Photographs of the structure of cast rods are included.—A. R. P.

High-Temperature Products of Silicon. Frank J. Tone (*Indust. and Eng. Chem.*, 1931, **23**, 1312–1316).—The properties of silicon carbide are discussed and the accidental discovery of the manner in which silicon could be produced in the silicon carbide furnace is described.—F. J.

Some of the Newer Uses of Silicon Carbide. Charles McMullen (*Met. Ind.* (*Lond.*), 1931, **39**, 35–36).—Abstract of paper read before the Electrochemical Society. See this *J.*, 1932, **50**, 279.—J. H. W.

Definition of Bimetal. Anon. (*Metallwirtschaft*, 1932, **11**, 452).—Recommendations of the Deutsche Gesellschaft für Metallkunde for a uniform use of the terms bimetal, doublé, electroplated, galvanized, and leonic (*leonisches*) material.—v. G.

Some Aspects of the Selection of Engineering Materials. L. B. Hunt (*Found. Trade J.*, 1932, **47**, 384–385, 397–398; and (abstract) *Met. Ind.* (*Lond.*), 1933, **42**, 97–100, 129–131).—Read at a joint meeting of the London Sections of the Institute of Metals and the Institute of British Foundrymen. The following points were discussed: the tendencies in engineering practice; interpretation of test results; the mechanism of failure in metals; cohesion and slip; methods of slip-resistance (grain-refinement by modification: roughening the slip-planes by adding a second metal which enters into solid solution: the presence of a second phase); the action of phosphorus in cast iron; the basis for the selection of material; the function of chemical analysis; correlation with microstructure; significance of mechanical tests; value of elongation figures; notched-bar test, and fatigue testing.—J. H. W.

Discussion on L. B. Hunt's Paper on Some Aspects of the Selection of Engineering Materials. C. H. Kain. H. J. Gough. J. Cartland. S. L. Archbutt. A. J. Murphy. —— Curzon. H. G. Summerfield. W. C. Devereux. L. B. Hunt (*Found. Trade J.*, 1933, **48**, 25–26, 161, 168).—Cf. preceding abstract. C. H. K. suggested that engineers should specify material which could be readily cast or forged into a perfectly sound part. H. J. G. doubted the applicability of the true cohesive force as determined by the force required to break atoms apart; queried the statement that the Izod was not a shock test, and commented on the abuse of the Stanton test. J. C. asked for means of specifying the microstructure, and remarked that 2 materials each with zero elongation might give very different angles of twist. S. L. A. commented on the grain-refinement in the modification of silicon–aluminium alloys; A. J. M. discussed creep values and H. G. S. asked for a ratio between "experimental value" and "service value." W. C. D. questioned the great value of elongation tests and stressed the connection between grain-size and elongation, considered that the impact test was a shock test and thought that the repeated impact test was of considerable value. L. B. H. replied.—J. H. W.

Recent Developments in Engineering Materials. T. H. Turner (*J. Inst. Production Eng.*, 1931, **9**, 248–262).—An address. Non-ferrous materials discussed include zinc, tin, and aluminium alloy die-castings, magnesium and aluminium casting alloys, and aluminium–brass condenser tubes.—J. C. C.

An Engineer's Conception of Matter and Its Application to Materials of Construction. E. W. Stedman (*J. Roy. Aero. Soc.*, 1932, **36**, 861–882).—A memorandum intended to give those engineers who have not the time or opportunity to study the latest books, a working idea of the trend of modern investigations. The physics of the atom, the liquid, gaseous, and solid states, the crystalline structure of metals, conductivity, solid solutions, metallic compounds, hardening of metals, and heat-treatment of light alloys and steels are treated briefly.—H. S.

Some Phases of the History of Chemical Engineering. Walter L. Badger (*J. Eng. Education*, 1932, 22, 691–707).—An historical survey of chemical engineering methods from early times. The successive use of copper, stoneware, wood, lead, and iron as piping materials, the development of pump design and construction, and the growth of heating and evaporating plant are traced, with illustrative plates.—P. M. C. R.

Researches on Buckling. Edmond Marcotte (*Science et Industrie*, 1932, 16, 313–319).—The danger of buckling, formerly guarded against by the introduction of high factors of safety into the empirical formulæ common in structural work, is greatly increased in the case of the complex stresses occurring in such members as machine or aeroplane parts. After a brief discussion of certain cases, and of experimental methods of study, an analogy is traced between the inception of buckling and the "natural" elastic limit (the point at which Lüder's lines make their appearance). A preliminary series of tests on models, designed to supplement and check results obtained by calculation, is outlined, and the necessity of much more such work is emphasized.—P. R.

Stresses in a Plate with Two Holes, and the Examination of Cognate Problems. Seinen Yokota (*J. Fac. Eng. Tokyo Imp. Univ.*, 1932, 20, 101–113).—[In English.] A mathematical treatment.—E. S. H.

The British Association Standards of Electrical Resistance, 1862–1932. Anon. (*Nature*, 1932, 130, 600–601).—An historical review. Standard resistance coils of platinum made in 1865 preserve their original value unchanged at the present day, whilst all the coils made of alloys have changed.—E. S. H.

Experiments to Decrease the Limit of the Temperatures Obtained. W. H. Keesom (*Proc. K. Akad. Wet. Amsterdam*, 1932, 35, 136–143).—[In English.] A temperature of 0·71° abs. is reached in a volume of 5 c.c. by exhausting the vapours from liquid helium. The lowest pressure obtained above the liquid helium was 0·0033 mm. A vessel is described in which liquid helium can be transported from the liquefier to an apparatus.—E. S. H.

On a Method for Correcting for Incomplete Thermal Isolation in Measurements of Small Heat Capacities. W. H. Keesom and J. A. Kok (*Proc. K. Akad. Wet. Amsterdam*, 1932, 35, 294–300).—[In English.] A method is worked out for correcting for heat exchange with the surroundings when measuring very small heat capacities after Nernst and Eucken's method under conditions such that thermal isolation is incomplete.—E. S. H.

Graphical Method for Converting Atomic Per Cent. into Weight Per Cent. Arne Olander (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1932, 4, 438).—The method depends on Menelaos' theorem that if a line from a point O outside a triangle ABC on the extension of one of the sides BA intercepts the other two sides, CA in D and CB in E, then $(OA\cdot BE\cdot CD)/(OB\cdot CE\cdot DA) = 1$. If OA is the atomic wt. of A, OB that of B, AD the weight % of A, and CD that of B, then BE is the atomic-% of A and CE the atomic-% of B.—A. R. P.

Dust Collection by Electrostatic Precipitation. Anon. (*Mech. World*, 1932, 92, 39–40).—Electrostatic precipitation provides a method of cleaning industrial gases to a degree of fineness which is difficult to obtain by other methods, such as filtering or scrubbing. The process is described and illustrated and a number of applications, including metallurgical ones, are enumerated.—F. J.

XXIII.—BIBLIOGRAPHY

(Publications marked * may be consulted in the Library.)

(Continued from pp. 420–425.)

***Chemical Markets, Inc.** Chemical Guide Book, 1933. Ninth edition. 4 × 9 in. Pp. 600. 1933. New York: Chemical Markets, Inc., 25 Spruce Street. ($2.00.)

***Ewing, [Sir] Alfred.** *An Engineer's Outlook.* Cr. 8vo. Pp. xxiv + 333, with portrait and 5 illustrations. 1933. London: Methuen and Co., Ltd. (8*s.* 6*d.* net.)

***Guillet, Léon.** *Les Méthodes d'étude des Alliages métalliques.* Deuxième édition. Roy. 8vo. Pp. xv + 859, with 998 illustrations. 1933. Paris: Dunod. (Relié, 203 francs; broché, 192 francs.)

***Heraeus Vacuumschmelze A.G.** *Heraeus-Vacuumschmelze, Hanau am Main,* 1923–1933. Demy 8vo. Pp. iv + 434, with numerous illustrations. 1933. Hanau: G. M. Albertis.

[Contains the following: W. Rohn: "Die Entwicklung der Heraeus-Vacuumschmelze A.-G. 1923–1933"; O. Buddenberg, F. Duftschmid, u. L. Schlecht: "Reines Carbonyleisen als hochpermeabler magnetischer Werkstoff"; L. Dede: "Normal- und Präzisions-Gewichte aus Molybdän-Chromnickel"; L. Dede: "Ein Elektrodenmaterial für Funkenspektroskopische Zwecke"; K. L. Dreyer u. G. Tammann: "Die Erholung der elastischen Spannungen, verglichen mit der Erholung anderer Eigenschaften"; E. Englert u. W. Gerlach: "Über die transversale ferro-magnetische Widerstandsänderung des reinen Nickels"; H. Gruber u. W. Rohn: "Die Reduktion von Chrom aus Chromoxyd durch Gase"; H. Gruber: "Darstellung kohlefreier Chromlegierungen aus kohlehaltigem Ferrochrom"; A. Grunert: "Kriechgrenze und Kriechgeschwindigkeit"; A. Grunert, W. Hessenbruch, u. K. Ruf: "Widerstandslegierung für Temperaturen bis 1300°"; H. Hagemann u. H. Hiemenz: "Über den Einfluss der Banddicke, der Glühatmosphäre und mitgeglühter Zwischenisolation auf die Anfangs- und Maximal-Permeabilität von gewickelten Bandkernen aus Nickel-Eisen-Legierungen"; W. Hessenbruch: "Vakuumgeschmolzene Beryllium-Legierungen"; W. Hessenbruch u. E. Horst: "Über den Widerstand säurebeständiger und vergütbarer Chromnickel-Legierungen gegen interkristalline Korrosion"; W. Hessenbruch u. W. Rohn: "Hochwertige Chromnickel-Legierungen und deren Lebensdauerprüfung"; H. Ipavic: "Über schwefelbeständige Legierungen"; H. Ipavic: "Zwei analytische Spezialmethoden"; A. Kussmann, B. Scharnow, u. W. Steinhaus: "Über das Permalloy Problem"; G. Masing u. W. Pocher: "Entwicklung eines technischen Giessverfahrens für Beryllium-Kupfer-Legierungen"; H. J. Reusch u. H. V. Wartenberg: "Schmelzpunktsdiagramme hochfeuerfester Oxyde mit Kalk"; W. Rohn: "Induktionsofen für Drehstrom von Netzfrequenz"; W. Rohn: "Walzwerke mit dünnsten Arbeitswalzen"; K. Ruf: "Spulmaschinen mit konstanter Zugspannung"; K. Ruf: "Mehrfachdrahtziehmaschinen aus Einzelmotoren"; R. Straumann: "Über Legierungen für Federn mit kleinem Temperaturkoeffizienten des Elastizitätsmoduls"; A. Thum: "Der Einfluss der Korrosion auf die Dauerfestigkeit von Chromnickel-Legierungen."]

***Noddack, Ida und Walter.** *Das Rhenium.* Roy. 8vo. Pp. viii + 86, with 7 illustrations in the text. 1933. Leipzig: Leopold Voss. (R.M. 7.80.)

***Rhodes, J. E. Wynfield.** *Phase Rule Studies. An Introduction to the Phase Theory.* With an introduction by E. L. Rhead. Cr. 8vo. Pp. x + 131, with 58 illustrations. 1933. London: Oxford University Press (Humphrey Milford). (6*s.*)

***Schiel, Karl.** *Die Formsande und Formstoffe. Vorkommen, Eigenschaften, Aufbereitung und Prüfung.* (Die Betriebspraxis der Eisen-, Stahl- und Metallgiesserei. Eine Sammlung von Einzelabhandlungen aus dem Gebiete praktischer Giessereitechnik. Herausgegeben von Hubert Hermanns. Heft 18.) Med. 8vo. Pp. viii + 155, with 87 illustrations. 1933. Halle (Saale): Wilhelm Knapp. (Br., R.M. 8.80; geb., R.M. 10.)

XXIV.—BOOK REVIEWS

(Continued from pp. 426–432.)

Elementary Metallurgy for Engineers. By G. F. C. Gordon. Pp. ix + 156, 25 illustrations. 1932. London: Constable & Company, Ltd. (8*s.* 6*d.*)

In this short volume of 156 pages an attempt is made to present in simple language a general outline of the subject of engineering metallurgy in elementary form. The book is intended, primarily, for the young engineer, but the young metallurgist might also read it with advantage, as well as all those interested in the metallurgical side of engineering. In dealing with an important subject in an elementary manner, difficulty is sometimes experienced in summarizing the subject sufficiently without detracting from its value. The author, however, has met this difficulty in a very practical form, and has produced a book in which few essential details are omitted.

The chapter on the testing of materials is brief, but, at the same time, contains sufficient information, particularly on the question of fatigue, to induce the new reader to seek for further information, and the same remarks apply to the chapters on the production of structural steels and forgings. Special attention is devoted to the thermal changes in metals, a knowledge of which is so essential to the beginner, and which are dealt with as fully as space will allow.

In the chapter on metallography and macrography more space might have been given with advantage to the various macrographic methods of examination. Non-ferrous metals are considered briefly yet very concisely in a special chapter. The metals and alloys dealt with include copper, aluminium, brasses, bronzes, aluminium alloys, cupro-nickel alloys, and white metals, and a brief reference is also made to methods of protection such as galvanizing, metallization, enamelling, and the use of aluminium paint.

The final chapter deals with the selection of materials, and sufficient is said in it to show how important a knowledge of metallurgy is to all those engaged in the engineering industry. The book is illustrated by a number of photographs showing various structures in metals and various types of failures.—J. W. Donaldson.

Overstrain of Metals and Its Application to the Auto-Frettage Process of Cylinder and Gun Construction. By A. E. Macrae. Med. 8vo. Pp. ix + 378, with 246 illustrations. 1930. London: H.M. Stationery Office. (21*s.* net + postage.)

In many engineering designs the permissible working stress is obtained by dividing the ultimate tensile strength of the material by a factor of safety which experience has shown to be appropriate to the particular working conditions of the constructional material, and despite the large number of investigatory tests which have been carried out, the factor of safety, in many cases, is still a factor of ignorance. Accordingly, it is pleasing to find that in the auto-frettage process of the manufacture of guns, design is based on the results of experimental work on the stress-strain characteristics of the materials used, and that the factor of ignorance is practically eliminated. A full description of this achievement is now available in Major Macrae's book. The intending reader should understand, however, that the book is almost entirely concerned with auto-frettage of thick cylinders and related problems, and cannot pretend to be a treatise on the general subject of overstraining of all kinds of ferrous and non-ferrous metals.

The earlier chapters of the book give in considerable detail the results of tests in which the breakdown and restoration of the elastic properties of certain steels and other metals have been examined. It is of interest to note that Dalby optical recorders and testing machines were used in this work, and that interesting results of the effects of low-temperature treatments on steels are recorded. Equations for the stress-strain relationships in thick cylinders and for cylinders subjected to auto-frettage (internal pressure producing residual stresses) are then developed; but it must be remarked that the mathematical treatment is rather elementary and diffuse, although the detailed numerical illustrations are probably useful. The apparatus used in auto-frettage is then described, followed by detailed calculations, manufacturing methods, and tests on monobloc guns and built-up cylinders.

The book is not a " readable " book, and its arrangement is such that it is not very convenient for reference purposes, but it should prove very valuable to those engaged in the design of thick cylinders, and it also places on record a large amount of accurate data on stress-strain relationships beyond the elastic range which should find useful application in other directions.—G. A. Hankins.

Definitions and Formulæ for Students (Metallurgy). Compiled by E. R. Taylor. Pp. iv + 44. 1932. London: Sir Isaac Pitman & Sons, Ltd. (6*d.* net.)

The object of this little book is to provide students and those engaged in the business side of the metal trades with definitions of the terms used by metallurgists. The terms are arranged alphabetically in six sections, covering respectively: general metallurgy, pyrometry, iron and steel, foundry-work, fuels and refractories, formulæ and tests. Taken as a whole, the definitions given are terse and to the point, but in some instances a certain degree of vagueness is apparent, *e.g.* coring, cupellation, electron, creep, and in others the definition given is not sufficiently accurate, *e.g.* gold bullion, white gold, gas pyrometer. In two places it is stated that British silver coinage contains 925/1000 of silver. Nevertheless, the book should prove sufficiently informative to those for whom it was written.—A. R. POWELL.

Die Elektrometrische (Potentiometrische) Massanalyse. Von Erich Müller. Fünfte, verbesserte und vermehrte Auflage. Med. 8vo. Pp. xx + 276, with 92 illustrations. 1932. Dresden und Leipzig: Theodor Steinkopf. (Geh., R.M. 14.50; geb., R.M. 16.)

In the seven years which have elapsed since the fourth edition of this book appeared considerable advances have been made in the field of potentiometric analysis, both in its scope and in its technique, and Dr. Müller and his collaborators have been among the foremost workers in these developments. In preparing this edition, the author has taken the opportunity of rewriting a considerable portion of the book, in order to incorporate the most important and useful of these improvements. The practical part has been rearranged in a systematic way based on a scientific classification of the reactions involved. The new book provides a thorough grounding in the theoretical principles of potentiometric analysis and in its practical applications, and should therefore be of great value to advanced students as well as to practising analysts. No general index of the usual type is included, but there is a table of contents followed by tables showing the various determinations and separations included in the book, and an alphabetical index to authors and references. The book is beautifully printed, and the paper and illustrations are a credit to the printers and publishers. The price is very reasonable for this type of book.—A. R. POWELL.

Forschungsarbeiten auf dem Gebiete des Schweissens und Schneidens. Herausgegeben im Auftrage des Deutschen Azetylenvereins von W. Rimarski. (Geschweisste Kunstschmiedearbeiten, Azetylenschweissung im Stahlbau, Zusatzwerkstoffe, Form des Sauerstoffstrahls bei Schneiddüsen, Oberflächenhärtung, Gleichdruckanlagen, Siliziumwasserstoff, Wasserdampfeinfluss auf die Temperatur der Azetylen–Sauerstoff–Flamme, Prüfung explosionssicherer Schmiermittel.) Siebente Folge. Mit Beiträgen von H. Richter, H. Holler, W. Hoffmann, E. Streb, W. Geldbach, M. Maier, H. Malz, und H. v. Conrady, M. Maier und E. Zorn, W. Rimarski und H. Friedrich, W. Rimarski und M. Konschak, H. Jooss, M. Konschak, W. Rimarski und K. Noack, H. Kahle. 4to. Pp. 120, illustrated. 1932. Halle a. S.: Carl Marhold. (Kart, R.M. 4.90.)

This is yet another collection of papers by Dr. Rimarski and his collaborators on all phases of gas-welding technology. There are fourteen papers, of which five will be of interest mainly to the ferrous man, one deals with copper welding, two with the design of blowpipe nozzles, three with plant, and three with welding gases. The papers of most importance from the point of view of the non-ferrous welder have already appeared in the journal *Autogene Metallbearbeitung* and have been abstracted in this *Journal*. They are Geldbach: "The Influence on the Welding of Copper of Small Additions in the Welding Rods" (this *J.*, 1932, **50**, 187); Jooss: "Contribution to the Knowledge of the Temperature of the Oxy-Acetylene Flame, the Effect of Water Vapour in the Acetylene, and the Consequent Effect on Welding" (this *J.*, 1932, **50**, 501); Rimarski and Friedrich: "Procedure for Testing the Safety in Working of Acetylene Equal-Pressure Plant" (this *J.*, 1932, **50**, 699).—H. W. G. HIGNETT.

Handbook of Chemistry and Physics. A Ready Reference Book of Chemical and Physical Data. Edited by Charles D. Hodgman. Seventeenth Edition. Fcap. 8vo. Pp. xiii + 1722. 1932. Cleveland, O.: Chemical Rubber Publishing Co. ($6.00.)

The seventeenth edition of this useful book of reference differs in many points from the previous edition. Among notable alterations are the addition of tables of (i) magnetic susceptibility of both inorganic and organic substances; (ii) refractive index of aqueous solutions of sucrose; (iii) the arrangement of electron orbits; (iv) correction of boiling point to standard pressure; (v) variation of vapour pressure with temperature; and several mathematical tables. The tables of flame and bead tests, oxidation and reduction potentials, cubical expansion of solids, specific heat of gases, specific rotation and wire gauges have been completely revised. The outstanding change, however, in this edition is the revision and extension by more than 1000 compounds, of the table of physical constants of organic compounds. This table gives the name, synonym, formula, molecular weight, crystalline form, colour, specific gravity, melting point, boiling point and solubility in water, alcohol, and ether of more than 4000 organic substances.

The handbook is excellently produced and contains a large quantity of data frequently required by chemists and physicists, whom it will save much weary searching in the literature. It can be warmly recommended to these and to others working in engineering and other branches of pure or applied science.—JAMES F. SPENCER.

Kelly's Directory of the Engineering, Hardware, Metal and Motor Trades (Including the Wireless Industry) Throughout England, Scotland, and Wales. Twentieth Edition. 6½ × 10 in. Pp. lvi + 2661 + 35 + 115. London: Kelly's Directories Ltd. (45*s.* net.)

This Directory should prove invaluable to all connected with or interested in the metal trades. It is designed to give complete lists of those engaged in the trades mentioned in the title of the volume and in various other businesses and occupations allied thereto. Its wide scope is indicated by the fact that merely the index to the trades listed covers no fewer than fourteen pages of closely printed matter. The geographical arrangement of the book is very convenient, as it enables one to turn up the entry of any town in the United Kingdom, and find there the names of local firms and individuals listed according to their trades. Another useful section of the Directory is that containing a comprehensive list—covering 115 pages—of proprietary articles and trade names, with the addresses of the makers.

American Institute of Mining Engineers. *American Institute of Mining Engineers Series: Technical Writing.* By T. A. Rickard. Third edition. Pp. xi + 337. *Choice of Methods of Mining and Metallurgy. A Record of Experience in Making Engineering Decisions.* By Pope Yeatman, Robert E. Tally, F. W. Bradley, E. De Golyer, Howard N. Eavenson, L. D. Ricketts, Arthur L. Walker, W. H. Bassett, Eugene McAuliffe, Newell G. Alford, and A. B. Parsons. Pp. ix + 178. *Mineral Economics. Lectures under the Auspices of the Brookings Institution.* By H. F. Bain, E. C. Eckel, J. R. Finlay, J. W. Frey, J. W. Furness, D. F. Hewett, C. E. Julihn, C. K. Leith, L. Logan, G. F. Loughlin, R. S. McBride, T. T. Read, E. B. Swanson, F. G. Tryon, and F. E. Berquist. Pp. x + 311, with 31 illustrations in the text. *A History of American Mining.* By T. A. Rickard. Pp. xii + 419, with 27 illustrations in the text. *The Examination of Prospects. A Mining Geology.* By C. Godfrey Gunther, revised by Russell C. Fleming. Second edition. Pp. ix + 220, with 65 illustrations in the text. Demy 8vo. 1932. New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd. (five volumes, £3 15*s.* net).

The last four books of this series are of interest only to those concerned in prospecting, mining, and ore dressing although the second book has an interesting chapter on "Learning how to Refine and Cast Copper." They form a most interesting and instructive series for all who intend to follow any of these professions. The first book has already been reviewed in this *Journal*, and this edition is similar to the second in all respects except that several minor errors therein have been rectified. We can thoroughly recommend a purchase of the series to all mining and metallurgical students.—A. R. POWELL.

Bibliography of Bibliographies on Chemistry and Chemical Technology. Second Supplement 1929–1931. Compiled by Clarence J. West and D. D. Berolzheimer. (Bulletin of the National Research Council. Number 86.) Sup. Roy. 8vo. Pp. 150. Washington, D.C.: National Research Council of the National Academy of Sciences. ($1.50.)

This bulletin includes the bibliographies which have been published between 1929 and 1931, as well as some which were omitted from the earlier bulletins Nos. 50 and 71. Quite a number of subject headings are included for the first time. It should prove of great use to those in search of information on published bibliographies on all branches of chemistry and chemical technology, whether these appear in books, journal articles, or encyclopædia articles.

—A. R. POWELL.

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

1933 SEPTEMBER Part 9

I.—PROPERTIES OF METALS

(Continued from pp. 433–435.)

An Investigation of the Electrochemical Properties of Light Metals and their Alloys.—I. Masuo Kawakami (*Kinzoku no Kenkyu*, 1933, **10**, (5), 211–219).—[In Japanese.] This paper deals with the preliminary measurement of the single potentials of aluminium in various solutions with respect to the normal calomel electrode, for the purpose of obtaining information concerning the electromotive behaviour of aluminium.—S. G.

An Allotropic Transformation of Barium in the Solid State. E. Rinck (*Compt. rend.*, 1931, **193**, 1328–1330; *C. Abs.*, 1932, **26**, 1492).—The melting point of pure barium prepared by distillation under argon is 710° ± 2° C. Discontinuities at 375° C. in the cooling curve and in the electrical conductivity indicate transformation into an allotropic form at this temperature.—S. G.

Variation of the Magnetic Properties of Barium with Temperature. [Allotropy of Barium.] C. T. Lane (*Phys. Rev.*, 1933, [ii], **44**, 43–45).—The mass susceptibility of barium has been determined above room temperature, and increases from $+ 0{\cdot}147 \times 10^{-6}$ at 20° C. to $+ 0{\cdot}415 \times 10^{-6}$ at 400° C. The susceptibility-temperature curve shows a break at 350° C., indicating that two modifications exist; this agrees with the work of Rinck (preceding abstract), who found a sharp break in the electrical resistance–temperature curve at 370° C. The existing theory of paramagnetism cannot account for the present curves showing an increase in paramagnetic susceptibility with increasing temperature. Details are given for the preparation of rods of barium free from contamination.—W. H.-R.

The Thermal Expansion of Bismuth Single Crystals. T. L. Ho and A. Goetz (*Phys. Rev.*, 1933, [ii], **43**, 213).—Abstract of a paper read before the American Physical Society. The thermal expansion of bismuth crystals with known admixtures of electronegative and electropositive impurities in small concentrations has been determined between room temperature and the melting point. The decline of the expansion coeff. before the melting point, as reported previously by Roberts and by the authors, could be verified; it was found, furthermore, that admixtures cause definite changes in the thermal expansion at temperatures characteristic for the impurity present, which is interpreted by the influence such admixtures have on the habitus of the mosaic structure of these crystals.—S. G.

Magnetostriction in Bismuth Single Crystals. A. Wolf and A. Goetz (*Phys. Rev.*, 1933, [ii], **43**, 213).—Abstract of a paper read before the American Physical Society. The magnetostriction of bismuth single crystals has been measured in the longitudinal field of a solenoid at approx. 20,000 gauss in two different directions to the principal axis [111] of the crystal. The observations were made in stationary field conditions which renders the experiments isothermal in contradistinction to the adiabatic method of Kapitza. The crystals of pure bismuth gave as moduli of magnetostriction (defined by $\Delta l/l = H^2/2 \times m_s$) $m_{s\parallel} = + 5{\cdot}7 \times 10^{-16}$ and $m_{s\perp} = - 7{\cdot}0 \times 10^{-16}$; *i.e.* the dilatation occurs parallel to [111] and a contraction normal to [111] measured in the direction of the field lines. These values support Kapitza's recent measurements fairly well quantitatively. Furthermore, the influence of foreign atoms embedded in the crystal was checked and the effects found have been compared with the known influences on crystal diamagnetism, For impurities with one valency less than bismuth (lead, tin) a decrease of $m_{,\perp}$ was found which caused the effect to disappear ($m_{,\perp} = 0$) at concentrations of 0·45% for tin and 1·9% for lead. For larger concentrations the effect changes its sign into a dilatation in which finally the values are almost twice as large as the original ones. The atomic influence on the magnetostriction reaches 0 in the neighbourhood of concentrations close to the solubility limit of the admixture in bismuth. Similar but more complex effects were found for $m_{,\parallel}$. Electronegative impurities (tellurium) have influences similar to the previously reported effects of electronegative admixtures on crystal-diamagnetism.—S. G.

An Allotropic Transformation of Calcium in the Solid State. E. Rinck (*Compt. rend.*, 1931, **192**, 421–423; *C. Abs.*, 1931, **25**, 2355).—Heating and cooling curves for calcium exhibit a horizontal portion that reveals a point of transition between two solid forms of calcium. Below 450° C. the stable form is α-calcium; between 450° C. and the melting point at 848° C. the stable form is β-calcium. The curve of electrical resistance *vs.* temperature exhibits a break at 450° C. The change from β- to α-calcium involves contraction in volume. Attempts to retain β-calcium at room temperature by rapid cooling were unsuccessful.—S. G.

Measurement of Contact Potential Differences between Different Faces of Copper Single Crystals. H. E. Farnsworth and B. A. Rose (*Phys. Rev.*, 1933, [ii], **43**, 375).—Abstract of a paper read before the American Physical Society. Measurements on contact potential difference between the (111) and (100) faces of single crystals of copper, as a function of the time of outgassing in a high vacuum, were made by the standard Kelvin null method. Care was first taken to obtain smooth surfaces etched parallel to the desired planes with practically no etching parallel to other planes. Two sets of observations with different experimental tubes show that the (111) face assumes a positive potential with respect to the (100) face. This value increases rapidly from near zero to about 0·4 v. during the first few hours of outgassing at dull red heat, and then more slowly to a limiting value of 0·463 ± 0·002 at 70 hrs. and remains constant to at least 150 hrs. In one case the value decreased by further heating at temperatures which exposed other faces by evaporation. Observations were taken at a pressure of about 10^{-7} mm. mercury as measured on an ionization gauge. Although the present outgassing is not complete, it is more than that required to reduce the surface gas layer to such a thickness that it possesses a definite crystal structure related to that of the underlying copper, as shown by Farnsworth. Hence, the above result should be characteristic of surface gas crystals on copper.—S. G.

Atomic Weight of Lead from Cyrtolite. G. P. Baxter and Chester M. Alter (*Science*, 1932, **76**, 524–525; *C. Abs.*, 1933, **27**, 639).—The lead from thorium-free cyrtolite from Bedford, N.Y., U.S.A., was extracted by hydrofluoric acid and purified by recrystallization of the nitrate and chloride, and by sublimation in hydrochloric acid. A weighed quantity of the fused salt was precipitated with a weighed, nearly equivalent amount of pure silver, and the end-point of the reaction determined nephelometrically by the equal opalescence method. Comparison experiments were carried out with common lead (atomic weight 207·22) and lead from Swedish kolm (atomic weight 206·01). The average atomic weight of lead from cyrtolite was 205·924, indicating the practical absence of common lead, wherefore the lead–uranium ratio may be used for the geological age estimation. The low value is difficult to understand in the light of (1) Aston's value of the isotopic weight of radium-lead, 205·98 ± 0·02, if the factor for converting from the physical to the chemical scale is 1·00022; and (2) the ratio of Pb^{206} to Pb^{207} in pure uranium lead from Katanga, which is 93·3 to 6·7 as found by Aston. The minimum atomic weight to be expected is 206·03.—S. G.

The Solubility of Metallic Lithium in Liquid Ammonia at Low Temperatures. Warren C. Johnson and M. M. Piskur (*J. Physical Chem.*, 1933, **37**, 93–99).—The vapour pressures of solutions of lithium in liquid ammonia have been determined at high lithium concentrations at 0° C., — 32·7° C., — 33·2° C., and — 63·5° C. The results show that the solubility of metallic lithium in liquid ammonia increases appreciably from — 63·5° C. to 0° C.—J. S. G. T.

The Electrochemical Properties of Light Metals and their Alloys.—II. Masuo Kawakami (*Kinzoku no Kenkyu*, 1933, **10**, (5), 220–226).—[In Japanese.] The measurement of the single electrode potential of magnesium is dealt with. The experiments were carried out as in the case of aluminium (see *J.*, this volume, p. 481). The electrode potential of magnesium has been found generally more basic than with aluminium; the former, therefore, has been considered to be more easily corroded than the latter. The results present a general idea of the electrochemical behaviour of magnesium.—S. G.

Empirical Formulæ for the Relation between the Temperature and Pressure of Saturated Vapour. [Vapour Pressure of Mercury.] A. Adamson (*Mem. Proc. Manchester Lit. Phil. Soc.*, 1931–1932, **76**, 1–9).—Empirical formulæ are given connecting the vapour pressures of saturated vapours with the temperature. For mercury between 100° and 420° C., the departure from experimental values of p is less than 0·4%, the pressure ranging from 0·28 to 2120 mm.—W. H.-R.

The Electrocapillary Maximum for a Mercury Electrode in Contact with a Solution containing Mercurous Ions. S. R. Craxford (*Phil. Mag.*, 1933, [vii], **16**, 66–79).—It is shown experimentally that the evidence, derived from two methods of determination, that the potential of the electrolytic null-point for a mercury electrode in contact with mercurous ions is near + 0·5 v., is really without value. The Gibbs method of treatment is inapplicable to the treatment of the polarized inter-phase, which is best discussed by the Lippmann treatment.—J. S. G. T.

The Effect of High Electrostatic Fields on the Vaporization of Molybdenum. G. B. Estabrook (*Phys. Rev.*, 1933, [ii], **43**, 383).—Abstract of a paper read before the American Physical Society. It has been found for wires of varying diameters, that, (1) for field strengths of about $0·52 \times 10^6$ v./cm. or less at the wire surface, there was no change in the rate of change of resistance with time and hence in the rate of vaporization on application of the field; (2) for field strengths above approx. $0·52 \times 10^6$ v./cm., as successively higher fields were applied, the rate of vaporization first decreased slowly, then more rapidly, and finally asymptotically toward zero at field strength over $1·8 \times 10^6$ v./cm.; (3) with increasing temperatures, the same field strength applied at the surface of a wire produced progressively smaller decreases in the rate of vaporization; (4) when there was an effect on the rate of vaporization, sudden increases in resistance occurred when the field was applied, and sudden decreases when it was removed. A decrease in vaporization rates was found for platinum, along with a sudden increase in resistance on applying the field, and a sudden decrease when the field was removed. Worthing has reported similar results for tungsten except that the sudden increases and decreases were opposite to those of platinum and molybdenum.—S. G.

The Temperature Dependence of Young's Modulus for Nickel. Jerrold Zacharias (*Phys. Rev.*, 1933, [ii], **44**, 116–122).—A method is described for the measurement of Young's modulus. The metal in the form of a rod is cemented to a rod of quartz so as to form a composite piezo-electric oscillator by means of which the fundamental frequency of free longitudinal vibration of the rod can be determined, and is simply related to the Young's modulus. The moduli have been determined between 30° and 400° C. for single crystals of purified nickel containing 0·11% molybdenum, and for polycrystalline commercial nickel annealed at various temperatures. With commercial nickel annealed at 900° or 1100° C. and then slowly cooled, the modulus first decreases with increasing temperature to form a minimum between 150° and 200° C., increases to a maximum at the Curie point, and then decreases linearly with temperature. A similar behaviour was noted for the single crystal slowly cooled from 1450° C. For commercial specimens heated to 700° C. and slowly cooled, and for all specimens quenched from 1100° C., the maxima and minima are absent, and the moduli diminish with increasing temperature, the curves showing changes in direction at the Curie points. The bearing of these results on the internal friction is discussed. [*Note by Abstractor.*—The synopsis refers to experiments on hard-drawn specimens, but these are apparently those heated to 700° C. and slowly cooled.]—W. H.-R.

The Contamination of Nickel Crystals Grown in a Molybdenum Resistance Furnace. Andrew Dingwall, Jerrold Zacharias, and Sidney L. Siegel (*Electrochem. Soc. Preprint*, **1933**, Sept., 395–400).—When high-purity nickel was melted in an alundum crucible in a molybdenum wire-wound resistance furnace, the metal absorbed 0·1% of molybdenum. This contamination was avoided by surrounding the crucible with a gas-tight porcelain tube, but this led to contamination of the nickel by silicon, although to only a relatively small extent. These results show that before making physical measurements it is necessary carefully to test purified metals after melting and working to ascertain whether they have taken up any impurities.—A. R. P.

Diffusion of Hydrogen through Palladium. Effect of Pressure, Temperature, and the State of Purity of the Metal. Victor Lombard and Charles Eichner (*Compt. rend.*, 1933, **196**, 1998–1999).—Measurements of diffusion were made with thin plates of commercial palladium after prolonged heating at about 500° C. in a current of hydrogen. The rate of diffusion of hydrogen from a region of pressure P to a region of vacuum was given, for various values of P up to atm. pressure, by $D = KP^{0 \cdot 56}$ with plates 0·097 and 0·099 mm. thick, but with a plate 1·027 mm. thick and at 490°–570° and 617° C., the equation became $D = KP^{0 \cdot 5}$. In the case where the second region was under pressure P, the equation was $D = K(P^{0 \cdot 5} - p^{0 \cdot 5})$. For various temperatures between 350° and 850° C. the most satisfactory equation for the "specific diffusion" was found to be $D_{SN} = 20 \cdot 73 T^{\frac{1}{2}} e^{\frac{2022}{T}}$ (cm.³, hr., cm.², mm. thickness). The permeability of palladium is considerably affected by the purity of the metal.—J. H. W.

X-Ray Scattering Power of Metallic Silver for K_α Copper Radiation. Ludwik Chrobak (*Z. Krist.*, 1933, **84**, 475–477).—[In English.] Using particles of silver having a diam. of 0·001 mm., absolute intensities of the reflections have been obtained, and the F-values have been calculated therefrom.—E. S. H.

Revision of the Atomic Weight of Tellurium. Analysis of Tellurium Tetrabromide. O. Hönigschmid, R. Sachtleben, and K. Wintersberger (*Z. anorg. Chem.*, 1933, **212**, 242–256).—The analysis gave a value of 127·61 for tellurium.—M. H.

The Extension of Tin Crystals. J. Obinata and E. Schmid (*Z. Physik*, 1933, **82**, 224–234).—Investigations of the extension of crystals of white tin confirm previous results relating to the two most important translatory systems, *viz.* $t = [001]$; $T = \{100\}$ or $\{110\}$. Which kind of translation occurs depends on the orientation of the tension. Translation characterized by $t = [101]$; $T = \{101\}$ occurs occasionally. Values of the critical thrust corresponding with these different systems of translation are all of about the same order of magnitude. With increasing slip, the thrust corresponding with both principal systems of translation increases only very slightly. Increase of temperature is characterized by a very small decrease of the critical thrust. The observations do not afford any evidence of the existence of a high transformation temperature in the case of white tin.—J. S. G. T.

The Measurement of the Viscosity of a Molten Metal [Tin] by Means of an Oscillating Disc. Vaughan H. Stott (*Proc. Phys. Soc.*, 1933, **45**, 530–544).—Observations of the logarithmic decrement of an alumina disc supported by a phosphor-bronze wire and executing torsional vibrations in molten tin are employed to determine the viscosity of tin at temperatures between 240° and 800° C. The following values of the viscosity (measured in poises) were found at the respective temperatures stated (° C.); 240°, 0·0191; 260°, 0·0182; 280°, 0·0174; 300°, 0·0167; 320°, 0·0160; 340°, 0·0154; 360°, 0·0148; 380°, 0·0143; 400°, 0·0138; 420°, 0·0133; 440°, 0·0129; 460°, 0·0125; 480°, 0·0122; 500°, 0·0118; 520°, 0·0115; 540°, 0·01125; 560°, 0·0110; 580°, 0·0107; 600°, 0·0105; 620°, 0·01025; 640°, 0·1005; 660°, 0·00985; 680°, 0·00965; 700°, 0·00945; 720°, 0·0093; 740°, 0·00915; 760°, 0·0090; 780°, 0·00885; 800°, 0·0087. Discontinuity in the viscosity–temperature curve of molten tin at temperatures near its freezing point is very improbable, and certainly does not occur at temperatures more than 6° C. above that point. The method of the oscillating disc is satisfactory, but it is desirable to verify the measurements of Sauerwald and his co-workers by the capillary tube method in order that full reliance may be placed on values of the viscosities of metals used for calibrating the apparatus.
—J. S. G. T.

On the Dissolution of Metallic Tungsten by Ammoniacal Cupric Hydroxide Solution. Theodor Millner (*Z. anorg. Chem.*, 1933, **212**, 284–288).—Tungsten powder dissolves in ammoniacal cupric hydroxide solution yielding ammonium tungstate.—M. H.

[Determination of] the Thermal Expansion of Zinc by the X-Ray Method. E. A. Owen and John Iball (*Phil. Mag.*, 1933, [vii], **16**, 479–488).—The crystal parameter of zinc has been measured at temperatures between 20° and 400° C. The crystal structure remains close-packed hexagonal throughout, indicating that no allotropic modification of zinc exists up to 400° C. The following values of the mean linear coeff. of expansion of zinc, perpendicular to ($\perp$) and parallel to ($\parallel$) the hexagonal axis and mean volume coeff. of expansion were deduced for the respective temperature ranges: 20°–250° C., ($\perp$) $1{\cdot}5 \times 10^{-5}$; ($\parallel$) $5{\cdot}3 \times 10^{-5}$; $7{\cdot}2 \times 10^{-5}$; 20°–350° C., ($\perp$) $1{\cdot}7 \times 10^{-5}$; ($\parallel$) $5{\cdot}5 \times 10^{-5}$; $8{\cdot}2 \times 10^{-5}$; 20°–400° C., ($\perp$) $1{\cdot}6 \times 10^{-5}$; ($\parallel$) $5{\cdot}9 \times 10^{-5}$; $8{\cdot}9 \times 10^{-5}$.—J. S. G. T.

A Precise Determination of the Thermal Diffusivity of Zinc. Richard H. Frazier (*Phys. Rev.*, 1933, [ii], **43**, 135–136).—Using the method previously described (Frazier, this *J.*, 1932, **50**, 595), the thermal diffusivity of very pure zinc was measured, and gives $k/c = 2{\cdot}832 \pm 0{\cdot}004$ g.-cm.$^{-1}$sec.$^{-1}$, where k is the thermal conductivity, and c the specific heat. (See also following abstract).—W. H.-R.

Purity of Zinc for which Thermal Diffusivity Recently was Reported. R. H. Frazier (*Phys. Rev.*, 1933, [ii], 43, 762).—A note. Details of the analysis of the zinc used in F.'s work on thermal diffusivity (preceding abstract).
—W. H.-R.

Report of Committee B-2 [of A.S.T.M.] on Non-Ferrous Metals and Alloys. William Campbell and E. E. Thum (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–5).—Mainly very brief summaries of the various sections of work under review by the sub-committees. The following requirements for special high-grade zinc are recommended for adoption: It shall not contain more than 0·010% lead, 0·005% iron, or 0·005% cadmium, and shall be free from aluminium. The sum of lead, iron, and cadmium shall not exceed 0·010%. The addition of lead to certain tin-base bearing alloys improves their physical properties. Various alterations in the electrolytic methods for determining copper and lead, mainly in the voltage to be employed, are noted.—W. A. C. N.

Report of Joint Committee [of A.S.T.M. and A.S.M.E.] on Effect of Temperature on the Properties of Metals. Progress Report to Sponsor Societies. H. J. French and N. L. Mochel (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–4).—Reports are made on the progress of the following investigations: Test for short-time high-tension measurements on metallic materials and test for long-time (creep) high-temperature tension measurements of metallic materials.—W. A. C. N.

Phenomena Occurring in the Melting of Metals. W. L. Webster (*Proc. Roy. Soc.*, 1933, [A], **140**, 653–660).—Experiments designed to investigate factors affecting the disappearance of crystallization nuclei in bismuth, cadmium, lead, or tin when a melt is heated above the conventional melting point are described. In bismuth, lead, and tin persisting nuclei remain when the solid is melted. In tin these nuclei are easily destroyed and are usually not re-formed until a definite degree of under-cooling is effected. In bismuth and lead the nuclei are apparently only very slowly destroyed as the melt is superheated, and to each stage of their destruction there corresponds a characteristic degree of under-cooling at which what remains of the nuclei recovers the power to act as a centre of crystallization. The nuclei exhibit a temperature hysteresis effect. An apparent lowering of the temperature of solidification of bismuth occurs in capillary tubes.—J. S. G. T.

Surface Tension of Molten Metals. A. I. Krynitsky (*Metals and Alloys*, 1933, **4**, 79–84).—A correlated abstract of recent work, especially on copper–tin, bismuth–tin, cadmium–antimony, zinc–antimony, lead–antimony, and aluminium–copper alloys and on many of the common base metals of low melting point. The importance of surface tension data for studying soldering and brazing problems is emphasized, methods of determining surface tension at high temperatures are discussed, and a plea is made for further work on the free-flowing properties of metals and alloys.—A. R. P.

On the Effect of High Electrostatic Fields on the Vaporization of Metals. A. G. Worthing (*Phys. Rev.*, 1933, [ii], **43**, 383).—Abstract of a paper read before the American Physical Society. Work with tungsten and molybdenum (see Estabrook, *J.*, this volume, p. 483) shows that their vaporization rates may be altered greatly by electrostatic fields. Obviously there may be involved either the recapture by the external field of material vaporized presumably as dipoles, the actual prevention of vaporization, or both. Recapture of material vaporized as atoms on the dipole assumption alone fails because of the huge polarizabilities required. Recapture of material vaporized as large aggregations of atoms fails because the effect actually becomes appreciable only at fields of the order of a million volts/cm., though the prevention of vaporization is almost complete at fields 3 or 4 times this value. Production of electrostatically oriented surface layers of dipoles with consequent strengthening of the external field, similar to the strengthening of an external magnetic field by ferromagnetic material, with consequent recapture of vaporized metals fails quantitatively. The foregoing seems to exhaust possibilities of classical explanations of this effect. Further consideration is being given on the basis of quantum mechanics.
—S. G.

Heat Content of Some Metals [Copper, Platinum, Brasses] and Slag Forming Constituents at Temperatures up to 1200° C. Hans Esser, Robert Averdick and Walter Grass (*Arch. Eisenhüttenwesen*, 1932–1933, **6**, 289–292; and (abstract) *Stahl u. Eisen*, 1933, **53**, 80).—The heat contents of copper up to 1250° C., platinum up to 1100° C., and various nickel–brasses and brasses, quartz, alumina, lime, and manganous oxide up to 1250° C. have been determined in a metal block vacuum calorimeter.—J. W.

Gases in Metals. V. H. Gottschalk and R. S. Dean (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 43).—A brief summary and discussion of a paper read before the American Institute of Mining and Metallurgical Engineers. See this *J.*, 1932, **50**, 470.—R. G.

On the Theory of Frictional Oxidation. Max Fink and Ulrich Hofmann (*Arch. Eisenhüttenwesen*, 1932–1933, **6**, 161–164; and (abstract) *Stahl u. Eisen*, 1932, **52**, 1026).—See *J.*, this volume, p. 340.—J. W.

Fatigue of Metallic Materials. Paul Ludwik (*Forschungen u. Fortschritte*, 1933, **9**, 274).—A review of recent work. Under twisting and bending stresses below the yield-point the increase in endurance strength is approximately proportional to the applied stress both in the case of polished, and of notched or corroded, specimens.—J. W.

The Magnetic Analysis of Internal Strains.—II. M. Kersten (*Z. Physik*, 1933, **82**, 723–728).—The change of remanence effected in certain ferromagnetic materials by tension or pressure, in accordance with Becker's theory, is used to deduce the value of the mean specific stresses in such materials. The values, so derived, in the case of plastically stretched nickel wire, agree with those deduced from values of initial permeability and the reversible work of magnetization.—J. S. G. T.

Phase Boundary Potentials of Adsorbed Films on Metals. I.—The Behaviour of Oxygen on Gold. II.—The Behaviour of Iodine on Platinum. III.—The Examination of the Interaction of Copper and Iodine Vapour by the Method of Surface Potentials. I and III.—Harold Kenneth Whalley and Eric Keightley Rideal. II.—Lewis Jacobs and Harold Kenneth Whalley (*Proc. Roy. Soc.*, 1933, [A], **140**, 484–489, 489–496, 497–504).—(I.—) The surface potentials at gold or oxidized gold surfaces in nitrogen are determined. The results show that the potential difference between clean and oxidized gold is 1·56 v. (II.—) The rate of evaporation of iodine from the surface of platinum, on which a film of oxygen is present, is unimolecular in character, and the latent heat of evaporation is dependent on the phase boundary potential which can be altered by oxygen. (III.—) The evaporation of unimolecular layers of iodine from cuprous iodide is unimolecular in character, but the phase boundary potential between copper and iodine is altered by the presence of a layer of cuprous oxide. The phase boundary potential depends both on the thickness and the crystalline state of the cuprous oxide.—J. S. G. T.

The Affinity of Metals for Sulphur. IV.—The Dissociation of the Sulphides of Zinc and Manganese. E. V. Britzke, A. F. Kapustinsky, and B. K. Wesselowsky (*Z. anorg. Chem.*, 1933, **213**, 65–70).—The dissociation pressures of zinc and manganese sulphides and the affinity of zinc and manganese for sulphur between 292° and 727° C. and between 407° and 1100° C., respectively, have been calculated from a study of the equilibria of the reactions between these sulphides and hydrochloric acid.—M. H.

The Affinity of Metals for Sulphur. V.—General Conclusions. E. V. Britzke and A. F. Kapustinsky (*Z. anorg. Chem.*, 1933, **213**, 71–76).—*Inter alia*, the following order of decreasing affinity of metals for sulphur at 1000° abs. is given: zinc, manganese, cobalt, cadmium, copper, nickel, iron, lead, tin, silver, antimony, bismuth.—M. H.

Polish on Metals. R. C. French (*Proc. Roy. Soc.*, 1933, [A], **140**, 637–652).—The structures of polished surfaces of copper, silver, gold, and chromium have been examined by electron diffraction using cathode rays. The results show that highly polished surfaces are almost amorphous, thus confirming Beilby's theory. In some cases the distance between atoms in the polished surface differed appreciably from that in normal crystals. Kirchner's conclusion that polishing consists only in a levelling of the crystalline surface is not supported.—J. S. G. T.

Recrystallization Phenomena in Synthetic Metal Bodies. F. Sauerwald (*Naturwiss.*, 1933, **21**, 467).—A short confirmatory note on the work of W. Trzebiatowski, *J.*, this volume, p. 226.—J. W.

Use of Metals in Firing Processes of Vitreous Enamelware. Clyde E. Williams (*Ceram. Ind.*, 1932, 18, 179–180).—See this *J.*, 1932, **50**, 532.—S. G.

The Thermal and Electrical Conductivities of Several Metals [Iron, Tungsten, Molybdenum, Silver] between – 183° C. and 100° C. W. G. Kannuluik. Appendix: C. E. Eddy and T. H. Oddie (*Proc. Roy. Soc.*, 1933, [A], **141**, 159–168).—An electrical method of determining the thermal and electrical conductivities of a metal wire at temperatures between – 183° and 100° C. is described. The following values of specific resistance, σ, in ohm cm. $\times 10^{-6}$, thermal conductivity, λ, in cal. cm.$^{-1}$ sec.$^{-1}$, ° C.$^{-1}$, and of the Lorentz coeff. $(\lambda\sigma/T) \times 10^{8}$, were found for the respective metals at the temperatures (° C.) stated: iron, 100°, 15·49, —, —; 0°, 9·57, 0·1688, 2·47; – 78·50°, 5·74, 0·1710, 2·11; – 183·00°, 1·531, 0·224, 1·60; tungsten (single crystal, rectangular section), 100°, 7·35, 0·389, 3·20; 0°, 4·98, 0·399, 3·04; – 78·50°, 3·22, 0·405, 2·80; – 183·00°, 0·892, 0·461, 1·91; tungsten (single crystal, hexagonal section), 100°, 7·29, 0·390, 3·19; 0°, 4·94, 0·405, 3·06; – 78·50°, 3·17, 0·425, 2·90; – 183·00°, 0·843, 0·511, 2·00; molybdenum, 217·96°, 10·05, —, —; 100°, 7·56, 0·329, 2·79; 0°, 5·17, 0·329, 2·61; – 78·50°, 3·33, 0·329, 2·35; – 183·00°, 0·882, 0·430, 1·76; silver, 217·96°, 2·863, —, —; 100°, 2·123, 0·998, 2·37; 0°, 1·510, 0·999, 2·31; – 78·50°, 1·035, 1·005, 2·24; – 183·00°, 0·341, 1·018, 1·62. The iron was presumably of purity 99·88%; the other metals were extremely pure. A method of determining their purity, by the method of "raies ultimes," is given as an Appendix by *C. E. Eddy* and *T. H. Oddie*.—J. S. G. T.

Elementary Theory of Electronic Semi-Conductors, and Some of their Possible Properties. R. H. Fowler (*Proc. Roy. Soc.*, 1933, [A], **140**, 505–522).—Wilson's theory of semi-conductors is simplified and applied to models representing substances (1) of very small conductivity, (2) with impurities supplying excitable electrons, and (3) with impurities absorbing excited electrons. The equilibrium state, thermionic and photo-electric work functions, contact potential, conductivity, Hall coeff., and thermo-electric power are derived for these models, using as standard of comparison, where necessary, an ideal metal. The occurrence of abnormal signs for the Hall coeff. and thermo-electric power is accounted for.—J. S. G. T.

The Demonstration of Eddy Currents in Conductors of Various Shapes. D. Brown (*Proc. Phys. Soc.*, 1933, **45**, 555–558).—A simple method is described for demonstrating visually the existence of eddy currents in conductors and of showing how the lines of flow of these currents are distorted by slots or laminations. Essentially, the method comprises laying a sheet of opal glass sprinkled with iron filings on the conductor arranged in the magnetic field of a vertical a.c. electromagnet.—J. S. G. T.

New Method of Measuring Electric and Magnetic Properties of Metals in the Region of Ultra-Short Electromagnetic Waves. G. Potapenko and R. Sanger (*Phys. Rev.*, 1933, [ii], **43**, 210–211).—Abstract of a paper read before the American Physical Society. In a Lecher system, which consists of two parallel wires and two connecting bridges, the distance between the bridges in the case of resonance does not correspond exactly to the half wave-length. It is always shorter than the half wave-length, the difference being called bridge contraction (Brückenverkürzung) by Drude. Its value depends on the reflecting power of the bridges used and this is affected by the self-induction of the bridges (Drude's theory) and by the resistance of the bridges (exact theory). A plate, the size of which is at least of the order of half of the wave-length, is used as one bridge (the plate bridge, perfectly reflecting). The other bridge consists of wires of different materials and of different diameters (the wire-bridge, poor reflection). Resonance studies make it possible to measure the bridge contraction and the damping of the Lecher system for all kinds of wire used. A theory of the propagation of the waves along the wires of a Lecher system, taking into account the perceptible resistance of the bridge, is developed. This makes it possible to calculate the value of the resistance of the wire-bridge from the measurement of the bridge contraction and of the damping of the Lecher system. Hence, taking into account the skin-effect and comparing the results for non-magnetic bridges with those for magnetic bridges, or the results for bridges of different diameters, the electrical conductivity and the magnetic susceptibility of the metals of the wire-bridges can be evaluated. The proposed method is checked by preliminary measurements on copper and iron bridges by the use of undamped waves in the region of wave-lengths from 10 to 100 cm.—S. G.

On a Possible Explanation of Superconductivity. J. Frenkel (*Phys. Rev.*, 1933, [ii], **43**, 907–912).—Theoretical. Previous theories have neglected the electromagnetic inductive forces between the electrons in a metal, and F. shows that, when these are taken into account, an explanation of superconductivity is possible. The picture presented somewhat resembles that of the Lindemann electron-lattice theory; the electrons at very low temperatures move collectively as an organized crowd, and remain undisturbed by the heat motion of the crystal lattice. The transition temperature is the point at which the organized state is destroyed, and the effect of a magnetic field is in general agreement with this point of view.—W. H.-R.

Change of the Resistance of Metals in a Magnetic Field at Low Temperatures. W. J. de Haas and P. M. van Alphen (*Proc. K. Akad. Wet. Amsterdam*, 1933, **36**, 253–262).—[In English.] Experiments with alloys of copper–zinc, cadmium–mercury, titanium–zirconium, and with pure aluminium and impure cadmium are described. In general, a marked change of resistance goes with high diamagnetism. Impurities have a greater influence at low, than at high, temperatures.—E. S. H.

Magnetic Properties of Metals at Low Temperatures. W. J. de Haas and P. M. van Alphen (*Proc. K. Akad. Wet. Amsterdam*, 1933, **36**, 263–270).—[In English.] Data are recorded for graphite, copper, zinc, copper–tin alloy (30 : 70), silver, cadmium, tin, antimony, tellurium, iodine, tungsten, gold, lead, thallium, magnesium, niobium, molybdenum, bismuth, and a copper–tin alloy (Cu_3Sn) at temperatures down to 14·2° K.—E. S. H.

Electromotive Forces Associated with Barkhausen Discontinuities. C. W. Heaps (*Phys. Rev.*, 1933, [ii], **43**, 945).—A note. H.'s previous conclusion (*J.*, this volume, p. 342) that discontinuities of resistance are associated with the Barkhausen effect are shown to be untenable, because intrinsic impulsive e.m.f.s are produced in the wire by the Barkhausen discontinuities themselves, and are large enough to mask any effect caused by change of resistance. Indirect evidence that the Barkhausen effect is accompanied by change in resistance is discussed.—W. H.-R.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 435–440.)

The Fatigue Properties of Light Metals and Alloys. R. L. Templin (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–17).—A discussion of various types of fatigue tests suitable for light metals and alloys. A number of machines used for these tests is described. Included in the latter are a direct tension–compression fatigue apparatus and also a high-speed vibrating wire type. Fatigue data for the majority of the important aluminium alloys in both the wrought and cast states, and also for a number of magnesium base alloys are given. The relation between the endurance limit and tensile strength and the effects of cold-working and heat-treatment on the former are discussed. As the elongation is reduced by cold-working notches also were found, to become more deleterious in their effects on the fatigue strength. The effect of grain-size on the endurance limit is problematical. The necessity for carrying out the tests to a sufficiently large number of cycles is stressed. The number of cycles of stress required to define the endurance limits of most light alloys is of the order of 500 million.—W. A. C. N.

High-Temperature Tests of Hiduminium. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 667).—A short note. At temperatures up to 300° C., Hiduminium shows better tensile and hardness properties than "Y" alloys of similar density.—J. H. W.

Hydronalium, a New Light Alloy. Anon. (*Automobiltech. Z.*, 1933, **36**, 269).—Hydronalium, an aluminium-base alloy of sp. gr. 2·63–2·59, is stated to possess exceptional resistance to corrosion, combined with the following mechanical properties: *As cast:* tensile strength 10·8–16·5 tons/in.^{2}, elongation 3–12%; *As forged:* tensile strength 22–28 tons/in.^{2}, elongation 22–12%, Brinell hardness 75–95. In contact with alkaline solutions or sea-water, these properties show less deterioration after 48 days' exposure than those of pure aluminium or of Duralumin. Possible applications are enumerated, and some directions for heat-treatment, riveting, and welding are given.—P. M. C. R.

Bondur and Albondur. Anon. (*Z. Flugtechnik u. Motor.*, 1933, **24**, 209–210).—A summary of Leaflet No. 15 (Dec. 1932) published by the Vereinigte Leichtmetall-Werke, Bonn, describing the physical, mechanical, and anti-corrosive properties of Bondur and its development Albondur.—P. M. C. R.

Bordur and Albondur. Anon. (*Maschinenkonstrukteur*, 1933, **66**, 91–92).—Bondur is described as an age-hardening alloy of the Duralumin class; the best mechanical properties are obtained by quenching from 500° C. and storing for 5 or 6 days; this period is required to complete the ageing process, which proceeds rapidly for 8 hrs. and then slows considerably. For certain purposes appropriate modifications of the treatment are suggested. Brinell hardness, tensile strength, yield-point, and elongation are shown graphically in relation to quenching temperature; graphs also show the relation of strength and elongation to temperature and to ageing period. For sea-water exposure, a plated Bondur has been developed; the coating may be of aluminium or of some such resistant alloys as K.S.–Seewasser. The mechanical and physical properties of Bondur are tabulated, with notes as to the modifications necessary in the case of plated material. Both Bondur and Albondur are available as sheet, strip, sections, or tubing.—P. M. C. R.

"Wilmil M"—An Improved Aluminium–Silicon Alloy Suitable for Stressed Parts. Anon. (*Aluminium Broadcast*, 1933, **4**, (9), 15–17).—"Wilmil M" is an aluminium–silicon alloy containing additional alloying elements which impart higher elastic properties and a high fatigue strength. Its principal characteristics are:—

	As Cast.	Tempered.	Fully Heat-treated.
0·1% Proof stress, tons/in.^{2}	4·7	7·0	15·0
Ultimate tensile strength, tons/in.^{2}	10·5 to 12·5	11 to 13	16 to 18
Elongation, % on 2 in.	3·0	0·66	0·5
Fatigue strength, tons/in.^{3}	3·6	3·6	4·86

—J. C. C.

Aluminium–Silicon Alloys.—II. —— Broniewski and —— Smialowski (*Rev. Mét.*, 1932, **29**, 601–604).—Cf. *J.*, this volume, p. 11. Mechanical properties are discussed in relation to modification treatment. Work of other investigators is reviewed briefly. The authors melted their alloys in an electric furnace, obtaining the desired silicon content by means of a 50% silicon alloy. The tensile and impact properties and microstructure of chill-cast bars in alloys containing 0 to 15% silicon were investigated. Treatment of the molten alloys with titanium tetrachloride (equivalent to 0·1% Ti) had little influence on the mechanical properties of the cast alloys, but some refinement of the structure of the eutectic was observed microscopically. Treatment with alkaline salts was much more beneficial.—H. S.

Report of Committee A-10 [of A.S.T.M.] on Iron–Chromium, Iron–Chromium–Nickel and Related Alloys. Jerome Strauss and H. D. Newell (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–2).—Brief details are given of the scope of work of the various sub-committees. It includes classifications of data, chemical analysis, methods of corrosion testing, metallography, welding, and specifications.—W. A. C. N.

Magnetic Properties of Iron–Cobalt–Tungsten Alloys. B. A. Rogers (*Metals and Alloys*, 1933, **4**, 69–73).—Classification of iron–cobalt–tungsten alloys with 10–30% tungsten into 5 groups has been made from the results of determinations which have been made of the changes which occur in the physical and magnetic properties of the alloys during ageing. Group I contains alloys with 0–20% cobalt and 10–30% tungsten; these behave similarly to binary iron–tungsten alloys having the same tungsten content. Group II comprises alloys with 40–20% cobalt and 10–30% tungsten; these alloys show a peculiar fall in the coercive force at a relatively low temperature when the hardness is at a maximum and the density at a minimum and on further heating their electrical conductivity rises very rapidly within a narrow temperature range. Group III comprises alloys with 60–40% cobalt and 30–10% tungsten; they are relatively non-magnetic after quenching, but become equal to the best cobalt magnet-steels after heat-treatment, although in this state they are not nearly so stable as the cobalt steels. Group IV comprises alloys with around 60% cobalt and 20% tungsten; they are inert towards all heat-treatment. Group V comprises alloys with 90–70% cobalt and 10–30% tungsten with relatively little iron; although these alloys are difficult to obtain in a homogeneous condition, they all show a large increase in hardness on ageing accompanied by a rise in the coercive force and electrical conductivity.—A. R. P.

Beryllium–Copper: A Copper Alloy that can be Heat-Treated. Anon. (*Machinery* (*N.Y.*), 1933, **39**, 733).—The principal properties of beryllium–copper containing 2·5% of beryllium are enumerated.—J. C. C.

Copper–Cadmium Alloys. E. A. Owen and Llewelyn Pickup (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 44–45).—A summary and discussion of a paper published in *Proc. Roy. Soc.*, 1933, [A], **139**, 526. See *J.*, this vol., p. 189.—R. G.

Susceptibility and Electrical Conductivity of Cu–Mn Alloys. S. Valentiner and G. Becker (*Z. Physik*, 1933, **82**, 833).—Corrections necessary in the author's previous paper (*ibid.*, 1933, **80**, 735) are given. See *J.*, this vol., p. 234.—J. T.

Tensile Tests Relating to Copper–Nickel Crystals. E. Osswald (*Z. Physik*, 1933, **83**, 55–78).—A method of preparation of single crystals and mixed crystal alloys in a high-frequency electric vacuum furnace is described. The effect of tensile stress on crystal structure and orientation was determined by X-ray methods. Contrary to what was found in the case of nickel, the incidence of slip in single-crystal copper is not characterized by a very definite limiting extension. The curve showing the relation of the limiting extension to the nickel concentration in a series of copper–nickel alloys is complicated, compared with the comparatively simple curve found in the case of the gold–silver alloys. The curve is unsymmetrical, the limiting extension being greater on the nickel side. Nickel appears to be differentiated in this respect from the metals copper, gold, and silver. The slip mechanism characterizing the series of alloys is common to all crystals of the same lattice type hitherto investigated. The phenomenon of change of hardness due to crystallographic slip follows the same laws as those found for the gold–silver series.—J. T.

Melting Points of Some Binary and Ternary Copper-Rich Alloys Containing Phosphorus. W. Earl Lindlief (*Metals and Alloys*, 1933, **4**, 85–88).—The equilibria in the copper–phosphorus system up to 12% phosphorus have been re-determined. The eutectic point is placed at 714° C. and 8·38% phosphorus (Heyn and Bauer, *Z. anorg. Chem.*, 1907, **52**, 129, found 707° C. and 8·27% phosphorus). The liquidus of hypo-eutectic alloys falls regularly in a smooth curve slightly concave to the axis of composition; the sharp downward bend observed by H. and B. at 6·5% phosphorus has not been confirmed, L.'s figure for the liquidus at this point being 50° C. lower than that of H. and B. The liquidus and eutectic arrests of 18 alloys in the copper–phosphorus–silicon system have been determined; the alloys tested contained 90–96% copper, 2–7% phosphorus, and 1–6% silicon. The liquidus slopes uniformly down from the melting points of the copper–silicon alloys as increasing amounts of phosphorus are added, and a eutectic valley extends across the diagram from the binary copper–phosphorus eutectic and consists of a binary mixture of α-copper–phosphorus–silicon solid solution and Cu_3P containing silicon in solid solution. The eutectic temperature is raised from 714° to 725° C. by 1% silicon. The liquidus, eutectic arrests and solid transformation temperatures in 37 copper–zinc–phosphorus alloys with 10–50% zinc and 1–10% phosphorus are shown in a table and a partial ternary diagram; the system contains a ternary eutectic at 32·5% zinc, 6% phosphorus, and 690° C. which consists of α-solid solution, Cu_3P, and a zinc-rich phosphide of undetermined composition. This phosphide has a high melting point, as shown by the rapid rise in the liquidus of alloys containing increasing proportions of it.—A. R. P.

The U.D.M. Bronzes [Nida; Kuprodur; Kurbus; Aeterna VL–22]. Anon. (*Automobiltech. Z.*, 1933, **36**, 166).—Nida-Bronze, a phosphor–bronze containing copper 91–92 and tin 8–9%, is available as drawn tubing. Kuprodur or "Kurbus" (composition not stated) is capable of being worked in the soft condition; subsequent heat-treatment increases the tensile strength to 75 kg./mm.^{2} (46·6 tons/in.^{2}); dimensions can hence be much reduced. Aeterna VL–22 is recommended as a bearing alloy.—P. M. C. R.

The Effect of Sulphur and Iron on the Physical Properties of Cast Red Brass (Cu 85, Sn 5, Zn 5, Pb 5). H. B. Gardner and C. M. Saeger, Jr. (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–11; and (abstract) *Iron Age*, 1933, **132**, 22).—The object has been to collect data to be used in the further simplification of the number of typical compositions of copper-base ingot metals. The sulphur content ranged from 0·025 to 0·10%, and the iron from 0·1 to 0·6%. In the former instance casts were made at five temperatures between 1040° and 1260° C. and in the latter at 1065°, 1150°, and 1230° C. Tensile strength, Brinell hardness, electrical resistivity, and density for melts consisting of virgin metal and of remelted metal were compared. The addition of sulphur has less influence in lowering the physical properties of the alloy containing copper 85, zinc 5, tin 5, and lead 5% than increasing the casting temperature. All physical properties of this alloy, other than electrical resistivity, are improved by the addition of iron. Both sulphur and iron appeared to decrease the viscosity of this alloy at casting temperature, but in both cases the shrinkage remained unchanged.—W. A. C. N.

Relating the Chemical Composition to the Microstructure of a Complex Brass. Wesley Lambert (*Metallurgia*, 1933, **8**, 83–84).—Data are given by which the percentage microstructure of a complex brass of known composition can be determined, within close limits, in the absence of a complementary photomicrograph of a particular alloy. Such data consist of Guillet's "coefficients" for copper and zinc of the various metals contained in a complex alloy, together with the maximum and minimum limiting figures of the zinc content for each of three groups of brasses and their corresponding structures. With such data the composition of a complex brass containing in addition to copper and zinc, aluminium, manganese, iron, tin, silicon, lead, and nickel, is first reduced to a "copper–zinc" composition from which the microstructure is then calculated.—J. W. D.

New Alloys of Lead. Anon. (*South African Engineering*, 1933, **44**, 102).—An account of B.N.F. ternary lead alloys Nos. 1 and 2. See this *J.*, 1932, **50**, 731.—P. M. C. R.

The Hall Effect and some other Physical Constants of Alloys. I.—The Lead–Bismuth Series of Alloys. W. Rheinallt Thomas and E. J. Evans (*Phil. Mag.*, 1933, [vii], **16**, 329–353).—Values of the resistivities at 0° C., the mean temperature coeff. of resistance between 0° and 30° C. and between – 20° and 0° C., the thermo-electric powers, the densities at 16° C., and of the Hall effect in magnetic fields ranging from about 3000 gauss to about 9000 gauss have been determined for a series of 26 alloys ranging from pure lead to pure bismuth. The curves connecting resistivity, temperature coeff. of resistance, thermo-electric power, and density with composition of the alloys have either a well-defined maximum or minimum at a composition depending on the physical property concerned.—J. S. G. T.

The System Iron–Ferrous Sulphide–Manganese Sulphide–Manganese. Rudolf Vogel and Hermann Baur (*Arch. Eisenhüttenwesen*, 1932–1933, **6**, 495–500; and (in abstract), *Stahl u. Eisen*, 1933, **53**, 513).—In the region iron–ferrous sulphide–manganese sulphide–manganese thermal and micrographic investigations on alloys with up to 30% sulphur and 35% manganese have shown that there is a large miscibility gap which closes near the iron corner at 3% sulphur and 6% manganese; at lower temperatures there is a secondary segregation in the iron corner. The sulphur preferentially combines with the manganese and manganese sulphide–iron solid solutions are, in contrast to iron sulphide–iron solid solutions, not brittle, hence their fine distribution around the iron crystallites does not adversely affect the working of the metal.—J. W.

Are Liquid Sodium Amalgams Colloidal? Henry E. Bent (*J. Physical Chem.*, 1933, **37**, 431–435).—Contrary to the conclusion of Paranjpe and Joshi (see this *J.*, 1932, **50**, 663), B. concludes that there is no proof that the properties of pure sodium amalgams are determined by the method of preparation, nor that sodium amalgams are colloidal. The facts (1) that the freezing-point depression of mercury in dilute amalgams is that calculated for an ideal solution; (2) that the lowering of vapour-pressure is that calculated for an ideal solution; (3) that photomicrographs of the solid phases show definite crystalline structure, and (4) that a large amount of heat is liberated during the formation of an amalgam, indicate that the amalgams are true solutions.—J. S. G. T.

Report of Committee B–4 [of A.S.T.M.] on Electrical-Heating, Electrical-Resistance, and Electric-Furnace Alloys. Dean Harvey and F. E. Bash (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–6).—Certain revisions in the accelerated life test for metallic materials used in electrical heating are indicated. Minor alterations in the test for thermo-electric power are also recommended. Further progress in connection with chemical analysis, mechanical tests, wrought and cast alloys for high-temperature use, specifications and thermostatic metals—all in relation to the electrical industry—is reported.—W. A. C. N.

[Illium] A Lasting Alloy for Corrosive Service. Wayne L. Cockrell (*Refiner Natural Gasoline Manuf.*, 1933, **12**, 156–159; *C. Abs.*, 1933, **27**, 3434).—The development, production, properties, and applications of Illium are discussed. It consists of nickel 58·40, chromium 21·80, copper 7·95, molybdenum 3·52, tungsten 2·38, manganese 1·72, silicon 0·70, iron 3·10, and carbon 0·32%. It has a tensile strength of 60,000 lb./in.², a Brinell hardness of 170–200, a coeff. of expansion per degree of 0·0000135, melting point 1300° C., sp. gr., 8·3, specific heat 0·105 cal./degree, electrical resistance 121·9 microhm, and machinability comparable to that of cast steel. In boiling 25% sulphuric acid or 25% nitric acid solution Illium should not lose more than 40 mg./cm.² in 24 hrs. Hot sulphur dioxide gas at 1800° F. (982° C.) has no effect. Wet chlorine atmosphere has no action on the alloy.—S. G.

Illium. Anon. (*Met. Ind.* (*Lond.*), 1933, **43**, 38).—Cf. *J.*, this volume, pp. 125, 301. Illium is an alloy containing nickel 60·5–62·5, chromium 21·0, copper 6·5, molybdenum 4·7–5·0, tungsten 2·0, manganese, silicon, aluminium, and iron each 1·0%, and small quantities of titanium, boron, and carbon. Its chief use is in the production of thermo-elements but it also derives applications from its resistance to nitric acid.—J. H. W.

Properties of the Alloys of Nickel with Tantalum. Eric Therkelsen (*Metals and Alloys*, 1933, **4**, 105–108).—With up to 36% tantalum nickel–tantalum alloys consist of a homogeneous solid solution, the liquidus and solidus falling uniformly from 1453° to 1350° C. with only a narrow gap between them. The liquidus then rises to a flat maximum at 1543° C. and 50·7% tantalum corresponding with Ni_3Ta, and again falls to 1400° C. with 60·7% tantalum, after which it rises sharply to the melting point of tantalum. In the solid state there is a narrow β-field around Ni_3Ta; the α solid solution extends to 41% tantalum at 1350° C., but only to about 36% tantalum at 600° C., so that alloys with 36–41% tantalum are amenable to precipitation-hardening. There is a complex heterogeneous region in the solid state between 60·7 and 77% tantalum; at 1350° C. alloys with 52–75% tantalum undergo a transformation associated with the separation of long white needles from β, followed by decomposition of most of the remaining β with the separation of rounded crystals. Alloys with up to 35% tantalum are malleable and ductile, whereas those with more tantalum are hard and brittle, especially the 60·7% tantalum alloy. The resistivity of the 9% tantalum alloy between 0° and 180° C. is $0{\cdot}262\,(1 + 2 \times 10^{-3}t + 1{\cdot}6 \times 10^{-6}t^2)$ ohms/m.mm.²; the resistance to corrosion of the alloys is good, especially at 12·5 atomic-% tantalum.
—A. R. P.

Platinum–Cadmium Alloys. K. W. Ray (*Proc. Iowa Acad. Sci.*, 1931, **38**, 166; *C. Abs.*, 1933, **27**, 1852).—Platinum-cadmium alloys containing as much as 50% platinum were prepared by heating the two metals together. Solid platinum dissolves in hot molten cadmium to form a series of alloys, which have relatively low melting points. The thermal diagram of a portion of the system was investigated by means of thermal analysis, microscopic study and X-ray examination. Two intermetallic compounds are formed, Pt_2Cd_9 and $PtCd_2$. Pt_2Cd_9 decomposes at 615° C. into cadmium and $PtCd_2$. $PtCd_2$ melts at 725° C. Pt_2Cd_9 and cadmium form a eutectic at 2% cadmium, which melts at 315° C. All platinum–cadmium alloys having more than about 6% platinum are very brittle and are much harder than either platinum or cadmium. Alloys containing as much as 35% platinum are exceedingly brittle and have a hardness nearly equal to that of hardened steel. The alloys are white and dissolve in hydrochloric acid or sulphuric acid to form the corresponding cadmium salts. The platinum is left undissolved as black sponge. The cadmium volatilizes rapidly when attempts are made to form alloys containing more than 50% platinum, and a pasty mass is obtained which cannot be melted except under pressure.—S. G.

[**The Constitution of**] **the Alloys of Platinum with Cobalt.** W. A. Nemilow (*Z. anorg. Chem.*, 1933, **213**, 283–291).—[*Note by Abstractor.*—Concentrations are given in atomic-% platinum.] The liquidus has been determined between 0 and 50%; it has a very flat minimum at 20–30% and 1467° C. The constitution of solid alloys has been studied by microscopic investigations and measurements of Brinell hardness after slow cooling from 900° C. (alloys with 0–92%) and after quenching at 500° C. and 1200° C. (alloys with 0–41%). At 1200° C. a continuous series of solid solutions exists. Between 1200° and 500° C. in alloys with up to about 30%, a transformation of still unknown nature takes place characterized by a breakdown of the large solid solution crystals into very small crystallites. The hardness–concentration curve of the slowly cooled alloys has two maxima at about 12 and 50% and a relative minimum at 20–25%. The existence of platinum-rich solid solutions was confirmed by electrical resistance measurements with alloys between 80 and 100%.—M. H.

Nature of the Solid Solution of Aluminium in Silver. C. S. Barrett (*Metals and Alloys*, 1933, **44**, 63–64, 74).—The lattice parameter of silver is reduced linearly by 0·0012 A. and the density by 0·069% for every 1 atomic-% of aluminium that is present in solid solution; hence it is concluded that the solid solution of aluminium in silver is of the simple substitutional type. —A. R. P.

Equilibrium Diagrams of Binary Alkali Metal Alloys. The Sodium–Potassium Alloys. E. Rinck (*Compt. rend.*, 1933, **197**, 49–51).—Special apparatus which enables the molten alkali metals to be manipulated out of contact with air has been devised and used to construct the sodium–potassium equilibrium diagram. An unstable compound, Na_2K, and a eutectic containing 66 atomic-% of potassium are shown to exist. The reaction resulting in the formation of the compound is never complete, and is shown on the diagram by a horizontal line at — 12·5° C., the solidification temperature of the eutectic. The results obtained with these alloys agree completely with those of van Bleiswijk.—J. H. W.

The Effect of the Addition of Lead on the Hardness of Certain Tin-Base Bearing Alloys at Elevated Temperatures. J. N. Kenyon (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–15; and (abstract) *Iron Age*, 1933, **132**, 22).—For temperatures up to 100° C. the addition of 3–4% lead to 3 tin-base alloys increases their hardness, and even up to the melting point of the tin–lead eutectic (183° C.) there is no appreciable falling off in hardness. Hardness–temperature curves for tin-base alloys are parabolic, and when the values are plotted logarithmically the hardness of these materials at higher temperatures can be reasonably predicted. In the hardness determinations greater accuracy was attained by using a load which did not cause "cratering" of the Brinell impression. The paper contains an interesting survey of previous work on correlated subjects, and also a *bibliography*.—W. A. C. N.

A Comparison of Certain White-Metal Bearing Alloys Particularly at Elevated Temperatures. C. E. Swartz and A. J. Phillips (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–10; and (abstract) *Iron Age*, 1933, **132**, 22).—The physical properties of certain tin-base and cadmium-base bearing alloys, at temperatures up to 300° C., have been studied. The cadmium alloys showed better qualities than the tin-base materials. The former were particularly impressive at higher temperatures owing to the higher range of the solidus. The cadmium alloys are also harder and less brittle than those containing tin. Tests on a practical scale on a six-cylinder motor unit confirmed the results of the laboratory tests. Creep tests indicate a much higher order of creep resistance in the cadmium–nickel alloy than in the tin alloy. The former alloy readily bonds itself to steel, brass, and bronze, and can be used with advantage in many installations.—W. A. C. N.

Ageing of Metals after Cold-Working by Applied Tension. J. Galibourg (*Rev. Mét.*, 1933, **30**, 96–111).—Stress–strain diagrams of steel wire are studied in relation to overstrain in tension followed by ageing. Diagrams for freshly-drawn wire which has undergone 10% reduction since being annealed show no defined elastic limit. Immediate ageing at 160°–170° C. causes the appearance of an elastic limit. Overstrain in tension followed by ageing at 160°–170° C. shows a very marked horizontal below which the curve is rectilinear. Ageing for 70 days at 15° C. straightens out the curve somewhat, the effect being less accentuated than that of ageing at 160°–170° C., and supplementary ageing at 160°–170° C. raises the elastic limit, causing the occurrence of a short horizontal portion. In more heavily drawn wires an elastic limit is observed after similar treatments but the horizontal is not seen even after elevated ageing. Similar experiments with pure nickel indicated that drawn nickel wire has a lower elastic limit than annealed nickel, as was also the case with steel wire. The principal features of tests of steel wires at elevated temperatures are described.—H. S.

Inverse Segregation.—II. H. Sutton (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 35–36).—Cf. *J.*, this volume, p. 350. A continuation of the review of present knowledge of the subject, summarizing the recent work of Haase on copper–zinc alloys, of Masing and Overlach on antimony–bismuth alloys, and of Watson on silver–copper alloys. An alternative explanation of Watson's results is put forward to correlate them with those of other workers. —R. G.

Solubility of Hydrogen in Some Metals and Alloys. Lothar Luckenmeyer-Hasse and Hermann Schenck (*Arch. Eisenhüttenwesen*, 1932–1933, **6**, 209–214; and (abstract) *Stahl u. Eisen*, 1932, **52**, 1178).—The solubility of hydrogen at atm. pressure in iron, chromium, nickel, and manganese and in certain of their alloys has been determined at temperatures up to 1200° C. (1500° C. for iron). The solubility in manganese increases suddenly in the transition from α to β and again in the transition from β to γ; the solubility in nickel–iron alloys is greater than in iron but it is less than in pure iron in α-chromium–iron alloys and slightly greater in γ-chromium–iron alloys with 5–15% chromium.—J. W.

On the Physics of Polymorphic and Magnetic Transformations. Heinrich Lange (*Z. tech. Physik*, 1933, **14**, 226–229).—A short review of various types of transformations in metallic systems—polymorphic, magnetic, and superstructure—and on modern ideas of their mechanism discussed chiefly with the austenite–martensite transformation as an example.—J. W.

The Magnetic Susceptibility of Metallic Solid Solutions and Some Binary Alloys [Au–Ag, Au–Cu, Sb–Bi, Pt–Pd, Sn–Bi, Bi–Pb, Cd–Sn, Sb–Pb, Bi–Te, Al–Sn]. Yosomatsu Shimizu (*Kinzoku no Kenkyu*, 1933, **10**, (2), 49–62).—[In Japanese.] See abstract from English source, *J.*, this volume, p. 186.—S. G.

On the Equilibrium Diagrams of Quaternary Systems.—I. Shuzo Takeda (*Kinzoku no Kenkyu*, 1933, **10**, (2), 71–90).—[In Japanese.] Based on the gravity relation of heterogeneous equilibrium, the quaternary system is discussed graphically, and the construction of equilibrium diagrams (isothermal diagram, general diagrams, concentration–temperature space model, projection diagram, sectional diagram) of a simple eutectic type and a method for their determination are explained.—S. G.

On the Equilibrium Diagrams of Quaternary Systems.—II. Shuzo Takeda (*Kinzoku no Kenkyu*, 1933, **10**, (3), 91–102).—[In Japanese.] The case in which a binary peritectic compound is formed is dealt with. A binary peritectic compound gives rise to a peritecto-eutectic reaction in a ternary system, and a peritecto-ternary eutectic reaction in a quaternary system, *i.e.* a non-variant reaction in which a liquid phase and a solid phase act together, forming 3 solid phases.—S. G.

The Basic Principles of Metallurgical Reactions. Willy Ölsen (*Z. tech. Physik*, 1933, **14**, 222–226).—A summary of recent theoretical and experimental work on the equilibria between metal and slag (cf. *J.*, this volume, p. 75).—J. W.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 440–441.)

Polishing and Etching of Constituents of Aluminium Alloys. F. Keller and G. W. Wilcox (*Metal Progress*, 1933, **23**, (4), 45–46, with attached chart; (5), pp. 38, 40, 42, 44, 46, 48, 50).—(I.—) A general classification of the nature of constituents occurring in aluminium alloys is followed by directions for polishing and by a test of common etching reagents, with concentrations, etching temperatures, and methods of application and washing. The compositions of the alloys used in preparing a forthcoming series of illustrations are given. (II.—) Seven sheets of photomicrographs are given, showing characteristic constituents, etched by various methods, at a standard magnification of 500 diam.—P. M. C. R.

X-Ray Investigation of the Solid Solubility of Aluminium in Copper. J. Obinata and G. Wassermann (*Naturwiss.*, 1933, **21**, 382–385).—A redetermination of the solubility of aluminium in solid copper at various temperatures by the X-ray method has substantially confirmed the results obtained micrographically by Stockdale. The solubility appears to remain constant below 650° C. Homogeneous single crystals of alloys with 3, 5, and 8% aluminium obtained by slow solidification have the same lattice constants as cast or recrystallized specimens of the same composition.—J. W.

Eutectoid Transformation of Bronze. Gunji Shinoda (*Suiyokai-shi*, 1932, **7**, 367–372; *C. Abs.*, 1933, **27**, 2123).—[In Japanese.] Bronzes containing 22·38 and 25·70% tin (I and II, respectively) were quenched from 650° C., and their internal structures were investigated by means of Cu$K\alpha$ X-rays. The β-phases have body-centred cubic lattices of 2·973 A. for (I) and 2·981 A. for (II). These β-phases are transformed, by tempering, into β'-phases, which are then decomposed into α- and δ-like phases. Alloy (I) quenched from 730° C. had a body-centred lattice with $\alpha = 2{\cdot}889$ A. and c/a 1·059.—S. G.

An X-Ray Investigation of the Gold–Rhodium and Silver–Rhodium Alloys. Roy W. Drier and Harold L. Walker (*Phil. Mag.*, 1933, [vii], **16**, 294–298).—The gold–rhodium series of alloys was found to be one of two solid solutions. The maximum contraction of the gold lattice due to solution of rhodium amounts to 0·011 A., which indicates a solubility of 4·1% (atomic) of rhodium in gold. Limiting spectra and consideration of Westgren's and Almin's results indicate that a better value of this solubility would be nearer 8% (atomic). The edge of the unit cell of rhodium expands in the alloys by as much as 0·003 A. The solubility of gold in rhodium lies between 1·1% (atomic) and 2·5% (atomic); a possible value is 1·5% (atomic). The intersolubility of silver and rhodium could not be detected, but it is considered probable that these metals are at least minutely soluble in each other and that the system of alloys is one of two exceedingly limited solid solutions.—J. T.

Zone-Like Structure of Electrolytically Deposited Nickel Films. W. G. Burgers and W. Elenbaas (*Naturwiss.*, 1933, **21**, 465).—The orientation of the crystallites of electrolytically deposited metal films is dependent on the conditions of deposition. In the case of nickel the [100]- or [110]-, and occasionally the [113]-planes are in the direction of the current lines. This regular orientation frequently remains throughout the deposit, or it may form a complex fibrous structure. Different textures may appear in zones on top of one another in the same film, and no generally applicable conclusions can be reached as to the orientation which will be obtained under given conditions.—J. W.

Detection of Lattice Distortion by X-Rays. B. Pfarr (*Z. tech. Physik*, 1933, **14**, 220–221).—The known changes which occur in the sharpness of the ultimate interference lines in X-ray spectrograms during cold deformation, annealing, and hot deformation have been confirmed by photometric measurements of the breadth of the lines. In hot deformation the degree of distortion is not a simple function of the sharpness of the lines, since the effects of deformation and recrystallization may mask one another in different ways. —J. W.

Statistical Mechanics with Particular Reference to the Vapour Pressures and Entropies of Crystals. R. H. Fowler and T. E. Sterne (*Rev. Modern Physics*, 1932, **4**, (4), 635–722).—Theoretical. A general development of the theory of "chemical constants" is given, part being based on Fowler's "Statistical Mechanics," and the remainder being previously unpublished. The validity of Nernst's Heat Theorem is discussed, and it is concluded that the theorem is not universally true, or at least not when applied straightforwardly to the data of the practical physical chemist. The term "chemical constant" is therefore discarded, and the name "vapour-pressure constant" used for the constant appearing in the vapour-pressure equation. The paper contains *inter alia*: Chapter I. Introduction to the Study of the Vapour Pressures and Entropies of Crystals; Chapter II. Quantum Statistical Mechanics and the Vapour Pressure Constants of Monatomic Vapours. This includes data for the vapour-pressure constants of mercury, cadmium, zinc, lead, sodium, and potassium; Chapter IV and Appendices I and II. Applications of Quantum Mechanics to Crystals; Chapter VII. Mixed Crystals; Chapter IX. Entropies and Chemical Equilibria. An index of authors and subjects is included.—W. H.-R.

Magnetic Quadrupole Field and Energy in Cubic and Hexagonal Crystals. L. W. McKeehan (*Phys. Rev.*, 1933, [ii], **44**, 38–42).—Theoretical. In crystalline arrays of equal and co-directed ideal bar magnets or circular Amperean current loops the magnetic field at certain points, and the magnetic potential energy of the array depend, if the linear dimensions of the magnetic elements are small in comparison with the distance between them, on a series of terms, the first of which would be due to a similar array of dipoles. The second term in the series is called the quadrupole term, and is calculated for simple cubic, face-centred and body-centred cubic, diamond type, simple hexagonal, and hexagonal close-packed arrays. McK. points out and corrects errors in the calculations of Peddie (*Proc. Roy. Soc. Edinburgh*, 1912, **32**, 216), Forrest (*Trans. Roy. Soc. Edinburgh*, 1926, **54**, 601), and Mahajani (*Proc. Camb. Phil. Soc.*, 1926, **23**, 136; *Phil. Trans. Roy. Soc.*, 1929, [A], **228**, 63).—W. H.-R.

A Method of Taking X-Ray Photographs of Crystalline Powder at the Temperature of Liquid Air. J. A. Santos and J. West (*J. Sci. Instruments*, 1933, **10**, 219–221).—A Debye-Scherrer camera for taking X-ray photographs of powdered crystals at the temperature of liquid air is described. The specimen is contained in a thin-walled glass tube which is made to rotate about, and to oscillate along, a vertical axis under conditions in which the tube is submitted to a continual stream of liquid air. The vertical travel causes the specimen periodically to enter a tube full of liquid air, and thus ensures a constant temperature. A scale diagram is included.—W. H.-R.

IV.—CORROSION

(Continued from pp. 442–443.)

The Influence of Heat-Treatment on the Corrosion of Rolled Light Alloys. Anon. (*Z. Flugtech. u. Motor.*, 1933, **24**, 284–285).—The heat-treatment designed to give the maximum improvement in mechanical properties does not necessarily coincide with that best suited to develop resistance to corrosion. Time and temperature of age-hardening and of annealing, and quenching temperature and speed, have been shown to affect anti-corrosive properties. The work of H. Mann (*Korrosion u. Metallschutz*, 1933, **9**, 141–150, 169–178) has been supplemented by that of Rawdon and Meissner, on Duralumin 681B and on magnesium-free Lautal ULW14. The influence of annealing temperature and of accelerated ageing have been investigated, and optimum conditions for these treatments established for the alloys in question.—P. M. C. R.

Duralplat, a Corrosion-Resisting Light Alloy of High Strength. K. L. Meissner (*Maschinenkonstrukteur*, 1933, **66**, 88–90).—An account of extended sea-water corrosion tests on Duralplat (for earlier work see this *J.*, 1932, **49**, 135–145). The investigation took the following forms: (1) examination of the surface condition of test-pieces after cleaning and/or removal of marine growths; (2) estimation of loss of weight. M. considers this method fruitful only in the case of plated specimens, on which attack is evenly distributed; it is valueless for unplated alloys of types susceptible to intercrystalline corrosion, which show grave deterioration in properties, while suffering little or no loss of weight; (3) mechanical testing, the principal properties tested being yield-point, tensile strength, and elongation; (4) microscopic examination. The effects of exposure on sheets and sections plated to various thicknesses are discussed, and exposure times are plotted against yield-point, elongation, and tensile strength.—P. M. C. R.

Resistance to Sea-Water Corrosion of Certain Aluminium–Magnesium Alloys. E. Herzog and G. Chaudron (*Compt. rend.*, 1933, **196**, 2002–2003).—Pinhole and intercrystalline corrosion in natural sea-water have been investigated by (*a*) anodic attack for 4 days; (*b*) attack under pressure of oxygen for 8 days, and (*c*) alternate immersion and emersion for 5 months. It was found that quenching and tempering alloys containing magnesium and silicon causes precipitation of Mg_2Si and renders the alloys particularly susceptible to intercrystalline corrosion. Manganese prevents this. Copper causes pinhole corrosion. Hence copper and silicon should be absent and the mechanical properties retained by adding extra magnesium. Alloys consisting of pure aluminium and magnesium can be rolled at about 400° C. For an alloy containing 6% magnesium and less than 0·15% silicon, after annealing at 450° C., the breaking stress was 30 kg./mm.^{2} (19 tons/in.^{2}) and the elongation 28%; for an alloy containing 9·5% magnesium and 0·2% silicon, after quenching in air from 420° C., they were 38 kg./mm.^{2} (24 tons/in.^{2}) and 30%, respectively.—J. H. W.

The Corrosion of Brass. The Structure of the Corroded Surface. Charles W. Stillwell and Edward S. Turnipseed (*Physics*, 1933, **4**, 263).—X-ray analysis indicates that ε-brass, etched by 2N–16*N* nitric acid, is dissolved as such. The only corrosion layer is a thin layer of copper probably redeposited by displacement. When ε-brass is etched in *N* sulphuric acid the layer is copper after a short etch. With increase of etching time (up to 1 hr.) β- and then γ-brass are found beneath the copper. The γ-brass is most concentrated next to the unetched ε-brass base; the outside layer is copper and between is β-brass. When ε-brass is etched in acetic acid, the zinc is dissolved and the first corrosion layer is γ-brass. These results agree with the conclusions reached by Graf relating to the corrosion of copper–gold alloys by strong and weak acids.—J. S. G. T.

The Corrosion and Protection of Condenser Tubes. M. Varinois (*Caoutchouc & Gutta-percha*, 1933, **30**, 16272–16274; *C. Abs.*, 1933, **27**, 1602).—A discussion of the different kinds of corrosion.—S. G.

Corrosion of Lead Cable Sheaths. T. Kyōgogu (*J. Inst. Elect. Eng. Japan*, 1932, **52**, 59–60; *Sci. Abs.*, 1932, [B], **35**, 512).—In order to facilitate research on this problem, K. developed two indicators which show by a colour change the corroded zone on a lead sheath caused by residual mechanical stress or other physical heterogeneities when the sample is immersed in an electrolyte. In addition, the change of single potential of a lead bar was measured when various loads were applied or removed from one end. These methods have been of value in the investigation of the mode of corrosion of buried lead-sheathed cables, especially at points where they are liable to be subjected to mechanical stress.—S. G.

Remarks on the Study of the Corrosion of Metals and the Corrosion of Different Alloys of Magnesium. A. Portevin, P. Bastien, and M. Bonnot (*Compt. rend.*, 1933, **196**, 1999–2002).—In order to obtain a comparable standard of the rate of corrosion in the case of simple solution, the gas evolved when a sufficiently rapid current of the liquid passes coaxial cylindrical specimen is measured. The curve representing the rate of corrosion, thus defined, is a straight line when the velocity exceeds 4·6 m./minute. Should the curve not be rectilinear, it is an indication of a more complex phenomenon such as passivity or polarization. In the case of the magnesium-rich magnesium–aluminium–copper alloys, the addition of aluminium diminishes the rate of corrosion in dilute hydrochloric acid and salt ($MgCl_2$) solutions, until the second constituent appears. In the case of the magnesium–copper–silicon alloys, the curve is not a straight line, owing to autoprotection by the compound Mg_2Si. Thus the addition of aluminium to a magnesium alloy diminishes the rate of corrosion initially and then increases it, whilst silicon increases it initially and then diminishes it.—J. H. W.

Report of Committee B-3 [of A.S.T.M.] on Corrosion of Non-Ferrous Metals and Alloys. T. S. Fuller and Sam Tour (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–2).—Progress reports on the work of Sub-Committees dealing with the following subjects—atmospheric corrosion (see abstract below), corrosion in liquids, and galvanic electrolytic corrosion.—W. A. C. N.

Report of Sub-Committee VI [of Committee B-3 of A.S.T.M.] on Atmospheric Corrosion of Non-Ferrous Metals and Alloys. William H. Finkeldey (*Amer. Soc. Test. Mat. Preprint*, **1933**, 3–20).—Appendix to Report of Committee B-3 (preceding abstract). The results of atmospheric corrosion tests on 24 non-ferrous metals and alloys following exposure at 9 stations showing widely variant atmospheric conditions. The extent of corrosion was measured by one or more of the following methods: (1) change in weight; (2) change in tensile strength and percentage elongation; (3) visual examination of the amount and character of the surface films produced. The methods of carrying out these tests are described and discussed. In the tension tests comparison pieces which had suffered no corrosion were used as standards. Account had also to be taken of possible ageing effects where extreme temperatures were met. Generally speaking, corrosion results in marked surface roughening of the specimens leading to the "notch effect" or stress concentrations and resulting localization of deformation. This induces a reduction in elongation and tensile strength. These spots are especially noticeable in the early days of a corrosion test. The thickness of the specimen sheet is of major importance. A table of the average meteorological conditions at the various stations is included.—W. A. C. N.

Experiments on the Corrosion of Metals in Mayonnaise Plants. Results of Tests Made in Plants under Actual Operating Conditions. F. L. Laque (*Spice Mill*, 1932, **55**, 1414–1416, 1421; *C. Abs.*, 1933, **27**, 1602).—The corrosion tests indicate that Inco Chrome-Nickel (nickel 81, chromium 13, and iron 6%) and 18 : 8 chromium-nickel-iron alloy are the most appropriate for general use in mayonnaise plants.—S. G.

Testing the Resistance of Metals Under the Conditions of Carbon Tetrachloride Production. L. Vernitz and A. Kudinova (*Trans. State Inst. Appl. Chem.* (*Leningrad*), No. **15**, 1932, 39–43; *C. Abs.*, 1933, **27**, 2919).—The action of dry and wet liquid and gaseous carbon tetrachloride, sulphur chloride, and sulphur bichloride and their mixtures on lead, iron, cast-iron, nickel, brass, copper, silver, aluminium, and chrome iron was investigated. Aluminium and copper do not resist the action of sulphur chloride, chrome iron resists dry sulphur chloride and sulphur bichloride, but not the mixture of hydrochloric acid and dry sulphur chloride. Nickel is very resistant and lead comparatively resistant.—S. G.

Corrosion in Non-Pressure Refining Equipment. S. S. Shaffer and J. E. Pollock (*Proc. Amer. Petrol. Inst.*, **1932**, (III), 63–70; and *Refiner and Natural Gasoline Manuf.*, 1932, **11**, 568; *C. Abs.*, 1933, **27**, 2023).—Corrosion in storage tanks, pipe lines, atmospheric stills and columns, and condensers is discussed, and the quantity of ammonia gas needed to combat corrosion is given.—S. G.

Fuel Problems [Section on Corrosion by Alcohol]. C. O. Ostwald (*Automobiltech. Z.*, 1933, **36**, 157–158).—Concluding portion only of a contribution to a discussion on fuel problems held at the Berliner Automobilklub, Sept. 8, 1932. A case of apparently complete corrosion of brass sheeting from a fuel tank is cited. The " failure," attributed to corrosion by alcohol fuel, was only apparent, a thick brownish-green deposit actually protecting the sound material below. O. considers that many such cases exist, and further that erosion due to small amounts of grit and other impurities is frequently attributed to corrosion by alcohol fuels. An apparatus for carrying out comparative corrosion tests is illustrated and described. O. states that the hydrocarbons and combustion products of benzol attack ordinary structural materials more vigorously than do the products of the pure alcohol used in fuels; these in some cases lessen the liability to corrosion.—P. M. C. R.

Acid Treatment for Increasing Oil Production. R. B. Newcombe (*Oil Weekly*, 1933, **69**, (11)).—The development of the treatment is traced, and the type of acid now in general use is described. Aqueous hydrochloric acid, of concentration from 5 to 20%, is employed; its corrosive action on iron, steel, and copper is very largely inhibited by the addition of certain inhibiting agents. Arsenious oxide is frequently used; other chemical inhibitors are sometimes substituted for it. Other methods are: the introduction of a " blanket " or non-reactive body before the acid, the effects of which are confined to the productive zones, where the paraffins themselves largely protect the metal; the use of a brine seal, or a material forming a gel with salt water and inhibiting the action of the acid; a surface-tension breaker which allows the calcium chloride formed in the reaction to leave the rock and minimize acid corrosion.—P. M. C. R.

Ricardo Has New Theory to Explain Concentrated Wear of Cylinder Bore. Anon. (*Automotive Ind.*, 1933, **68**, (14)).—*H. C. Ricardo* considers that much of the loss of metal from cylinder liners is explained by direct corrosion by products of partial combustion. A discussion of the probable mechanism of the process is followed by an explanation of failure in big-end white-metal linings.—P. M. C. R.

Rapid Detection of Rates of Corrosion with Simplified Apparatus. Cloyd M. Chapman (*Water Works and Sewerage*, 1932, **79**, 282–284; *U.S. Public Health Abs.*, 1932, **12**, W, 139; *C. Abs.*, 1933, **27**, 1602).—Preparation of the surface of corrosion test-specimens of metals and alloys by pre-test polishing to a sufficient degree to permit microscopic detection of the character and progress of the corrosive attack offers a means for making rapid determinations of the relative suitability of the material to resist corrosion. The test is very delicate, as indicated by the fact that exposure for only a few hours may be sufficient to indicate a difference in the extent of corrosion produced by minor differences in the quantities of corrosive elements present.—S. G.

A Sensitive Method of Measuring Corrosion. W. E. Campbell (*Bell Laboratories Record*, 1933, **11**, 333–338).—By measuring the electrical resistance of a wire, it is possible to follow the progress of corrosion in reducing its cross-sectional area. Details are given of the application of the method to the study of the corrosion of lead wires when exposed to the vapours from moistened sawdust, to the corrosion of metals when maintained at a potential in respect to various insulating materials with which they are in contact in a humid atmosphere, and to the corrosion of metals in contact with oils and organic acids.—J. C. C.

Endurance of Metal in Corrosive Surroundings. T. S. Fuller (*Metal Progress*, 1933, **23**, (6), 23–26).—A rotating beam machine for making endurance tests on metals in controlled environment is described and illustrated, and the methods of use and of recording results are described. The history of the investigation of "corrosion-fatigue" is briefly summarized, with special reference to the work of McAdam; the results of later work (on steel) are tabulated and discussed.—P. M. C. R.

V.—PROTECTION

(Other than Electrodeposition.)

(Continued from pp. 443–445.)

Protective Coating for Aluminium. Anon. (*Indian Eng.*, 1933, **93**, 329).—An account of a coating, said to be identical with corundum both in composition and in hardness, which can be produced on aluminium in various colours. Lacquering is said to be unnecessary, and the product is stated to be non-porous.—P. M. C. R.

The Tarnishing of Silver and Means for Prevention. H. Reinhardt (*Oberflächentechnik*, 1933, **10**, 93–94).—The causes of tarnishing of silver ware are described and a brief account is given of the various methods which have been proposed to prevent it. These include lacquering, plating with chromium, palladium, rhodium, or platinum, alloying with cadmium (a large proportion is necessary to afford sufficient protection), and a new process in which the metal is dipped for 1 minute in a solution containing 0·5 grm./l. of chromic acid, potassium persulphate, or copper ammonium chloride.—A. P.

Aluminium Coating: the Alumilite Process. Anon. (*Indust. Australian*, 1933, **88**, 144).—The Alumilite coating process is briefly described, and the resistant and yet elastic quality of the protective film is emphasized.—P. R.

Tinning and Galvanizing. T. Aizawa, G. Wachi, and T. Ebihara (*Res. Electrotech. Lab. Tokyo*, No. 333, 1932, 1–19; *Sci. Abs.*, 1932, [B], **35**, 699).—[In Japanese, with English abstract.] Describes an investigation of the tin or zinc coating of telephone and telegraph wires. In the case of tinning, the diffusion of copper in the molten tin is discussed and the structure of the tin coating is explained with respect to the copper–tin equilibrium diagram. The effects of the addition of a small percentage of cadmium, magnesium, aluminium, zinc, lead, antimony, and bismuth on the chemical and mechanical properties of a tin coating are given. The formation of alloy layers due to the diffusion of copper into the tin coating is immaterial because these layers withstand the action of sulphur fairly well. The cause of failure of the tin coating is the improper handling of the wire in the course of the rubber insulation. A small quantity of cadmium in the tin increases the hardness and the ability to resist the action of sulphur, but it makes the tinning operation more difficult. In the case of hot-galvanizing, the relation between the cracking and peeling off of a zinc coating on a galvanized iron wire and the thickness of the alloy layer of $FeZn_7$ and $FeZn_3$, and also the effect of added elements such as aluminium, nickel, tin, copper, antimony, and cadmium on the growth of the alloy layer and on the corrosion properties are dealt with. The growth of the compound layer of $FeZn_3$ should be limited in order to prevent cracking of the coating; the addition of 0·5–1·0% aluminium was found to be most effective in preventing cracking. No appreciable difference was found in the corrosion test between pure zinc and zinc containing small quantities of various elements.—S. G.

Tin as a Metal Addition to Hot-Dip Galvanizing Baths. Wallace G. Imhoff (*Amer. Metal Market*, 1932, **39**, (232), 5; (233), 5, 8; (234), 4, 10; (235), 5, 8; (236), 5, 8; *C. Abs.*, 1933, **27**, 694).—The use of tin in hot-dip galvanizing is discussed from several different angles, including the factors affecting the amount to be added, its thinning and cleansing effect, &c. Adherence is increased and the tendency to tarnish decreased. It is considered probable, however, that the formation of "white rust" is accelerated by the addition of tin. It is concluded that small additions of tin between 0·1 and 0·3% are beneficial to zinc coatings under certain conditions.—S. G.

Production and Use of Galvanized Roofing Sheets. G. C. Bartells and K. J. T. Ekblaw (*Agricultural Eng.*, 1932, **13**, 47–50; *C. Abs.*, 1933, **27**, 3428).—The galvanizing of the sheets and the relation between the thickness of the zinc coating and the resistance to rusting are discussed. In actual use, sheets coated with zinc at the rate of 1·6–2·2 oz./ft.^{2} showed little or no signs of rust in 10–25 years, whereas those coated at the rate of 0·8–1·2 oz./ft.^{2} showed considerable rusting in 3–11 years.—S. G.

Report of Sectional Committee [of A.S.T.M.] on Zinc Coating of Iron and Steel. J. A. Capp and A. B. Campbell (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–3).—Progress reports on specifications for hot-dip zinc coating of hardware and fastenings, for hot-galvanized coatings on structural steel shapes, for pipes and pipe fittings, and for methods of testing the coatings are recorded.—W. A. C. N.

Proposed Tentative Specifications for Zinc Coating (Hot-Dip) on Hardware and Fastenings. —— (*Amer. Soc. Test. Mat. Preprint*, **1933**, 4–7).—Appendix to Report of Sectional Committee on Zinc Coating of Iron and Steel (see preceding abstract). The specifications are not intended to apply to coatings on marine hardware or on articles formed after coating. The weights of coatings for various classes of material are given in tabular form. On all classes of hardware the covering must withstand four 1-minute dips when subjected to the Preece test. It must also adhere tenaciously to the base metal, be free from blisters, flux, black spots, dross, and sharp projections.—W. A. C. N.

Report of Committee A-5 [of A.S.T.M.] on Corrosion of Iron and Steel. J. H. Gibboney and James Aston (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–4).—A revision of the standard methods of determining the weight of the coating on zinc-coated articles is recommended (see abstract below). Tentative specifications for galvanized iron or steel wires of various grades are now confirmed. Progress is reported on total immersion tests in sea-water of copper and non-copper bearing alloys. In field tests of metallic coatings it has been found that the relative resistance of zinc and iron to corrosion changes with location. Within a particular environment the durability of the zinc coating is substantially proportional to the weight of the coating. The results of inspections on various specimens are discussed. A report on embrittlement is also discussed (see abstract p. 504). Further information is being collected on the freedom of intermediate size shapes from injurious embrittlement, on the susceptibility to serious embrittlement of open-hearth steel, and on the need for reducing the gauge length for testing intermediate shapes having small holes, and of measuring reduction in thickness in testing angles.—W. A. C. N.

Report of Sub-Committee V [of Committee A–5 of A.S.T.M.] on Total Immersion Tests. F. B. Olcott (*Amer. Soc. Test. Mat. Preprint*, 1933, 5–7).—Appendix to Report of Committee A–5 (preceding abstract). A detailed record of the failures of 173 copper bearing and 127 non-copper bearing No. 22-gauge sheets is given. Further progress on the observation of 16-gauge sheets is discussed. Examination of exposed riveted test-plates shows spongy corrosion and pitting about equally divided among the rivets. Calked rows appear to be in better condition than the others. Tests of rivets and plates in oil tankers are also being made.—W. A. C. N.

Report of Sub-Committee VI [of Committee A–5 of A.S.T.M.] on Specifications for Metallic Coated Products. F. F. Farnsworth (*Amer. Soc. Test. Mat. Preprint*, 1933, 8–10).—Appendix to Report of Committee A–5 (abstract above). Tentative standards for galvanized iron or steel wire for telegraphs and telephones, for ties, and for cable strands are confirmed. The use of a bend or mandrel test for determining the adherence of zinc coating on chain-link fence fabric which has been galvanized after weaving is not favoured. The tentative specifications for galvanized wire fencing and for barbed wire are to be revised completely.—W. A. C. N.

Report of Sub-Committee VIII [of Committee A–5 of A.S.T.M.] on Field Tests of Metallic Coatings. R. F. Passano (*Amer. Soc. Test. Mat. Preprint*, 1933, 11–28).—Appendix to Report of Committee A–5 (abstract above). Records of failures of exposed sheets are tabulated and curves given showing the progressive development of rust on the test-pieces. An orderly increasing development of rust in all the classes with increase in time of exposure is shown. Tests on uncoated sheets have also been made for comparison. The following 8 coatings on hardware, structural shapes, tubular goods, &c., have been investigated: (1) hot-dipped zinc; (2) electrodeposited zinc; (3) sherardized zinc in gas-heated drum; (4) sherardized zinc in electrically-heated drum; (5) electrodeposited cadmium; (6) hot-dipped aluminium; (7) hot-dipped lead (Amaloy); (8) Parkerizing. It is concluded that articles treated by processes 1–4 have approximately the same service life. There are no outstanding differences in the performance of any class of coating which are attributable to the nature of the base metal. The resistance to corrosion of a zinc coating depends substantially on the weight of coating and not on the method of application. Electrodeposited coatings are thinner on the recessed parts, and hence fail there first. The protection offered by cadmium is less than that of zinc applied with equal weight. Hot-dipped aluminium coatings give good protection, but are rough. In industrial areas where zinc and cadmium are rapidly weathered away lead is sufficiently resistant in itself, but tends to show pinholes. Parkerizing affords no suitable protection for outside service. In discussing other electrodeposited coatings the following statements are made: (1) protective value is determined principally by the total thickness of the nickel or of nickel and copper. Coatings less than 0·0005 in. thick give but little protection, but those with 0·002 in. are nearly perfect; (2) the presence of a copper layer reduces the protective value of a coating of given thickness; (3) very thin chromium coatings reduce the protective value of relatively thin deposits, whilst thicker coatings of this metal give added protection.—W. A. C. N.

Report of Sub-Committee X [of Committee A–5 of A.S.T.M.] on Embrittlement Investigation. V. F. Hammel and C. S. Trewin (*Amer. Soc. Test. Mat. Preprint*, 1933, 29–31).—Appendix to Report of Committee A–5 (abstract above). A progress report on the embrittlement of various classes of ferrous materials.—W. A. C. N.

Proposed Revised Standard Methods of Determining Weight of Coating on Zinc-Coated (Galvanized) Iron and Steel Articles. —— (*Amer. Soc. Test. Mat. Preprint*, **1933**, 32–38).—Appendix to Report of Committee A–5 (abstract p. 503). The methods are applied to sheets and wire. In the case of sheets, the shop weighing, spot test, hydrochloric acid–antimony chloride and sulphuric acid processes are described, whilst the basic lead acetate, sulphuric acid–permanganate, thermal, and hydrogen evolution methods are mentioned as good alternatives. In the case of wire, only the hydrochloric acid–antimony chloride method is given. In an appendix the determination of iron in zinc coatings is described in detail. It consists essentially in the titration of the iron by permanganate in the presence of mercuric chloride.—W. A. C. N.

The Prevention of Corrosion. Anon. (*Indian Engineering*, 1933, **93**, 286).—An account of the Sherardizing process and its applications.—P. M. C. R.

Metal Spraying as a Protection against Corrosion. W. E. Ballard (*Metallurgia*, 1933, **8**, 67–69).—The process of spraying a less corrodible metal such as zinc, aluminium, brass, or nickel on iron and steel is briefly explained, and the advantages gained from such a process in the treatment of large structures are considered. Among the applications of the process outlined are the treatment of bridges, tanks, filter-press plates, and steel windows with zinc; of gas-holder shells with aluminium to resist the action of sulphur; and the treatment of light alloys of aluminium, such as Duralumin, with pure aluminium so as to increase their resistance to corrosion. The process known as aluminizing, where aluminium is sprayed on steel and subsequently heat-treated, is also dealt with, and various practical applications of the process in the treatment of heat-treatment boxes and pots, superheaters, and chain-links are referred to.—J. W. D.

Metal Spraying Technique. Anon. (*Chem.-Zeit.*, 1933, **57**, 381–382).—To obtain a homogeneous lead coating on iron and steel that will resist hot and cold sulphuric acid of *d* 1·8, a new type of pistol has been developed. In this pistol a 3-mm. lead wire is fed through the orifice at 3·5 m./second by means of a turbine driven by carbon dioxide taken at 2 atm. pressure from a steel cylinder. The exhaust gas from the turbine is passed through a chamber in which it is heated by means of an oxy-hydrogen flame to 300°–900° C., and is then passed through the orifice with the lead wire, which is thereby melted and atomized in a non-oxidizing atmosphere. The heating chamber is made of steel which has been sprayed with aluminium and heated to cause the coating to diffuse into the metal and give a non-scaling surface. The pistol weighs only 1·2 kg., and uses 600 litre/hr. of carbon dioxide at 92% efficiency.—A. R. P.

New Electrical Method for the Spraying of Metals. Anon. (*Technique moderne*, 1933, **25**, 242–243).—Abstracted from *Electrotech. Z.*, 1932, **53**, 1178. See *J.*, this volume, p. 248.—R. B. D.

Comparative Tests of Nitrocellulose Lacquer Coats on Duralumin and Wood. —— Tichonov (*Malyarnoe Delo*, **1932**, (1), 36; and (in German) *Nitrocellulose*, 1932, **3**, 227; *C. Abs.*, 1933, **27**, 1526).—[In Russian.] Nitrocellulose lacquers were tested thoroughly on Duralumin and wood parts of aeroplanes and found satisfactory.—S. G.

Modern Lacquer Finishing. Ray C. Martin (*Metal Cleaning and Finishing*, 1932, **4**, 555–558, 603–606, 610, 647–650; *C. Abs.*, 1933, **27**, 1772).—The characteristics of the various types of nitrocellulose, cellulose acetate, and ethylcellulose employed in lacquers are briefly described. The use of alkaline solvents in nitrocellulose lacquers, the distinction between solvents and diluents, and the desirable properties of nitrocellulose solvents are discussed. —S. G.

Cellulose Esters and Lacquers. Anon. (*Indust. Australian*, 1933, **88**, 144).—The formation of degradation products of cellulose and its acetates is stated to be due to the critical temperature having been exceeded in process of manufacture. This temperature varies according to conditions, especially with the sulphuric acid concentration. By careful control of temperature it is now possible to maintain simultaneously a low viscosity, a high proportion of cellulose derivative, and a good compatibility with gums and resins, thus improving the quality of cellulose-ester lacquers and varnishes.—P. M. C. R.

Chemical Injection in Kansas Wells Retards Corrosive Action. Anon. (*Oil Weekly*, 1933, 70, (3)).—Corrosion of plant in certain Kansas oilfields has been traced to a combination of hydrogen sulphide content in the oil and low brine concentration in the associated water. The use of anti-corrosive alloys and the application of electrolytic protection failed to eliminate the trouble, which is now overcome by the injection of caustic soda containing certain variable colloidal ingredients. Methods of application are described.—P. M. C. R.

VI.—ELECTRODEPOSITION

(Continued from pp. 445–449.

Tests of Thickness of Protective Cadmium Coatings on Steel. S. G. Clarke (*J. Electrodepositors' Tech. Soc.*, 1933, 8, (11), 1–10; and (abstract) *Met. Ind.* (*Lond.*), 1933, 43, 153–157).—Three methods, applicable in different cases, are described. (1) Iodine drop method, for larger articles. Drops of a 10% solution of iodine in 20% potassium iodide solution are allowed to fall from a small jet at 1 drop per second on the article supported at about 45° and about ¾ in. below the jet; perforation is marked by the appearance of a spot of the basis steel within the area tested, and the number of drops required, divided by 18, gives the thickness of coating in ten-thousandths of an inch (± 15%). A suitable apparatus is described. (2) Acid stripping method, for smaller parts. The article is immersed in a solution of 20 grm. of antimony trioxide per litre of hydrochloric acid (sp. gr. 1·146) at 60°–75° F. (16°–24° C.) until gassing has subsided. The loss in weight after stripping may be determined and the thickness calculated when the surface area is known, giving accurate results. The number of seconds during which gassing occurs, divided by 30, gives an approximation (± 50%) to the thickness in ten-thousandths of an inch, which may be of value in cases where the surface area cannot be readily measured, *e.g.* for small screws. (3) A 5% solution of ammonium persulphate to which is added 10% by volume of concentrated ammonia (sp. gr. 0·88), which is without action on steel but readily dissolves cadmium, may be used for stripping the deposit for determination from loss in weight. Articles must be freed from grease before testing.—S. W.

The Detection and Significance of Porosity in Electrodeposited Cadmium Coatings on Steel. S. G. Clarke (*J. Electrodepositors' Tech. Soc.*, 1933, 8, (12), 1–20; and (summary) *Met. Ind.*, (*Lond.*), 1933, 43, 15–16, 61–62, 109–110).—Porosity may be detected by immersing the article, from which all greasy matter has been removed, in dilute hydrochloric acid (1% of concentrated acid in distilled water) for up to 10 minutes, when hydrogen bubbles form at discontinuities. With large pores or numerous small pores the bubbles form within a few minutes, but the full period is necessary for detecting slight porosity. The test is non-destructive of the coating. Coatings deposited from cyanide plating solutions of the usual composition on rolled steel of good quality are ordinarily substantially non-porous, even when of extreme thinness (*e.g.* 0·00005 in.), but may be distinctly porous on cast steel when of greater thickness. In the early stages of use of the solutions, however, deposits produced on rolled steel may be appreciably porous, but less so as the thickness is increased to 0·0005 in. The effects of porosity and discontinuities in cadmium coatings on steel under condition of exposure outdoors and in a Stevenson screen have been studied: (1) by determining the influence of contact with steel on the rate of corrosion of cadmium; (2) by carrying out tests of cadmium coatings of varying porosity and thickness. Porous coatings are attacked more rapidly than continuous coatings, and the factors deciding the degree of acceleration appear to be the total area of steel exposed at the pores and the severity of the corrosive conditions. With highly porous and very thin coatings (0·0001 in.), the stimulation of attack was marked, but with the lower porosity found with coatings of good commercial thickness (say, 0·0003 in. and above), the effect was relatively slight. On atmospheric exposure, the sacrificial protection afforded to exposed steel is slight, but sufficient to protect from rusting tiny areas of exposed steel, such as at pores; at small areas which are just visible to the naked eye, partial protection is afforded, but at larger areas rusting tends to proceed. It is concluded that slight porosity in a cadmium deposit is unlikely to affect its protective properties under ordinary conditions of use to an appreciable extent, but where pores are very numerous, a lower degree of protection than that afforded by a sound deposit of similar thickness may be anticipated.—S. W.

The Influence of Anions on the Electrodeposition and Solution of Cadmium and Zinc. Erich Müller and Herbert Barchmann (*Z. Elektrochem.*, 1933, **39**, 341–352).—The overvoltages which occur in the cathodic deposition and anodic solution of cadmium and zinc in solutions of their single salts have been determined. The current density–polarization curves showed decreasing steepness in the order chloride, bromide, sulphate, perchlorate. Raising the temperature leads to a straightening-up (*Aufrichtung*) of the curves. The explanation of the experimental results put forward is that there is a relation between the polarization and the extent of the anion radius. The current efficiency for the cadmium deposition had a mean value of 94–99%, being higher with higher temperatures. Increasing concentration of the anions had a depolarizing effect. Thick deposits of cadmium were obtained from perchlorate solutions, especially the sodium salt. Gelatine raised the overvoltage and effected a grain-refinement of the cadmium deposit. In the presence of gelatine, thick deposits of cadmium were obtained from sulphuric acid solutions of cadmium sulphate.—J. H. W.

Organic Addition Agents for Cadmium Electroplating. R. A. Claussen and H. L. Olin (*Metal Cleaning and Finishing*, 1933, **5**, 211–214).—See *J.*, this volume, p. 249.—S. G.

Throwing Power of Chromic Acid Baths. K. Altmannsberger (*Chem.-Zeit.*, 1933, **57**, 293–294).—The throwing power of chromic acid baths containing sulphuric acid is better with dilute than with more concentrated solutions at the same current density; the range of bright deposits is narrowed by increasing the chromic acid concentration, but at 35°–40° C. the concentration range for bright deposits is considerably enlarged. With a bath containing 250 grm./litre of chromic acid a $CrO_3 : SO_4$ ratio of 200 : 1 gives a better throwing power than a ratio of 100 : 1. A higher chromic acid concentration improves the throwing power, but reduces the lustrous range. A. recommends a bath with 350 grm./litre of chromic acid and profiled anodes to homogenize the current lines.—A. R. P.

The Control of Electrodepositing Solutions. XVI.—The Chromium Solution. Samuel Field (*Met. Ind.* (*Lond.*), 1933, **43**, 13–14).—Describes the methods for determining the sulphuric acid by reducing the chromic acid to chromium chloride with hydrochloric acid and alcohol and precipitating with barium chloride, and of estimating the iron and trivalent chromium by weighing as oxides.—J. H. W.

The Electrodeposition of Chromium from Tervalent Chromium Salt Solutions. II.—Chromium Acetate, Oxalate, and Tartrate Baths. Hubert Thomas

Stanley Britton and Oliver Brentwood Westcott (*J. Electrodepositors' Tech. Soc.*, 1933, **8**, (5), 1–9. Reprinted from *Trans. Faraday Soc.*, 1932, **28**, 627–634).—See this *J.*, 1932, **50**, 758.—S. W.

Determination of the Thickness of Chromium Deposits. O. Macchia (*Industria chimica*, 1932, **7**, 717–725).—The life of a chromium deposit depends on its thickness and the quality (porosity, hardness, &c.). The various methods of determining the thickness (electrochemical and gravimetric) are critically reviewed and the best results are said to be obtained by covering all but a measured portion of the plated surface with paraffin wax or grease, subjecting this exposed portion to the action of hydrochloric acid, and determining the amount of chromium in the resulting solution. The small area from which the chromium has been dissolved may readily be replated.—G. G.

Cathode Supports for Chromium Plating. R. J. Piersol (*Metal Cleaning and Finishing*, 1933, **5**, 67–70, 84; *C. Abs.*, 1933, **27**, 2099).—The requirements of cathode supports for large articles are discussed.—S. G.

Chromic Acid Poisoning. R. W. Graham (*Canad. Med. Assoc. J.*, 1932, **27**, 645–646; *C. Abs.*, 1933, **27**, 909).—A patient engaged in chromium plating for 2½ years developed an excessively troublesome cough and hoarseness. There were also loss of sleep and weight with anorexia and fatigue and nose bleeding. The nasal septum was perforated. Removal from the fumes, inhalations of Friar's balsam, free elimination from the bowels and bladder, together with an iron tonic, resulted in complete recovery.—S. G.

Chromium Plating for Abrasion and Corrosion-Resistance. George S. Brady (*Metal Cleaning and Finishing*, 1933, **5**, 164–166; *C. Abs.*, 1933, **27**, 3143).—A general discussion of the application of chromium plating to machine parts to increase their service qualities.—S. G.

Chromium Plating Finds New Applications in the Machine Shop. N. H. McKay and C. F. Bonnet (*Machinery* (*N.Y.*), 1933, **39**, 576–579; and (abstract) **Results Obtained with Chromium Plated Cutting Tools** (*Machinery* (*Lond.*), 1933, **42**, 218).—The characteristics of chromium deposits applied directly to the base metal are outlined, and their use as hard facings for guide strips, machine parts, and cutting tools, and as a means of reclaiming under-sized parts, is discussed.—J. C. C.

The Electrodeposition of Iron–Cobalt Alloys.—I, II. S. Glasstone and J. C. Speakman (*J. Electrodepositors' Tech. Soc.*, 1933, **8**, (5), 10–23. Reprinted from *Trans. Faraday Soc.*, 1933, **29**, 426–429).—See *J.*, this volume, p. 360.—S. W.

Carbonate in Cyanide Copper Plating. L. C. Pan (*Metal Cleaning and Finishing*, 1933, **5**, 19–22, 81–84; *C. Abs.*, 1933, **27**, 2099).—The resistivity of a cyanide copper solution decreases rapidly with increasing amounts of sodium carbonate up to 100 grm./litre. The anode polarization is reduced rapidly by the addition of sodium carbonate, the minimum being reached at about 42 grm./litre. The cathode polarization is practically unaffected by the presence of sodium carbonate except for a slight minimum at about 42 grm./litre. The bath voltage follows approximately the characteristics of the anode polarization. Throwing power shows a sharp maximum at 42 grm. sodium carbonate per litre and another, higher, maximum at 221·5 grm./litre. The anode efficiency is greatly reduced in the presence of sodium carbonate, with the exception of a small rise to a maximum at 12·5 grm./litre. The anode and cathode efficiencies intersect at two points, *viz.*, 5 and 30 grm. sodium carbonate per litre. The cathode efficiency decreases slightly with increasing sodium carbonate content. The anode film formed in the presence of sodium carbonate is soluble immediately in the solution, whereas the anode film formed in the absence of sodium carbonate is insoluble while the plating takes place. The cathode deposit shows a maximum brightness at 20 grm. sodium carbonate per litre. All factors being considered, the optimum sodium carbonate content would be about 42 grm./litre.—S. G.

Concentration of Cyanide Copper Plating Solutions. L. C. Pan (*Metal Cleaning and Finishing*, 1933, **5**, 112–114, 152–154, 166–167; *C. Abs.*, 1933, **27**, 3144).—The effects of concentration on anode and cathode efficiencies, on polarization, on resistance, on throwing power, and on appearance of the deposit are discussed. A cyanide copper-plating bath containing 1 mol. copper, 0·29 mol. free cyanide, and 0·39 mol. sodium carbonate per litre is most desirable and would be materially better than many of those now being used.—S. G.

Nickel-Plating of Aluminium. J. A. Sprenger (*Tecnica del Lavoro*, **1932**, (9), 23–24).—A short note.—G. G.

The Nickel Plating of Zinc-Base Die-Castings at High Current Density. N. R. Laban (*J. Electrodepositors' Tech. Soc.*, 1933, **8**, (6), 1–8).—A coating of nickel or copper and nickel of high adhesion and at least 0·0005 in. thick is essential prior to chromium plating. The following method has been satisfactorily worked by relatively unskilled labour; owing to the high current density and simple method used, the plant required is inexpensive. The articles are degreased by the trichlorethylene vapour method shortly before plating: they are anodically etched for ½ to 1 minute in 75–80% sulphuric acid at 10 v., very thoroughly swilled, and copper plated in CuCN 3·5, NaCN 5·0, Na_2CO_3 2·0, $Na_2S_2O_3$ 0·17 oz. per gall. at 50 amp./ft.^{2} and 65° C. for a few minutes. The articles are rinsed and immersed in potassium hydrogen tartrate solution; they are then nickel plated in $NiSO_4 7H_2O$ 2·5–3 lb., NaCl 2 oz., H_3BO_3 3 oz. per gall. at 80 amp./ft.^{2} and 60° C., p_H 5·2–5·8, for 11 minutes; the solution is vigorously agitated by compressed air. Owing to the high currents used, the articles are suspended on special jigs of ample cross-section. Finishing costs are not materially increased by the etching process, and rejects are stated to be markedly reduced.—S. W.

Electrodeposition of Nickel. M. Ballay (*Congrès internat. d'Élect., Paris, Section* 7, *Rapport* No. 7, 1932, 1–10; *Sci. Abs.*, 1932, [B], **35**, 704).—B. states that the two important applications of electrodeposition of nickel are: (1) as a protective coating against corrosion, and (2) the production of refined nickel from crude or impure metal. He discusses the latest advances in both branches of the industry as follows: (1) slow and quick methods of nickel plating; (2) plating on aluminium; (3) plating on zinc and its alloys; (4) management of the plating baths; (5) organization of the work; (6) repair work by thick deposits of the metal; (7) production of nickel anodes; and (8) refining crude nickel.—S. G.

Electrolytic Preparation of Heavy Seamless Nickel Tubes. Naoto Kameyama and Sojiro Oka (*J. Electrochem. Soc.* (*Japan*), **1932**, 157–160; *C. Abs.*, 1933, **27**, 2626).—[In Japanese.] Several precautions are given for the electrolytic preparation of seamless nickel tubes 1 mm. thick, 2 cm. in diam., and 20 cm. long. The best results were obtained with Langbein's bath at 70° C., and a current density of 1 amp./dm.^{2}. The hydrogen content of the deposited nickel was 0·003% by weight.—S. G.

The Electrodeposition of Palladium. R. H. Atkinson and A. R. Raper (*J. Electrodepositors' Tech. Soc.*, 1933, **8**, (10), 1–20; and (abstract) *Met. Ind.* (*Lond.*), 1933, **42**, 595–598).—Palladium is a white metal similar in corrosion-resistance to platinum. A sulphide coating is not formed in the atmosphere, and thus palladium is suitable for coating silver articles, jewellery, reflectors, &c. Coatings of at least 0·0002 in. are advised to avoid porosity, since protection is mechanical and not electrochemical. The history of palladium plating is fully reviewed. The simple salts are easily hydrolyzed and unsuitable as electrolytes. A complex nitrite or ammine palladium salt is used. Two processes are described in detail, including preparation and analysis of the electrolyte: (i) Electrolyte $Na_2(Pd(NO_2)_4)$ 10, NaCl 30 grm./litre, palladium anodes, current density 0·1 amp./dm.², 40°–50° app. 1·5 v., p_H value need not be controlled, but rises from 4·9 to 8·0 in use. Deposits up to 0·0001 in. thick are satisfactory and lustrous; polishing is unnecessary. Thicker deposits tend to be cracked. Diamond hardness number 387–435. (ii) A two-compartment cell with porous diaphragm, *e.g.* as in a Leclanché cell or porous hard rubber, is used with insoluble anodes of lead. The catholyte contains 40 grm. $Pd(NH_3)_2Cl_2$ dissolved in 35 c.c. NH_3 solution (0·880) and 10 grm. NH_4Cl per litre, the anolyte $(NH_4)_2CO_3$ 10 grm., $(NH_4)_2SO_4$ 20 grm., NH_3 solution (0·880) 50 c.c./litre. The catholyte is regenerated with $Pd(NH_3)_2Cl_2$, NH_4Cl accumulates in the anolyte. Current density 0·5 amp./dm.² at 3° C. to 2·0 at 70° C., p_H 9–10 (catholyte). Deposits up to 0·01 in. are coherent and easily polished, but brittle. Diamond hardness number 193–196. Current efficiency is high. Cathode polarization curves for both processes are given. Deposition is most satisfactory on silver, copper, or copper-base alloys and nickel. Deposits may be stripped anodically from silver in NaCl 100, HCl 3·6 grm./litre.—S. W.

Practical Problems Involved in Commercial Electroplating on Aluminium. Harold K. Work (*J. Electrodepositors' Tech. Soc.*, 1933, 8, (7), 1–11; and *Met. Ind.* (*Lond.*), 1933, 42, 499–502, discussion, 502–550).—Adhesion of nickel plate to aluminium and its alloys is obtained by degreasing in Na_3PO_4 1–3, Na_2CO_3 1–3, oz. per gall. at 80°–90° C., etching for 10–15 seconds in 5% hydrofluoric acid. A further etching process, varied for different alloys and cast or wrought material, is applied to roughen the surface and produce pits of under-cut shape which key the electrodeposit to the basis metal. Suitable acid etches are given. The time of etching and the temperature and acidity of the etching solution need to be carefully controlled. The etched article is nickel plated in a solution containing $MgSO_4$ or Na_2SO_4 to increase polarization (sample composition given) with at least 0·0005 in., preferably 0·001 in., of deposit. Polishing of the deposit is difficult, and adhesion, although adequate, is not high. Other metals such as chromium or copper can be deposited on the nickel plate. A procedure for zinc-plating aluminium, of value for electrical contact purposes, is described.—S. W.

The Plating of Zinc and Zinc-Base Die-Castings. L. Wright and F. Taylor (*J. Electrodepositors' Tech. Soc.*, 1933, 8, (8), 1–19; and (abstract) *Met. Ind.* (*Lond.*), 1933, 42, 355–358, 405–406).—The difficulties of direct nickel plating are discussed and the literature is reviewed. Degreasing is difficult in aqueous solutions owing to attack on the metal and tarnishing: cathodic cleaning at low current density for not more than 3 minutes in a solution of sodium silicate 10, Na_3PO_4 30 grm./litre operated at boiling point is advised. Etching is essential, 1–2% hydrofluoric acid or preferably 8% hydrochloric acid for 0·5–1 minute is satisfactory. Preliminary plating with brass or copper is unsatisfactory owing to the formation of blisters. Direct nickel plating can be achieved using a solution $NiSO_4.7H_2O$ 75, $Na_2SO_4.10H_2O$ 200, NH_4Cl 12, H_3BO_3 10 grm./litre at room temperature, p_H 6·0 ± 0·2, 10 amp./ft.². A thickness of not less than 0·00035 in. is advised. The effect of varying the constituents and operating conditions of the solution is shown.—S. W.

On Rust-Protective Metal Coatings. W. Borchert (*Oberflächentechnik*, 1933, 10, 85–86).—Excellent protection of iron from rusting is afforded by a cadmium coating 0·005–0·01 mm. thick with outer coatings of nickel and chromium, provided that these are non-porous. Penetration of corrosive media is rapid through pores in the outer layers, and corrosion quickly spreads by electrolytic action.—A. R. P.

Contribution to Our Knowledge of the Throwing Power of Electrolytic Baths. Victor Engelhardt and Nikolaus Schönfeldt (*Wiss. Veröff. Siemens-Konzern*, 1933, 12, (1), 34–38).—In acid and alkaline copper-plating baths, in sulphate nickel-plating baths and in chromic acid baths, the throwing power depends on the dimensions of the electrodes and on the dimensions of the cell.—A. R. P.

Electrodeposition of Metals and Alloys from Formamide Solutions. R. D. Blue and F. C. Mathers (*Electrochem. Soc. Preprint*, **1933**, May, 327–334).—Addition of dry hydrogen chloride to solutions in formamide of the chlorides of copper, zinc, bismuth, nickel, iron, and chromium improves the character and adherence of the deposits obtained by electrolysis, but is without action on the nature of the deposits obtained from solutions of tin, lead, and cadmium chlorides. Zinc and nickel thiocyanates give good deposits in formamide solution, but the corresponding cadmium salt gives only fair deposits. Stannous thiocyanate gives a poor deposit, and cuprous thiocyanate is insoluble. Aluminium chloride alone gives no deposit of aluminium, but on addition of ferric chloride a bright white alloy deposit is obtained which may contain up to 17% of aluminium; this alloy rapidly decomposes water. Alloys of zinc and manganese with a very small proportion of aluminium can be obtained from formamide solutions of the chlorides, but they are very reactive. No alloys of aluminium with any other metal could be obtained.—A. R. P.

Discussion on the Possibility of Standardizing Electrodeposits. R. S. Hutton. E. A. Ollard. S. E. Weill. E. J. Dobbs. T. L. Crow. A. Tremayne. L. Wright. J. W. Perring. A. W. Hothersall. C. Hobday. S. Wernick (*J. Electrodepositors' Tech. Soc.*, 1933, 8, (1), 1–6; and *Met. Ind.* (*Lond.*), 1932, **41**, 427–429).—The possibility and desirability of drawing up standard specifications for electrodeposits of various kinds are discussed. Representatives of the cutlery trade consider standardization of silver plate feasible and advisable, but it is considered that it would be difficult to obtain general trade acceptance of specifications for other electrodeposits.—S. W.

Standards in the Plating Industries. Anon. (*Met. Ind.* (*Lond.*), 1932, **41**, 339–340).—Editorial comment on a discussion opened by E. A. Ollard before the Electroplaters' and Depositors' Technical Society (preceding abstract). It is agreed that it is possible and even desirable to institute particular standards of electroplating on particular articles, but it is considered impossible and not necessarily desirable to issue a general standard of plate applicable to all kinds of plated articles and in any case even restricted standardization presents great difficulties.—J. H. W.

Research and Electrodeposition Practice—Presidential Address. D. J. Macnaughtan (*J. Electrodepositors' Tech. Soc.*, 1933, 8, (2), 1–8; and *Met. Ind.* (*Lond.*), 1932, **41**, 593–595, 598).—The development of the motor-car industry and the competititon of stainless alloys and cellulose lacquers have stimulated the electroplating industry to intensive research. Certain processes, such as chromium plating, are the result of academic research, and were not immediately adopted by the trade. Modern research is, however, directed to obtaining quantitative data on the physical properties, adhesion, corrosion-resistance, &c., of electrodeposits.—S. W.

Advances in Electroplating. Herbert Kurrein (*Oberflächentechnik*, 1933, **10**, 141–143).—A review of recent patents and journal literature with 103 references.—A. R. P.

Recent Developments in Electroplating. M. de Kay Thompson (*Metal Cleaning and Finishing*, 1933, 5, 9–18; *C. Abs.*, 1933, 27, 1829).—A review of recent, more important technical developments in the electroplating of chromium, nickel, cadmium, alloys, silver, zinc, tungsten, tin, and platinum, together with notes on temperature corrections in measuring throwing power and electroplating on aluminium.—S. G.

Electroplating in Great Britain. D. J. Macnaughtan (*Congrès internat. d'Élect., Paris, Sect.* 7, *Rapport* No. 6, 1932, 1–35; *Sci. Abs.*, 1932, [B], 35, 703).—A report on recent research work relating to the electrodeposition of metals carried out in Great Britain under the auspices of the Electroplaters' and Depositors' Technical Society and of the British Non-Ferrous Metals Research Association. The researches covered are: A. W. Hothersall, "The Electrodeposition of Nickel, Chromium, Copper, Silver, Zinc, Cadmium, Iron, Manganese and Alloys"; E. J. Dobbs, "Rapid Nickel Plating"; E. A. Ollard, "Chromium Plating"; S. Wernick, "Zinc and Cadmium Plating"; and H. Sutton, "The Anodic Oxidation of Aluminium and its Alloys." Each paper is accompanied by a bibliography of recent contributions to the technical literature of the subject.—S. G.

Idealism in Electrodeposition. S. Field (*J. Electrodepositors' Tech. Soc.*, 1933, **8**, (9), 1–7).—First William James Memorial Lecture.—S. W.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-Refining.)

(Continued from pp. 449–450.)

Electrolytic Extraction of Metals. H. J. Ellingham (*Sci. J. Roy. Coll. Sci.* (*Lond.*), 1932, **2**, 19–26).—A review.—S. G.

The Technique of Aluminium Manufacture. Jaime Forsch (*Quim. e Ind.*, 1932, **9**, 258–264).—A review.—S. G.

Rate of Dissolution of Industrial Alumina in Molten Cryolite. N. Parravano and —— D'Agostino (*Rend. Accad. Naz. Lincei*, 1932, **16**, 186–190).—From electrical conductivity measurements in fused cryolite it is concluded that the rate of dissolution of the various technical grades of alumina in cryolite baths is different, the rate is highest with alumina made by the Blanc process and lowest with that made by the Haglund process. This factor greatly influences the cost of production of aluminium.—G. G.

Metallic Beryllium at Low Cost. Anon. (*Indust. Australian*, 1933, **88**, 125).—A summary of the properties and sources of beryllium, with notes on methods of extraction.—P. M. C. R.

Electrochemical Industry of Japan. N. Kameyama (*Congrès internat. d'Elect., Paris, Sect. 7. Rapport*, No. 21, 1932, 1–17; *Sci. Abs.*, 1932, [B], **35**, 703).—K. gives details of the present development of the electrochemical industries of Japan, with an estimate of the energy consumed in 1930 and of the tonnage produced of various products. In that year, for the electrolytic production of chemicals and metals by wet processes the energy consumption was 1446 million kw.h., whilst electric thermal manufacturers accounted for another 2404 kw.h. The latter total does not include the energy used in the manufacture of steel, ferro-alloys or other similar products. The tonnages of metals produced in 1930 by electrolytic methods were: refined copper, 78,000 tons; lead, 3600 tons; tin, 800 tons; zinc, 4000 tons; sodium, 1000 tons. K. points to the considerable surplus power available in Japan for other electrochemical industries.—S. G.

Passivity Phenomena in Metals. Max Schlötter (*Chem.-Zeit.*, 1933, **57**, 533).—Under certain conditions of deposition very passive deposits of nickel, chromium, copper, and silver can be obtained which behave quite differently from ordinary deposits. The passive chromium and nickel contain highly dispersed oxide inclusions, and the silver and copper (obtained from iodide solution) contain iodides of these metals. Passive chromium is not wetted by water, and is therefore highly resistant to corrosion; passive nickel is attacked by sulphides only with great difficulty, and the gold-coloured silver containing 0·99% iodine obtained from solutions of silver iodide in potassium iodide is not attacked by liver of sulphur. S. suggests that these substances should be called "metallides," thus the silver mentioned above would be called "0·99 silver iodine metallide." Copper iodine metallide is photosensitive, becoming blue on exposure to light and reverting to red in the dark.—A. R. P.

Hydrogen Overvoltage of Lead and Lead–Antimony Alloys.—I, II. Yogoro Kato (*J. Electrochem. Soc.* (*Japan*), **1932**, 120–124, 161–167; *C. Abs.*, 1933, **27**, 2628).—[In Japanese.] Cf. *J.*, this volume, p. 362. (I.—) The hydrogen overvoltage of lead–antimony alloy (1–10% antimony) cathodes varies from the very beginning of the passage of electric current. Neither rapid nor slow cooling of the alloy appreciably affects the overvoltage. It is, however, very low for antimonized lead. An alloy having an especially high overvoltage, such as that reported by Raeder (*Z. physikal. Chem.*, 1928, **133**, 15–30) could not be found. (II.—) In the determination of overvoltage at the same current density, it was found that it varies at first with the time, and then approaches a definite value. The hydrogen overvoltage on lead depends on the surface condition of the cathode; it is high on a smooth surface and low on a rough surface. On the single crystal surface of lead, it is high, even when the surface is etched. The hydrogen overvoltage for cast lead, lead–antimony alloy and antimony, determined at a current density of 0·3 ma./dm.^{2} was highest for lead (1·00 v.), next for lead–antimony alloy (5% antimony) (0·67 v.), and lowest for antimony (0·51 v.).—S. G.

A Study of the Tellurium Electrode. Frederick H. Getman (*Electrochem. Soc. Preprint*, **1933**, Sept., 1–8).—Single crystals of tellurium have been prepared by slowly passing a sealed tube containing coarsely crushed metal through a furnace. Using these crystals the e.m.f. (*E*) of the cell Te–mTeCl$_4$ in 2·5*N*-HCl–saturated KCl–Hg$_2$Cl$_2$–Hg has been determined. *E* is a linear function of log *m* within the range, $m = 0{\cdot}0004$–$0{\cdot}1$ molar. From the results obtained it follows that for Te–Te$^{\cdot\cdot\cdot\cdot}$$E_0 = -0{\cdot}5682$ v.—A. R. P.

VIII.—REFINING

(Including Electro-Refining.)

(Continued from pp. 450–451.)

Electrolytic Refining of Metals. G. Eger (*Congrès internat. d'Élect., Paris, Sect.* 7, *Rapport* No. 9, 1932, 1–18; *Sci. Abs.*, 1932, [B], **35**, 705).—Describes the methods now adopted for the electrolytic refining of copper, silver, gold, lead, zinc, cadmium, tin, iron, nickel, antimony, and bismuth. Illustrations of the methods and plant used for copper refining are included.—S. G.

Modern Electrolytic Refining. Anon. (*Met. Ind.* (*Lond.*), 1933, **43**, 51–52).—A short general dissertation on modern electrolytic refining and some of the difficulties encountered therein, especially with respect to lead, magnesium, and aluminium.—J. H. W.

Current Efficiency in the Electrolytic Production of Copper. A. I. Gaev (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1930**, 562–573; *C. Abs.*, 1933, **27**, 667).—[In Russian.] The current consumption in the electrolytic production of copper at the Nijhne-Kuishtuimsk plant is given. Efficiency was between 64·4 and 73·8%. Improvements, to increase current efficiency, are recommended.—S. G.

The Metallurgy of Gold in the Transvaal. B. Kucevalov (*Chem. Listy*, 1932, **26**, 600–604; *C. Abs.*, 1933, **27**, 1847).—A survey of the geology, mining methods, cyanide and refining processes used for the preparation of metallic gold.—S. G.

Electrodeposition of Zinc. P. Röntgen and R. Buchkremer (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 38–43).—A detailed summary, with illustrations, of a paper by R. and B. *Metall und Erz*, 1932, **29**, 449. See *J.*, this volume, p. 450.—R. G.

IX.—ANALYSIS

(Continued from pp. 451–454.)

Use of the Photographic Plate in Quantitative Analysis with Emission Spectra. C. F. Linström and G. Scheibe (*Ber. VIII. Internat. Congr. Photography, Dresden*, 1931, 355–356; *C. Abs.*, 1933, 27, 672).—The photometric methods which are employed in quantitative analysis with emission spectra are discussed, as also are the possible sources of error in this kind of work which may arise from the use of the photographic plate. The effect of the kind of plate, and of development (manner, time, and temperature), and of the gradation in the various regions of the spectrum is discussed in regard to the Scheibe–Neuhäusser method of logarithmic sector and the 3-line methods of Scheibe–Schnettler.—S. G.

Spectrographic Analysis of Lead Cable-Sheath Alloys. G. H. Metson (*Post Office Elect. Eng. J.*, 1932, 25, 143–147; *Sci. Abs.*, 1932, [B], 35, 699).—The optical spectrum of a Pb–Sb alloy consists of numerous spectral lines due to the Pb and a smaller number due to the Sb. The intensity of the latter increases in a regular manner as the Sb percentage increases. In the rotating logarithmic sector photometer a disc is used, the outer edge of which is cut in a logarithmic spiral, is placed in front of the spectrograph slit and is rotated by a small electric motor. Each spectral line is thus exposed logarithmically along its length, the photograph being a narrow wedge instead of a parallel-sided bar. Since the law of photographic blackening is also logarithmic, the length of a particular Sb line-wedge is a measure of the line intensity and also of the Sb concentration of the alloy.—S. G.

Surface Effects on Assay Bands Caused by Metals of the Platinum Group. J. L. Byers (*Bull. Michigan Coll. Min. Tech.*, 1933, 6, 1–17).—See this *J.*, 1932, 50, 441.—S. G.

Detection of Silver in Very Dilute Solutions by Physical Development. A. J. Velculescu (*Z. anal. Chem.*, 1932, 90, 111–113).—One drop of the solution to be tested is placed on a filter paper and treated with a 0·02*N*-solution of KBr. After thorough washing to remove soluble salts, the spot is treated with 50 c.c. of developer solution (*D*) to which 2 c.c. of 0·1*N*-$AgNO_3$ are added just before use. If the spot contains AgBr, much of the Ag in the solution is reduced, and the spot becomes black. The method detects 1 part of Ag in 10^7 parts of solution even in the presence of 2000 times as much Pb, provided that no free HNO_3 is present. Hg interferes, and should be removed by evaporation of the solution and ignition of the residue prior to making the test. Solution *D* contains 10 grm. of metol and 50 c.c. of citric acid in 500 c.c. of H_2O.—A. R. P.

Application of Catalysis to the Detection of Certain Cations. Detection of Silver and Copper. Applications of the Method. Georges Denigès (*Bull. Soc. Chim. France*, 1932, [iv], 51, 1096–1100).—The oxidation of $MnSO_4$ to $HMnO_4$ by $K_2S_2O_8$ in the presence of Ag and by NaOBr in the presence of Cu may be used for the detection of these elements. Hg and Co interfere in the Ag test, and Ni and Co in the Cu test. The method may be used for the detection of Ag in coins: a small drop of HNO_3 is placed on the coin, and after 10 seconds the solution is rinsed into a test tube and heated to 100° C. with 20 drops of H_2SO_4, 2 drops of 0·4% $MnSO_4$ solution, and 0·1 grm. of $K_2S_2O_8$, when a pink colour develops if the coin contains Ag. Other applications of the method are detailed.—A. R. P.

On the Separation of Titanium from Aluminium and Certain Elements of Analytical Groups II and III by Means of Guanidine Carbonate in Tartrate Solution. A. Jilek and J. Kota (*Coll. Trav. chim. Tchécoslov.*, 1932, 4, 412–417).—Ti may be quantitatively separated from $Al^{\cdots}$, $CrO_4{}''$, $WO_4{}''$, $MoO_4{}'$, UO_2, Tl, or $AsO_3{}'''$ by addition of guanidine carbonate to a boiling, dilute, neutral solution containing NH_4 tartrate under certain specified conditions for details of which the original must be consulted.—A. R. P.

On the Precipitation of Calcium by Potassium Ferrocyanide. R. Chandelle (*Bull. Soc. chim. Belg.*, 1932, 4, 420–429).—In the presence of a large excess of NH_4Cl or KCl a crystalline precipitate is obtained on addition of $K_4Fe(CN)_6$ to a solution of Ca salt. The precipitate is $Ca(NH_4)_2Fe(CN)_6$ in the first case and $Ca_2Fe(CN)_6$ in the second.—A. R. P.

Gasometric Determination of Chromium. M. Couture (*Annali chim. appl.*, 1932, **10**, 680–682).—The growing importance of Cr in industry demands a rapid method for the analysis of plated articles, salts, alloys, electrical resistances, &c. Such a method based on the evolution of O_2 on treating CrO_3 solutions with a peroxide is described.—G. G.

Methods for Copper Determination. N. I. Matveev (*Zvetnye Metally* (*The Non-Ferrous Metals*), 1930, 1491–1505; *C. Abs.*, 1933, **27**, 680).—[In Russian.] A critical review of various methods for the determination of Cu in metals. Eighty-five references are given.—S. G.

The Potentiometric Determination of Iron and Vanadium in Ferrovanadium and of Iron and Chromium in Ferrochromium. Peter Dickens and Gustav Thanheiser (*Arch. Eisenhüttenwesen*, 1932–1933, **6**, 379–388).—Various methods for the simultaneous determination of Fe and V by oxidimetric and reductometric methods are critically reviewed; the former type is preferred. Standardization of the $KMnO_4$ with $Na_2C_2O_4$ and with V_2O_5 gives approximately the same result, but the former is more certain. The rapid method for V recently described has been applied to the analysis of ferrovanadium, and a new method for the simultaneous determination of Fe and Cr is also described. —J. W.

Colorimetric Method for the Determination of Traces of Tungsten. F. Feigl and P. Krumholz (*Angew. Chem.*, 1932, **45**, 674–675).—The solution (2 c.c.) containing the W as Na_2WO_4 and $0{\cdot}05$–$0{\cdot}5N$ with NaOH is treated with 5 drops of 25% KCNS solution and diluted to 5 c.c. with a 10% solution of $SnCl_2$ in HCl (d 1·19). After 30 minutes the yellow colour produced is compared with that of a standard prepared in a similar way from Na_2WO_4 solution. The method gives results with an error of ± 3% for quantities of W between 10 and 100μ grm. Molybdates produce a more intense colour than tungstates under these conditions, and must therefore be removed before applying the test.—A. R. P.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

(See also "Testing" and "Pyrometry.")

(Continued from p. 454.)

Thermal Analysis of Alloys by the Differential Method in Inert Gas Atmospheres. E. Alberti (*Z. tech. Physik*, 1933, **14**, 281–283).—A detailed description of the construction and operation of a suitable apparatus.—J. W.

Darkfield Illuminator. Anon. (*Instruments*, 1933, **6**, 89).—A brief description of the Leitz method of darkfield conical illumination.—J. C. C.

Outline of a Theory of the Technique of Temperature Regulation. Max Lang (*Z. tech. Physik*, 1933, **14**, 98–105).—J. W.

Radiation Thermopiles for Use at Liquid Air Temperatures. C. Hawley Cartwright (*Rev. Sci. Instruments*, 1933, [N.S.], **4**, 382–384).—Values of thermoelectric power against lead, the Wiedemann–Franz ratio and relative electrical conductivity at 25° C. and − 183° C. are tabulated for tellurium, Bi + 11% Sb, Bi + 10% Sn, and Constantan. A thermoelectric pile composed of Constantan and Bi + 11% Sb alloy, operated *in vacuo*, is 10 times as sensitive at − 183° C. as it is at 25° C.—J. S. G. T.

A Possibility of Attaining any Desired Low Temperature. F. Simon (*Z. Physik*, 1933, **81**, 824–831).—The possibility of attaining extremely low temperatures by the adiabatic demagnetization of certain paramagnetic materials and by the adiabatic expansion of condensed substances is discussed, and apparatus for this purpose, employing liquid helium, is suggested (cf. following abstract).—J. S. G. T.

The Attainment of Very Low Temperatures by Compression of Liquid Helium. W. Meissner. F. Simon (*Z. Physik*, 1933, **81**, 832–837, 838–839).—Contrary to the conclusion of Simon (see preceding abstract), M. shows that temperatures below 2° abs. are to be obtained by the *compression* of liquid helium, and not by its expansion, as liquid helium is characterized by a temperature of maximum density. S. replies.—J. S. G. T.

"1–2–3–5" System Weights. Anon. (*Instruments*, 1933, **6**, 92).—The use of the series 1, 2, 3, 5, adopted for the new Sartorius weights, obviates the use of two weights of the same denomination, saves time in identifying weights, and is said to enable a single calibration correction to be applied to any combination, thus avoiding the need for correcting each weight separately.—J. C. C.

A High-Vacuum Spectrograph for Chemical Analysis by X-Rays. E. Alexander (*Z. Physik*, 1933, **83**, 512–516).—A spectrograph characterized by two values of dispersion and permitting exposures to be made within an angular region of 120° is described.—J. S. G. T.

XI.—PHYSICAL AND MECHANICAL TESTING AND RADIOLOGY

(Continued from pp. 455–456.)

Report of Committee E-1 [of A.S.T.M.] on Methods of Testing. W. N. Fulweiler and R. E. Hess (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–7).—A summary of work done by the various sections of the Committee during the year. These have been concerned principally with tension testing (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 945, see *J.*, this volume, p. 374), compression testing (see abstract below), indentation hardness, testing thin sheet metals, impact testing, effect of speed of testing, elastic strength of materials, calibration of testing machines, flexure testing, plasticity and consistency, particle size and shape, sieve sizes, measurement of thickness, and interpretation and presentation of data. Among other definitions proposed are—*Consistency*—that property of a material other than a gas by virtue of which it resists the stresses which produce permanent change of shape. Consistency is expressed by the three following flow-force relations—*Simple* (*Newtonian*) *liquid*, when the ratio of flow to force in the material is constant. *Solid*—any body which requires a finite stress to produce a permanent deformation. *Non-Newtonian liquid*—a body which yields permanently under very small stresses and yet is not a simple liquid. *Plasticity* is that property of a solid by virtue of which it is permanently deformed when stressed above the yield value. Factors which define plasticity are the yield value and the mobility. *Yield value* θ—the minimum stress required to produce a permanent deformation in a solid. *Mobility* μ. The coeff. in the law of plastic flow $v = \mu(F - \theta)r$, where v is velocity imparted by stress F per unit area, to either of two parallel planes separated by the distance r, the space between the planes being filled with the plastic material.—W. A. C. N.

Correspondence on Testing of Castings. W. Rosenhain (*Rev. Mét.*, 1933, **30**, 117).—W. R. points out an error in the report of the Zürich Congress of the International Association for Testing Materials, as given in *Rev. Mét.*, 1932, **29**, 308, which states that the unanimous opinion of the metallurgists of the world was strongly opposed to the use of test-pieces cut from the castings themselves. The official summary of the discussion mentions that two different points of view were expressed. Representatives of Belgium, Czecho-Slovakia, Germany, Great Britain, Holland, Switzerland, and the U.S.A. spoke with favour of the use of specially cast test-pieces, whilst the representative of France put forward the method of testing small pieces cut from the castings themselves.—H. S.

An "Overnight" Test for Determining Endurance Limit. H. F. Moore and H. B. Wishart (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–7; and (abstract) *Iron Age*, 1933, **132**, 32B).—The principle of the test is that below the endurance limit cycles of repeated flexure increase the endurance limit and presumably the tensile strength, whilst above the endurance limit cracks begin to develop, and reduce the tensile strength. A period of about 1,400,000 cycles appears to be sufficient to develop such cracks for the materials tested. The Rockwell hardness of the specimens is determined. They are then subjected to the specified number of cycles of stress in a rotating beam machine, which usually requires some 15–16 hrs. After this the specimens are pulled as tension specimens. Those breaking before the end of the 1,400,000 cycles are credited with zero tensile strength. Making corrections proportional to the hardness figures, the data are plotted, with the stresses applied for 1,400,000 cycles as ordinates and tensile strength after this period as abscissæ. The endurance limit is taken as the ordinate corresponding with the maximum abscissa on this curve. The test has been checked for a variety of ferrous and non-ferrous materials. The maximum variation from the results of long period tests was in the case of Duralumin — 11·8%.—W. A. C. N.

Proposed Revision of Tentative Accelerated Life Test for Metallic Materials for Electrical Heating (B 76–29 T). —— (*Amer. Soc. Test. Mat. Preprint*, **1933**, 7–8).—Appendix to Report of Committee B–4 on Electrical-Heating, Electrical-Resistance, and Electric-Furnace Alloys (see *J.*, this volume, p. 493). A list of a few general considerations and precautions which should be borne in mind in setting up and operating the life test equipment, and in carrying out the technique. Temperature is one of the most important variables to be considered, the life of a wire varying inversely with an exponential function of this factor. It can be measured by means of a modified disappearing filament type of optical pyrometer. The voltage must be carefully controlled. No general rule will indicate the limit for the useful life of a heating element.
—W. A. C. N.

Proposed Revised Tentative Methods of Compression Testing of Metallic Materials. —— (*Amer. Soc. Test. Mat. Preprint*, **1933**, 8–16).—Appendix to Report of Committee E—1 on Methods of Testing (see *J.*, this volume, p. 516).—In performing these tests the speed of the cross head of the machine when the machine is running idle shall be such that the load can be accurately weighed. In no case should the speed exceed 0·05 in./minute for a specimen 1 in. in length or 0·10 in./minute for specimens 3 in. long or over. In testing elastic limit in compression the cross-head speed should conform to the requirements of the corresponding tension test of the material. Test-specimens should be cylinders with plane ends and smooth surfaces, and of the following dimensions: short, for compression tests on bearing metals, 1⅛ in. diam. and 1 in. long; medium, for determining general compressive strengths of metallic materials 0·798 in., 1 in., or 1⅛ in. diam. and 2⅜ in., 3 in., or 3⅜ in. long, respectively; long, for determining the modulus of elasticity in compression, 1¼ in. diam., and 12½ in. long. Variations of ± 0·01 in. are allowable on the diam. The bearing blocks should be provided with machined plane surfaces. The upper end of the specimen shall bear a spherical seated compression block. A diagram of a suitable arrangement is given, followed by a description of the procedure to be followed. Finally, standard definitions of elastic limit, and yield-strength are included, together with details of the "drop of the beam," "total strain," and "set" methods of determining the yield-strength.—W. A. C. N.

A New Method of Determining the Modulus of Elasticity of Materials. P. Le Rolland and P. Sorin (*Rev. Mét.*, 1933, **30**, 112–116).—The method described consists in supporting upon the specimen two identical oscillating systems (gravity pendulums) and observing the time which elapses between successive periods of rest which are observed in both pendulums at intervals following commencement of oscillation in one of them.—H. S.

An Industrial, Mechanically Recording Extensometer. Pierre Chevenard (*Rev. Mét.*, 1933, **30**, 85–95).—The relative displacement of two points on the test-length is amplified by a lever and recorded on a drum which turns through an angle proportional to the tensile stress. Use of the extensometer at elevated temperature is described.—H. S.

Dynamic Extensometers and Oscillographs for Investigating the Rolling Process. Hubert Hoff and Theodor Dahl (*Stahl u. Eisen*, 1933, **53**, 593–604). —The advantages of oscillographs and of extensometers on the condenser principle in investigating the rolling process are mentioned, and a new apparatus is described for the exact determination of the number of revolutions of the rolls and the amount of slip.—J. W.

The Significance of the Results of Short-Time High-Temperature Tension Tests. H. F. Moore, J. W. Bolton, and J. J. Kanter (*Amer. Soc. Test. Mat. Preprint*, **1933**, 17).—Appendix III to Report of Joint Research Committee [of A.S.T.M. and A.S.M.E.] on Effect of Temperature on the Properties of Metals (see *J.*, this volume, p. 486). So far no correlation between the results of short-time high-temperature tension tests and slow creep at high temperatures has been found. There is also no evidence of any relation between these tests and those on fatigue strength. Where the phenomena of creep are not very important, however, as when a metal is exposed to occasional short periods of high temperature, the results of the short-time and high-temperature tests have some significance. The yield strength is a reasonable index of the resistance to permanent distortion under such occasional short-time loads. In general, it may be said that short-time high-temperature tests have a narrower field of usefulness than short-time tests at room temperature.—W. A. C. N.

Proposed Tentative Method of Test for Short-Time High-Temperature Tension Tests of Metallic Materials. —— (*Amer. Soc. Test. Mat. Preprint*, **1933**, 18–25).—Appendix to Report of Joint Research Committee [of A.S.T.M. and A.S.M.E.] on Effect of Temperature on the Properties of Metals (see *J.*, this volume, p. 486). The method covers tests within the range from room temperature up to 2000° F. (1090° C.). The surface of the test piece shall be smooth and free from scratches, and its dimensions those of the ordinary 2-in. standard specimen. The type of testing machine used must be reported with the test. Details of the heating furnace design are specified. A summary of the data which are necessary in completing a satisfactory test is given.—W. A. C. N.

Proposed Tentative Method of Test for Long-Time (Creep) High-Temperature Tension Tests of Metallic Materials. —— (*Amer. Soc. Test. Mat. Preprint*, **1933**, 26–34).—Appendix to Report of Joint Research Committee [of A.S.T.M. and A.S.M.E.] on Effect of Temperature on the Properties of Metals (see *J.*, this volume, p. 486). The method covers high-temperature creep tests at temperatures up to 1090° C. The temperature ranges that should be investigated in the case of a variety of metals are given. In the case of copper and aluminium alloys, this is 300°–800° F. (150°–430° C.). The constant-temperature constant-stress method is employed. Stresses to produce creep at the rate of 1·0% per 10,000 hr. and 0·1% per 10,000 hr. in the secondary flow period are to be determined. Details of procedure are included.—W. A. C. N.

The Determination and Significance of "Proportional Limit" and "Breaking Strength" in Short-Time High-Temperature Tests. H. F. Moore, J. W. Bolton, and J. J. Kanter (*Amer. Soc. Test. Mat. Preprint*, **1933**, 10–16).—Appendix II to Report of Joint Research Committee [of A.S.T.M. and A.S.M.E.] on Effect of Temperature on the Properties of Metals (see *J.*, this volume, p. 486). The determination of proportional limit is indefinite unless details of equipment and the method of tabulation of the results are specified. Except possibly for breaking strength at high temperatures, the results for proportional limit show a wider variation than any other test. It is quite possible that from the start of a test there is some departure from the normal straight-line relation, on account of uneven deformation of individual crystals in the material, and proportional limit is merely the value for which the aggregate of such action becomes detectable with the particular apparatus used. There is no logical or experimental basis for assuming the absolute identity of proportional limit and elastic limit for first permanent set. Various typical stress–strain diagrams and their significance are discussed. Even a very delicately determined proportional limit for a metal has little definite significance as an index of strength or weakness, whereas a fairly well-defined yield-strength does indicate the limiting stress below which serious structural damage due to permanent distortion will not occur. Preliminary data indicate that, for one of the materials used, some creep can be detected at stresses lower than any proportional limits determined in the short-time tests. There is no evidence at the present time that short-time proportional limit tests are a reliable index for creep strength of a metal at high temperature. There is some indication that, for some metals at least, large grain-size is of advantage in resisting creep. The determinations of proportional limit and of breaking strength have been omitted from the tentative method for short-time high-temperature tension tests.—W. A. C. N.

Studies on a Modification of the Rohn Test for Investigating Creep of Metals. C. R. Austin and J. R. Grier (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–15).—A discussion of experiences with a test method intended as a rapid means of classifying alloys as to their metallurgical behaviour and probable utility for use in mechanical service at high temperatures. The construction of the special furnace is described. In this particular type of test the following factors have to be considered carefully and allowed for: coeff. of expansion of the test rod and the changes in elastic modulus and temperature gradients. The test rod is about a metre long, and is itself used as a kind of dilatation thermometer, effecting the automatic regulation of the temperature by changes in its own length. A. and G. have superimposed an intermittent mechanical make and break on the original Rohn apparatus which has resulted in the elimination of marked temperature fluctuations.—W. A. C. N.

Proof Stress: An Historical Note. Wesley Lambert (*Met. Ind.* (*Lond.*), **1933**, **43**, 26).—The "proof stress" test, which allows a maximum permanent extension of 0·003 in. on a 2-in. gauge-length, is identified with the "permanent set" test and is traced back about 50 years. Some doubts of the practical convenience of the test are expressed.—J. H. W.

The Testing of Hardness in Metals. Anon. (*Indian Railway Gazette*, **1932**, **33**, 162–163).—Hardness testing methods are classified into "scratch" and "penetrative" tests, the latter being subdivided according as the penetration is percussive or produced by pressure. The "pendulum" method and some recent modifications of the Brinell test are briefly described.—P. R.

Recorder-Controller for Materials Testing Machines. Anon. (*Instruments*, **1933**, **6**, 90–91).—An illustrated account of the Southwark–Emery stress–strain recorder-controller, by means of which a tensile testing machine can be automatically operated either to apply constant rates of straining or of loading or to maintain a constant load.—J. C. C.

Proposed Tentative Methods of Verification of Testing Machines. —— (*Amer. Soc. Test. Mat. Preprint*, 1933, 17–28).—Appendix to Report of Committee E–1 on Methods of Testing (see *J.*, this volume, p. 516). Certain definitions of error, percentage of error, correction, tolerance, loading range, and of an elastic calibration device are first given. There follow details of methods for verifying testing machines that measure load, for applying the load, for selecting the test loads, and for correcting eccentricity of loading. The various methods of verification are very carefully examined and their limitations summarized.—W. A. C. N.

Proposed Tentative Method of Analysis for the Particle Size Distribution of Sub-Sieve Size Particulate Substances. —— (*Amer. Soc. Test. Mat. Preprint*, 1933, 29–35).—Appendix to Report of Committee E–1 on Methods of Testing (see *J.*, this volume, p. 516). As far as the shape of the particle will permit, the size is determined in absolute units. The method is applied to homogeneous materials; its application to mixtures is limited by the properties of the components. The range of sizes covered is between 72-micron and 0·2 micron. Preliminary separation into groups of sizes may be necessary where wide ranges are being examined, in order to facilitate measurement under the microscope. Definitions of the following terms as used in the paper are given: dispersion, individual particle, aggregate, ultimate working unit, flocculation, and average diameter. Separation into size groups is obtained by elutriation using a fluid which is completely volatile and does not react chemically with the solids. In mounting the samples care should be taken that the particles are in one plane, free from motion, so dispersed as to show individual particles, unaffected by grinding during mounting and in a medium which gives maximum definition. For measurement the methods used were: (1) by direct observation using the Filar micrometer; (2) by projection, involving the throwing of an image of the particle on a screen; (3) by photomicrography and subsequent measurement of the particles on a print. In all instances the average horizontal diameter should be measured. Two hundred and fifty particles in each of three fields, taken at random, are measured. For all elutriated samples weight distribution is the basis of comparison. If 90% by weight, however, fall into one class size a frequency curve suffices.—W. A. C. N.

RADIOLOGY

On the Measurement of Stresses by X-Rays. H. Möller (*Z. tech. Physik*, 1933, **14**, 217–220).—The changes which occur in the interference lines of the X-ray spectrogram during homogeneous and heterogeneous elastic deformations, the determination of the state of stress by precision measurements of the distances between the lattice planes, and the accuracy obtainable by the use of standard substances are described.—J. W.

Gamma-Rays to Insure Internal Soundness. Dartrey Lewis (*Metal Progress*, 1933, **24**, (1), 29–31).—Gamma-rays may, on account of their greater penetrating power, advantageously supplement X-rays in the detection of internal flaws, especially in such dense materials as bronze and iron. They are especially applicable, on account of their relatively slight tendency to scatter, to the examination of irregularly shaped sections. The portability of radium facilitates the process, but the time necessary for exposure is a serious disadvantage. Costs, manipulation, and protective measures are briefly reviewed.—P. M. C. R.

XII.—PYROMETRY

(Continued from p. 457.)

Principles and Applications of Pyrometry. S. F. Godfrey (*Western Gas*, 1932, 8, (11), 25–26; *C. Abs.*, 1933, 27, 638).—Temperature measurement in industry is reviewed, and the fundamental features of practical thermocouples are described. Pure metals and uniform alloys must be used for thermocouples. Various types of instruments for measuring the e.m.f. generated are described, and the calibrated galvanometer is compared with the potentiometer type.—S. G.

Anti-Hunting Device for Pyrometric Control. Anon. (*Instruments*, 1933, 6, 102).—The "Deoscillator" introduces a small e.m.f. into the pyrometer circuit which augments the thermocouple e.m.f. when the indicator is below the control point and opposes it when the reading is "high." As a result, on a rising temperature the heat input is decreased just before the desired point is reached, and on a falling temperature it is increased just above the control point. Thus the instrument anticipates the return to normality and tends to prevent "overshooting."—J. C. C.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 457–458.)

Report on World Foundry Congress, Paris, Sept. 13–18, 1932. F. Renaud (*Rev. Mét.*, 1933, 30, 212–221).—Reviews of leading papers are given. A. Portevin surveys recent work on "castability" of metals and alloys. Castability varies inversely with the solidification interval, is greatest for pure metals, eutectics, and maximum points on the liquidus, and minimum for saturated solid solutions. It depends on the form of solidification and is relatively much greater when the liquid deposits convex crystals of definite composition than when dendrites are formed.—H. S.

Non-Ferrous Foundries in Germany. Erich Weiss (*Met. Ind.* (*Lond.*), 1933, 42, 657–658).—A brief description of details in which non-ferrous foundries in Germany differ from similar foundries in England, and of general procedure.—J. H. W.

Gases and Shrinkage. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1933, 9, 33–34).—A discussion referring to the bad effects of gas cavities in castings, the larger shrinkage resulting from the use of gas-free metal, and the undesirability of avoiding casting difficulties by the use of gas-bearing metals in place of modified casting methods.—R. G.

Sand-Casting "Hiduminium" Alloy. Anon. (*Met. Ind.* (*Lond.*), 1933, 43, 31).—Short note on the casting and mechanical properties of alloy "R.R.53," taken from a data sheet issued by the manufacturers.—J. H. W.

The Practical Deoxidation of Brasses and Bronzes. Fernando González V. (*Rev. quím.*, 1932, [N.S.], 1, (4), 9–12; *C. Abs.*, 1933, 27, 1853).—Reduction of dissolved cuprous oxide by the addition of a copper–manganese–aluminium alloy to the molten metal is described and discussed.—S. G.

Deoxidizing Brasses. W. Broniewski and —— Lewandowski (*Rev. Fonderie moderne*, 1933, 27, 175–182).—The deoxidation of brasses containing 33–40% zinc have been studied by comparing the mechanical properties of an undeoxidized alloy with alloys treated with one of 13 deoxidizers (Al, B, Be, Cu, Mn, Mg, P, Si, Ti, V, 2Al–Si, and 1Al–Ca–Si alloy), added to the extent of 0·3%. The mechanical properties were measured for each alloy in the annealed and the cold-worked states. For the 33 : 66 brass, the best results were obtained when the alloy was not deoxidized during melting, pure metals being used. Of the deoxidizers, aluminium, and particularly Alpax, gave the best results. Magnesium, and, especially, phosphorus are distinctly harmful. For the 40 : 60 brass, the best results were also obtained by using pure metals, and by deoxidizing with silicon alloys, especially the 50% aluminium alloy. Phosphorus is very harmful. In general, the practice recommended is to melt in an atmosphere rendered strongly reducing by carbon; attempts to deoxidize oxidized brass are not satisfactory, but the best results are obtained by the use of aluminium–silicon alloys.—J. H. W.

Centrifugal Bronze Gear Blanks. Francis W. Rowe (*Metal Progress*, 1933, **23**, (6), 15–19).—The structure and properties of the eutectoid constituent of the bronzes are described and illustrated; the good anti-frictional properties of these alloys are attributed to the presence of the hard eutectoid embedded in a comparatively soft matrix. The effects of small additions of lead, phosphorus, and nickel are discussed. A description is given of the development of casting methods designed to secure the increased strength demanded by modern conditions without affecting the essential bearing structure; and a tabulated comparative summary gives the mechanical properties of worm-wheel blanks of two sizes, prepared by the following methods: sand-cast, ring chill-cast, three-sided chill-cast, centrifugally cast. The last is found to give the closest and most nearly uniform structure, with the minimum of unsoundness.—P. M. C. R.

Report of Committee B–6 [of A.S.T.M.] on Die-Cast Metals and Alloys. H. A. Anderson and P. V. Faragher (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–7).—In aluminium-base alloy die-castings the copper content in alloy No. XII is reduced to 6·0–8·0%, the range of silicon content increased to 3·5% (max.), and the zinc increased to 1·5%. A comparison is made between two well-known zinc-base die-casting alloys known as XXI and XXIII. The latter is being used the more extensively. A useful discussion on the manner in which test data should be published is included. An additional sub-committee is considering magnesium-base die-casting alloys.—W. A. C. N.

Die-Castings in Aluminium–Bronze. H. Bentley (*Met. Ind.* (*Lond.*), 1933, **43**, 52).—Short account of the application of "aluminium–bronze" to die-casting.—J. H. W.

Foundry Cores. Anon. (*Fonderia*, 1932, **9**, 446–452).—The requisite properties of a good core are enumerated, and methods of manufacture, drying, and binding are described.—G. G.

Colbond in the Foundry. J. Thompson (*Found. Trade J.*, 1933, **48**, 417).—Colbond, a definite natural mineral entity, is said to have the following advantages over naturally bonded sands: (1) less moisture required; (2) easier mixing; (3) maximum spreading of the bond through the sand; and (4) the costs of transport and storage are only 10% of those of naturally bonded sands.—J. H. W.

Cement Moulds in the Foundry. Louis Maillard (*Rev. Mét.*, 1932, **29**, 605–612).—Data are given on the permeability of cement–sand moulds. Typical applications of the moulds are described.—H. S.

Some Experiments with Routine Sand Testing of Green Sand. John Hird (*Found. Trade J.*, 1933, **48**, 426–427).—Describes the apparatus and methods of making routine tests of green sand and gives typical results and the method of reporting them.—J. H. W.

Sand Testing in the Foundry. Wm. Y. Buchanan (*Found. Trade J.*, 1933, **49**, 38).—Abstract of matter not previously published in this *Journal* from a paper read before the Polish Foundrymen's Association. Describes the testing of sand for density, green strength, and permeability. See *J.*, this volume, pp. 327, 382.—J. H. W.

XIV.—SECONDARY METALS: SCRAP, RESIDUES, &c.

(Continued from p. 458.)

Utilization of Copper Waste. N. P. Sosnovskii (*Gorno-Obogatitelnoe Delo*, 1932, (7/8), 81–85; *C. Abs.*, 1933, 27, 3176).—[In Russian.] Methods of recovery of copper from factory waste containing 4% copper are discussed. —S. G.

Industrial Profit in Tin Cans. Santos Miyara (*Requind.*, 1932, **2**, 11–15; *Rev. quím.*, 1932, [N.S.], **1**, (7), 11–15; *C. Abs.*, 1933, 27, 3177).—The following methods used for tin recovery from tin cans, &c., are reviewed: heating; extraction with solutions of acids, alkalis, &c.; chlorination, and electrolysis. —S. G.

XV.—FURNACES AND FUELS

(Continued from p. 458.)

Heat-Treatment Furnaces. Anon. (*Automobile Eng.*, 1933, **23**, 215–218 and 241–244).—Recent improvements in automatically controlled furnaces are considered, particularly with reference to their use in the automobile industry for the heat-treatment of complex alloy steels and special aluminium alloys. Among the types of furnaces dealt with are electric resistance double-deck furnaces for hardening and tempering, low-temperature electric furnaces with or without forced air circulation, conveyor furnaces of the belt type suitable for use with a neutral or reducing atmosphere, multiple purpose electric furnaces used for a variety of purposes, and gas furnaces which include both normalizing and carburizing furnaces of the continuous and continuous automatic type. All the furnaces are dealt with in considerable detail, and the control equipment and methods of operation are fully considered.—J. W. D.

Foundry Furnaces [Fired] by Heavy Oil. Ch. Dennery (*Usine*, 1931, **40**, (46), 29–31).—A long abstract of a paper read before the Association Technique de Fonderie. The particular properties of oil as a fuel and the methods of its application are explained. Various types of melting furnaces are described.—H. W. G. H.

Theory of the Electric Arc Furnace. A. I. Kholodov (*Domez*, **1932**, (6), 50–61).—[In Russian.] Mathematical.—S. G.

The High Frequency Furnace in Theory and Practice for High Temperature Use. W. Esmarch (*Z. tech. Physik*, 1932, **13**, 590–591).—A short review of the theory of high-frequency induction furnaces with an account of their method of operation and some of their uses. Very high temperatures may be obtained by heating sintered tungsten in the furnace. (Cf. *J.*, 1931, **47**, 613, and *Z. Elektrochem.*, 1932, **38**, 812.)—J. W.

Induction Furnaces. P. Bunet (*Congrès internat. d'Élect., Paris, Sect.* 7, *Rapport* No. **11**, 1932, 1–25).—Cf. *J.*, this volume, p. 271. Following a brief historical review, present practice in induction furnaces is discussed. Power factor, choice of frequency, cooling of primary winding and regulation, disadvantages of exterior flux and high operating voltage, &c., receive detailed attention, and the action of small-power furnaces energized by the intermittent discharge of a condenser is described.—S. G.

A Vertical, Vacuum, Split-Tube, Graphite-Resistance Furnace. Robley D. Evans (*Rev. Sci. Instruments*, 1933, (N.S.), **4**, 391–393).—By splitting the graphite resistor tube of a vertical, evacuated, high-temperature furnace, the construction is simplified, resistor breakage is prevented, and the zone of highest temperature is brought deeper in the furnace than is the case with spiral or solid tube types of vertical furnace. The construction of the furnace cover allows crucibles to be put into, or removed from, the furnace without breaking the main vacuum seal. The melt can be observed, and the gases can be drawn off to other apparatus. The furnace attains 2000° C. on 7-kw. power input.—J. S. G. T.

Low Cost and High Quality in Electric Furnaces. H. M. Webber (*Metal Progress*, 1933, **23**, (5), 34–37).—Quality of the product should receive equal consideration with the question of the overall cost of any heat-treating process. Accurate control of temperature, of furnace atmosphere and of heating and cooling speeds, and uniform distribution of heat, are shown to be important factors in determining quality, and modern types of equipment designed to emphasize these factors are described and illustrated.—P. M. C. R.

The Electric Furnace and Its Products in the U.S.S.R. C. H. Vom Baur (*Electrochem. Soc. Preprint*, **1933**, May, 391–394).—By the end of next year 449 electric furnaces, mainly for steel production, will be installed in Russia. Brief details of the distribution of these between the various types are given with some record of their capacities.—A. R. P.

Electric Heating in Industry. —— Michaelis (*Elekt. Betrieb*, 1931, **29**, 97–101; *Sci. Abs.*, 1932, [B], **35**, 71).—M. enumerates the uses in the various industries of arc, induction, and resistance furnaces, and pays special attention to the last named. Details are given of the uses of resistance furnaces for drying purposes, heat-treatment of metals, &c. Comparative costs are given for coal, gas, and electricity, with details from a brass foundry, steel treatment, and bright-annealing.—S. G.

Electric Melting of Aluminium. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 180–181).—A brief review, referring mainly to information given by E. Fr. Russ in *Metallwirtschaft*, 1932, **11**, 593–594. See *J.*, this volume, p. 155.—R. G.

XVI.—REFRACTORIES AND FURNACE MATERIALS

(Continued from pp. 384–388.)

Report of Committee C–8 [of A.S.T.M.] on Refractories. G. A. Bole and C. E. Bales (*Amer. Soc. Test. Mat. Preprint*, **1933**, 1–6).—A Refractories Manual containing a complete set of standard specifications and methods of testing refractory materials has been issued. Methods for determining the compression and flexural strength and the shrinkage of high-temperature heat-insulating materials are suggested. In testing the softening point of fireclay brick the base of the test cone should be embedded 3 mm. in the plaque. The section on slagging attempts to correlate slag-test data with performance in service.—W. A. C. N.

Refractories. J. C. Green (*Found. Trade J.*, 1933, **48**, 354; discussion, 208–209).—The requirements of high-grade refractories are considered, and the need for using good-quality materials in the manufacture of firebricks and of efficient firing of siliceous refractories is emphasized. The present position of the refractory question in the foundry, and in particular repairs of cupola linings, are discussed. The use of cement guns is suggested for placing material, and the whole question of patching is considered. In the discussion, *C. H. Kain* gave reasons for the recent improvements in silica refractories and remarked on the unsatisfactory nature of setting cements. *V. C. Faulkner* stressed the importance of the conductivity of bricks. *A. W. G. Bagshawe* sought co-operation between the gas industrialist and the refractory manufacturer and commented on the economic side of the question. *G.* replied.—J. H. W.

Tercod—A New Refractory Brick for Electric Furnaces. G. S. Diamond (*Electrochem. Soc. Preprint*, **1933**, May, 323–326).—The brick consists of silicon carbide with or without a proportion of graphite bonded with carbon and glazed with a borosilicate flux to prevent oxidation; it has a coeff. of thermal expansion only one-ninth of that of silica brick and less than half that of ordinary carborundum brick. The brick resists abrasion at 1350° C. and suffers no less by spalling in 10 cycles at 1350° C. in an air blast; it has a modulus of rupture of 478 lb./in.^{2} at 1350° C., a porosity of 18%, *d* 2·1. specific heat 0·18, thermal conductivity 110 B.t.u./ft.^{2}/hr./in./1° F., coeff. of thermal expansion 0·0000027, and electrical resistivity 0·009125 ohm/cm.^{3} at 816° C. and 0·006625 ohm./cm.^{3} at 1482° C. Tercod brick resists acid or neutral slags at all temperatures, but is readily attacked by basic slags; it can be used for lining Detroit electric furnaces for melting copper, brass, and (if glazed with alumina instead of the borosilicate flux) nickel.—A. R. P.

Alumina as a Highly Refractory Material. H. Gerdien (*Z. tech. Physik*, 1932, **13**, 586–590).—Crucibles and other laboratory apparatus made of pure alumina consist, after sintering, of pure α-corundum and have practically the same properties as natural corundum; they are highly resistant to reducing agents, good insulators, gas-tight up to 1700° C., and, owing to their high heat conductivity, insensitive to sudden temperature changes. The chemical behaviour of sintered corundum and some of its technical uses are described (cf. *J.*, this volume, pp. 273, 329).—J. W.

Magnesite Bricks Insensitive to Temperature Changes. K. Endell (*Technique moderne*, 1933, **25**, 357).—Abstract from *Stahl u. Eisen*, 1932, **52**, 759–763. See *J.*, this volume, p. 211.—R. B. D.

Effect of Manufacturing Process of Magnesia Refractories on their Hydration. Masaji Kajiwara (*J. Japan. Ceram. Assoc.*, 1931, **39**, 433–435; *C. Abs.*, 1933, **27**, 1124).—[In Japanese.] A dead-burned magnesite composed of SiO_2 3·52, Al_2O_3 0·99, Fe_2O_3 5·85, CaO trace, MgO 90·52, and MnO 0·56% has been made by firing a dried slurry prepared by grinding a caustic burned magnesite and a siliceous pyrite cinder with water. The crystals of periclase were one-third to one-half the size of those in an Austrian product. It was, however, far more resistant to the action of slaking. The effects of the fineness of the slurry, the time of storing, and the rate of heating are discussed.—S. G.

Proposed Tentative Methods of Testing High-Temperature Heat Insulation (Compression Flexure Shrinkage). (C—33 T.) —— (*Amer. Soc. Test. Mat. Preprint*, 1933, 7–11).—Appendix to Report of Committee C–8 on Refractories (see *J.*, this volume, p. 524). In the compression test the specimen should be half a brick (approx. 4½ × 4½ × 2½ in.), having true parallel planes. The usual precautions in the setting of the test-piece in the testing machine should be taken. The speed of loading should not exceed 0·05 in. per minute, and the specimen should be compressed to a deformation of 5% of the original thickness, provided failure has not previously occurred. In flexure testing the knife edges on which the specimen rests should be as long as the width of the brick, and spaced 7 in. apart. Shrinkage is to be determined after maintaining the standard specimen at the maximum appropriate temperature for 5 hrs, and then allowing it to cool to 260° C. Volume shrinkage is calculated from the change in dimensions along the three major axes.—W. A. C. N.

Thermal Expansion of Refractory Bricks. Seiji Kondo and Akitaro Mannami (*J. Japan. Ceram. Assoc.*, 1931, **39**, 576–581; *C. Abs.*, 1933, **27**, 1124).—[In Japanese.] The linear expansion of Japanese refractory bricks was determined. The shrinkage temperatures of grog brick, agalmatolite brick, and silica brick were 1153°–1285°, 1090°–1240°, and 1504° C., respectively, and their mean coeff. of expansion from room temperature to the shrinking temperatures were 0·0000046–0·000073, 0·0000051–0·0000066, and 0·0000489, respectively. The results of experiments in which linear expansion was determined under a small load by a special apparatus up to 1550° C. are described.—S. G.

Thermal Conductivity of Refractory Bricks. Seiji Kondo and Hiroshi Yoshida (*J. Japan. Ceram. Assoc.*, 1931, **39**, 657–663; *C. Abs.*, 1933, **27**, 1124).—[In Japanese.] The thermal conductivities of refractory bricks, building bricks, and an insulation brick were determined by means of a small water calorimeter. The mean values at different temperatures up to about 1200° C. are shown in tables and diagrams. The conductivities increase steadily with increase of temperature except in magnesia and chrome refractories. The mean conductivities in grm. cal./cm./° C./second are given. —S. G.

Conduction of Heat in Powders. W. G. Kannuluik (*Proc. Roy. Soc.*, 1933, [A], **141**, 144–158).—A description is given of a hot-wire method of determining the thermal conductivity of powders in gases, and results are given for glass spheres, diphenylamine, magnesium oxide, and a series of graded carborundum powders immersed, in turn, in air, hydrogen, carbon dioxide, and, in some cases, in helium. The conductivities were measured over the pressure range 0·5–76 cm. of mercury. The conductivity, k, is related to the pressure, p, by the equation $p/k = ap + b$.—J. S. G. T.

XVII.—HEAT-TREATMENT

(Continued from p. 388.)

Some Present Questions of Furnace Operation in the Annealing of Metals. V. Paschkis (*Z. Metallkunde*, 1933, **25**, 93–95, 117–121).—Chiefly theoretical considerations on the factors controlling the heat consumption and the possibility of heat economy for which the original paper must be consulted. The control and regulation of temperature, and the accuracy and sources of error of temperature measurements are also discussed.—M. H.

XVIII.—WORKING

(Continued from pp. 388–393.)

Dimensions, Materials, and Lubrication of Bearings of Rolling Mills. A. Kretzler (*Rev. Mét.*, 1932, **29**, 613–618).—A practical review of the subject, with special reference to design and operating features.—H. S.

Simplified Methods of Calibration for the Rolling of Non-Ferrous Metals. O. Emicke (*Z. Metallkunde*, 1933, **25**, 127–131; discussion 132).—Describes the control of calibration for rough and finish rolling of non-ferrous metals and alloys, especially of wires of 6–20 mm. in diameter, by means of simple graphic methods.—M. H.

Making Aluminium Foil. H. Obermüller (*Met. Ind.* (*Lond.*), 1933, **43**, 32).—See also *J.*, this volume, p. 376. A brief account of the manufacture of aluminium foil.—J. H. W.

Machining Aluminium. W. B. Francis (*Met. Ind.* (*N.Y.*), 1933, **31**, 158).—Hints on tools for turning and drilling aluminium.—A. R. P.

Progress in Machine Shop Practice. —— (*Amer. Soc. Mech. Eng. Preprint*, 1932).—Report of the Committee of the Machine Shop Practice Division of the American Society of Mechanical Engineers. Deals with advances made in welded structures, die-casting, material handling facilities, precision grinding machines, die cutting and engraving machine, gear generating machinery, and drop forging hammers.—W. P. R.

Modern Methods of Production of Small Machined Work. W. Fish (*Mech. World*, 1931, **89**, 154–155).—A brief abstract of a paper read before the Junior Institution of Engineers. The growth of the electrical, motor, and wireless trades has created a demand for large quantities of small machined and pressed parts. For example, a 3-valve wireless receiver includes possibly 2000 components, the total manufacturing cost of which must be kept down to 20*s*. or 30*s*. Although brass screws ⅝ in. long under head can be produced at the rate of one in 2½ seconds, efforts are being made to lessen time lost in feeding, by feeding coiled wire instead of straight bars, and it is hoped that the metallurgist will discover materials which will machine more easily without suffering in physical properties.—F. J.

What Can Be Accomplished with Modern Machine Tools and Cemented Carbide Cutting Tools. Arthur A. Merry (*Amer. Soc. Mech. Eng. Preprint*, 1932, Dec., 1–6).—In order to show the possibilities of cemented carbide tools, tests are described which were carried out on a lathe specially built for this purpose. The lathe is driven by a 100-H.P. motor, and the maximum speed is 1200 r.p.m. with such equipment cemented carbide tools removed 161 cu. ins. of nickel steel per minute. In one special test a single pointed tool removed material at the rate of 1⅓ tons per hr.—W. P. R.

Grinding Cemented Tungsten- and Tantalum-Carbide-Tipped Tools Economically. J. M. Highducheck (*Amer. Soc. Mech. Eng. Preprint*, 1932, Dec., 1–4).—Localized heating of a carbide-tipped tool causes cracking. Soft grinding wheels should be used, but the wheel should have sufficient strength to prevent its breaking down. In order efficiently to rough-grind clearance angles on tunsten carbide tool, it is necessary that the contact surface between the tool and the grinding wheel be a line and not a surface.—W. P. R.

Hard Metals in Drilling. M. B. Together (*Allgem. Österr. Chem. Tech. Zeit.*, 1932, **50**, 223–225, 235–237).—The structure and properties of hard metals containing tungsten carbide and their use in drilling are described. —A. R. P.

Recommendations for the Selection of Metal Working Oils. K. Krekeler (*Schweiz. Verband für die Materialprüfungen der Technik, Diskussionsber.*, No. **24**, 1932, 19–22).—The properties of oils and oil emulsions for use in drilling, turning, and drawing metals are discussed. Addition of graphite has no effect whatever on the power required in drawing wire.—A. R. P.

XIX.—CLEANING AND FINISHING

(Continued from pp. 393–396.)

Carbon Tetrachloride as a Technical Degreaser. Max Richter (*Chem. Zeit.*, 1933, **57**, 545).—If carbon tetrachloride is quite dry, its vapour has very little corrosive action on most metals, and is suitable for degreasing prior to plating. Since it is cheap and non-inflammable, it forms a good substitute for trichlorethylene. To prevent the action of moisture, anhydrous calcium chloride should be placed in the heating vessel with the tetrachloride.—A. R. P.

Researches on Chlorate Colouring Baths. H. Krause (*Mitt. Forschungsinst. Edelmetalle*, 1933, **7**, 17–24).—The colours produced on copper and on various brasses and bronzes by pickling for different periods in chlorate baths containing various addition agents are tabulated and the mechanism of the reactions involved is discussed.—A. R. P.

Surface Treatment of Light Metals. René Leonhardt (*Oberflächentechnik*, 1933, **10**, 106–107).—Polishing and plating processes are briefly described. —A. R. P.

On Researches with Oils Used in Polishing [Metals]. H. Stäger (*Schweiz. Verband für die Materialprüfungen der Technik, Diskussionsber.*, No. **24**, 1932, 5–17).—The characteristics of good oils for grinding and polishing metals, especially steels and cast iron are discussed.—A. R. P.

The Size Control of Abrasive Powders. Henry R. Power (*Metal Cleaning and Finishing*, 1933, **5**, 40–41).—A review.—S. G.

XX.—JOINING

(Continued from pp. 396–405.)

Modern Riveting Practice in Foreign Aero Construction. Wilhelm Pleines (*Z. Flug. u. Motor.*, 1933, 24, (3), 65–75).—Cases of failure in adjacent and apparently similar Duralumin rivets are attributed to lack of standardization in working, heat-treatment, and storage. American practice with regard to these is reviewed. Emphasis is laid on the necessity for close temperature control and efficient heat distribution during heat-treatment, on quick and effective quenching, and on arrangements for cold storage: quenching baskets and storage containers are illustrated, and the results of investigations on these points carried out by a firm of aircraft constructors are summarized. English work is reviewed on the stability and limitations of riveted joints, standardization of size, shape, and position of rivets, strength of lapped joints, and the De Bergue process is described and illustrated. A bibliography is appended.—P. M. C. R.

109° Below Zero [Suppressing Ageing of Duralumin Rivets]. Charles O. Herb (*Machinery* (*N.Y.*), 1933, **39**, 305–309; and *Machinery* (*Lond.*), 1933, **41**, 757–760).—Includes a description of dry ice (solid carbon dioxide) refrigerators suitable for maintaining heat-treated aluminium alloy rivets at − 20° F. (− 29° C.) to prevent age-hardening before use.—J. C. C.

Soft Solders and Fluxes. O. F. Hudson (*Met. Ind.* (*Lond.*), 1933, **42**, 468–470, 494–496).—Abstract of a paper read before the Sheffield Local Section of the Institute of Metals. Solders are classified as soft (low melting point alloys) and hard (silver and brazing solders). The principles of soldering and the action of fluxes are described. Zinc chloride is generally used as a flux, but the addition of ammonium chloride in eutectic proportions gives better results. Soft solders consist primarily of alloys of lead, tin, and antimony. The chemical composition, grades, physical properties, and applications of British Standard soft solders are given, and the characteristics of soft solders other than the lead–tin alloys are briefly described.—J. H. W.

New Type Flux [Flosol Cream]. Anon. (*Chem. and Met. Eng.*, 1933, **40**, 154).—A very brief note. Soldering of most of the commonly used metals except aluminium and its alloys is said to be readily accomplished by the use of a new flux named "Flosol Cream." This is applicable where the prevention of rust is of vital importance. A thin film of flux is applied like paint and neither runs nor spreads.—F. J.

Non-Corrosive Organic Flux for Soldering. Tsuneo Suzuki and Kazuhiko Oma (*Rikwagaku Kenkyū-jo Iho* (*Bull. Inst. Phys. Chem. Res. Tokyo*), 1932, **11**, 1060–1061; and English abstract, *Sci. Papers Inst. Phys. Chem. Res. Tokyo*, 1932, **19**, (380–382); *C. Abs.*, 1933, **27**, 55).—A certain derivative of $C_6H_4(CO)_2O$, such as $C_6H_4(CONH_2)CO_2H$, $C_6H_4(CO_2H)CO_2NH_4$,$C_6H_4(CO_2NH_4)_2$ in 1–5% aqueous solution containing 30% $CH_2OH{\cdot}CHOH{\cdot}CH_2OH$, applied as the soldering flux, dissolves oxides from the metallic surface, and soldering can easily be effected. On continued heating, the excess of the flux is converted into $C_6H_4(CO)_2NH$ and volatilizes at 238° C., leaving none of the corrosive compound, but only a trace of metallic oxides (Japanese Patent No. 92,672). Although the NH_4 salts of $(CH_2CO_2H)_2$ may also be used, the irritant fumes of volatilized succinimide exclude them from practical use. —S. G.

Soldering Glass to Metal. J. F. Kesper (*Diamant*, 1932, 54, 256; *Ceram. Abs.*, 1933, **12**, 56).—A brief description is given of the method followed in soldering glass.—S. G.

Electric Welding. M. Mathieu (*Bull. Soc. Franç. Élect.*, 1931, **1**, 810–845; *Sci. Abs.*, 1932, [B], **35**, 23).—Describes weldings by d.c., 1-phase, and 2-phase, and by various methods, including resistance, spark, arc, and hydrogen-arc.

Each method is discussed in detail. Resistance welding: 1-phase, l.f. is preferable, but the use of h.f. and condenser discharges is also mentioned. Spark welding: whereas the former method needs a l.t., high-current supply, spark-welding needs a higher voltage and lower current; on the ends to be welded attaining a suitable temperature, pressure is applied to force them together. Arc welding with a carbon electrode is limited by surface oxidation, and welding by arc in an atmosphere of hydrogen is the method next detailed; a tungsten electrode is usual with this process. Then follow the details of the design of machines for different welding processes, including desirable characteristics, size, rating, automatic regulation, conditions for stability, &c. —S. G.

Modern Welding Machines and their Applications. P. Neumayer (*Bull. Soc. Franç. Elect.*, 1931, 1, 846–855; *Sci. Abs.*, 1932, [B], 35, 23).—A consideration of generators for resistance and arc welding. Both d.c. and 1-phase generators are dealt with, the former being predominant in the paper, the generator usually being compounded and having both field control for voltage and series resistance for current. General considerations are followed by desirable characteristics required, and, finally, by several applications of welded joints including the now common fabricated construction.—S. G.

XXI.—INDUSTRIAL USES AND APPLICATIONS

(Continued from pp. 459–469.)

Aluminium as a Cause of Cancer. Heinrich Zellner (*Chem.-Zeit.*, 1933, 57, 193–194).—It is maintained that alumina in food does not produce cancer and that the small quantity derived from aluminium cooking utensils is far less than naturally occurs in many foods.—A. R. P.

Aluminium as a Cause of Cancer. O. Baumann. Heinrich Zellner (*Chem.-Zeit.*, 1933, 57, 424–425, 496).—A discussion of Z.'s article (cf. preceding abstract) and a reply. B. considers that alumina is non-toxic, but suggests that cooking food in aluminium vessels may produce toxic substances, since aluminium is a powerful reducing agent and readily reduces many organic compounds, thus it decolorizes yolk of egg and discolours wine. No data have yet been published of work done on these lines. Z. maintains that aluminium salts are non-toxic.—A. R. P.

Aluminium as a Cause of Cancer. —— Kornick (*Chem.-Zeit.*, 1933, 57, 576).—A reply to Baumann (preceding abstract). Iron is much more active in reducing organic matter than is aluminium, and readily discolours acid foods, hence the contention that cancer has increased since aluminium vessels have come into common use cannot be upheld on this account. Granted that ironware is usually enamelled, a great deal of use is made of it after the enamel is chipped to expose the metal.—A. R. P.

Possible Uses of Aluminium. Anon. (*Aluminium*, 1933, 15, (8), 1–3).—The sphere of usefulness of aluminium in domestic appliances, as a wrapping material in the form of foil, in the chemical and foodstuff industries, and in electrical work, is reviewed.—A. R. P.

Aluminium Dairy Utensils. Anon. (*Milk Trade Gazette*, 1933, Jan. 7; *Aluminium Broadcast*, 1933, 3, (42), 10–12).—J. C. C.

Use of Aluminium in Dairy Equipment. H. A. Trebler (*Aluminium Broadcast*, 1933, 4, (6), 2–8).—Extracts, with full bibliography, from a paper to the International Association of Milk Dealers. The non-toxicity, absence of effect on flavour, and nutritional value, and low solubility of aluminium make it the best material for handling milk. Necessary precautions include avoiding contact with other metals, adding silicate to cleaners and chromate to brines, and using rubber gaskets to connections.—J. C. C.

Aluminium Booms and Buckets on Mississippi Levees. Douglas B. Hobbs (*Engineering News-Record*, 1933, **110**, 192–194).—A detailed comparison is made between a composite 175-ft. aluminium–steel dragline excavator boom and a 150-ft. all-steel boom. The weight of the aluminium boom is 37·0% less, the overturning moment 9% less, the swing inertias with full and empty buckets 8·6% greater and 4·1% less, respectively, and the speed of excavation 10–30% greater. Further, by substituting aluminium–steel for all steel construction, the weight of 2 cubic yard buckets is decreased by 49–54·7% and the payload increased by 1500 lb.—J. C. C.

Electrical Condensers Using Aluminium. G. Gualtierotti (*Ingegneria moderna*, 1932, **10**, 356–365).—A long, detailed study, illustrated by a number of diagrams, on the effect of alloying elements in aluminium on the impedance, capacity, resistance, and probable life of condensers of the various commercial types.—G. G.

Aluminium Cylinder Heads Urged as Way to Better Design. F. F. Kishline (*J. Soc. Automotive Eng.*, 1933, **32**, 121–123).—Actual gains in performance have been registered by using aluminium instead of iron for cylinder heads in internal-combustion heads. The reason for the improvement is somewhat obscure.—W. P. R.

New Road Vehicles and Coachbuilding in Light Metals. M. Koenig (*Allègement dans les Transports*, 1933, (5–6), 58–64).—A brief review is given of modern practice in the design of motor-coach bodies incorporating pure aluminium and its alloys Anticorodal and Aluman. Bodies constructed of light metals are stated to be lighter than similar bodies made with high-strength steels.—R. B. D.

The Savings in Weight being Effected in Railway Rolling Stock by the Use of Aluminium and its Alloys in Place of Steel. Anon. (*Allègement dans les Transports*, 1933, (5–6), 71).—A table gives comparative figures obtained in the U.S.A. for the weights of various parts of motor and trailer rail coaches and of tramway cars in steel and also in aluminium. The reduction in weight varies from 29·7 to 31%.—R. B. D.

Aluminium Plymax. Anon. (*Aluminium Broadcast*, 1933, **4**, (8), 14–15).—"Plymax" consists of plywood to which thin sheet galvanized steel or aluminium is cemented on one or both sides. It is used for vehicle bodies and panelling generally.—J. C. C.

Thermal Insulation with Aluminium Foil. Anon. (*Metallurgia*, 1933, **7**, 190).—The efficiency of various types of aluminium foil air-cell insulation, which depends on a combination of the low thermal conductivity of air with the low emissivity or radiating power of bright aluminium foil in a structure designed to minimize air convection currents, is considered. These include the plain air-cell type, the type with corrugated separators between the sheets of aluminium foil, and the type containing crumpled aluminium foil. The first type is the most efficient, due to low air convections currents, such currents being more pronounced in the other two, particularly the latter.
—J. W. D.

Aluminium Foils and Plates for Photomechanical Impressions. Karl Hansen (*Aluminium*, 1933, **15**, (1), 4–5).—The lightly sand-blasted metal is coated in a yellow light with an albumen solution containing ammonium bichromate and a little ammonia. The photographic negative is then fixed firmly to the dried coating and the whole exposed to bright sunlight or to the light of an arc or powerful half-watt lamp. The negative is removed and the film covered with a thin layer of oil-paint (so-called developing paint), dried in a current of cold air, and allowed to soak in a cold-water bath for some minutes. Developing is effected by gentle rubbing with a pad of cotton wool under water. After touching up and drying, the plate is etched with a thick rubber solution containing 4 drops of phosphoric acid in 10 c.c., and is then ready for use in printing.—A. R. P.

Anaconda Hollow Copper Conductors. T. J. Little (*International Conference on Large H.T. Systems, Paris*, **1931**, 1–18; *Sci. Abs.*, 1932, [B], **35**, 183).—An account is given of the uses, design, and test results of the Anaconda hollow copper conductor. The purpose of the conductor is to reduce loss due to corona and skin effect. It consists of a flat-rolled soft copper I-beam which is spiralled on its longitudinal axis in helical fashion to form the core, and of a layer of hard-drawn copper wires which is then cabled around this in a direction opposite to the lay of the core. Details are given of the physical properties and tests of corona loss. Anaconda conductor is stated to be immune from vibrational fatigue. The accessories used are described, and an account is given of some installations where Anaconda conductor is employed.—S. G.

Copper Roof and Wall Construction. Anon. (*Eng. and Min. J.*, 1933, **134**, 95).—A note on possible applications of laminate metal using electrodeposited copper. The copper sheets have the burnished appearance of rolled copper in weights varying from 1 oz. to 8 oz. per ft.^{2}, in widths of 30 to 50 in. and in unlimited lengths. The most promising application of the sheets is for built-up metal roofing, with asphalt and also with a backing of heavy cotton fabric impregnated with asphalt bonded to the copper by a coating of pitch compound.—R. Gr.

Copper–Nickel Tubes; Their Advantages for Steam Condensers. Robert Worthington (*Metal Progress*, 1933, **24**, (1), 20–24).—The greater cost of installing copper–nickel condenser tubing (20% nickel) in place of Admiralty brass is shown by the results of actual working to be more than justified. The superior performance of the copper–nickel is attributed to the compact and resistant nature of the protective film developed on its surface; this remains unbroken under the exacting conditions of modern turbine practice, which often cause rapid breakdown in Admiralty tubing. The general mechanism of corrosion is discussed, and the influence on it of the high velocities and turbulent flow characterizing modern conditions is considered.—P. M. C. R.

Lead-Boring Beetles. Henry P. Ehrlinger (*Eng. and Min. J.*, 1933, **134**, 122).—A letter to the Editor, containing a note on and illustration of the Monochamus Titillaria, commonly known as the lead-boring beetle. Heating the infected areas with live steam kills all the larvæ.—R. Gr.

Elektron in European Omnibus and Lorry Construction. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 180–184, 202–204).—The applications of Elektron to the manufacture of various parts of heavy transport vehicles is described.—J. H. W.

Molybdenum. Its Mining, Milling, and Uses. Alan Kissock (*Min. and Met.*, 1933, **14**, 181–182, 189).—A review.—A. R. P.

Pure Nickel for the Chemical Industry. Anon. (*Apparatebau*, 1933, **45**, 49–52).—An illustrated article showing the high serviceability of nickel as construction material in numerous branches of the chemical industry. Qualitative data are given on the corrosion-resistance against various chemical agents.—M. H.

Nickel Clad Steel Plate Work. W. G. Humpton, F. P. Huston, and R. J. McKay (*Japan Nickel Rev.*, 1933, **1**, 168–176).—[In English and Japanese.] Light-gauge highly-finished products of nickel and steel bonded and rolled in intimate contact have been known for many years. The newer products, however, are of much heavier thicknesses, with the nickel about 10% of the whole, intended for more massive structures. The methods which have been adopted in the manufacture of the modern material, the precautions it is necessary to take, and the procedure in forming the plate into shapes are described and discussed. Pure nickel rivets have been found best hitherto for preserving the essential continuity of the nickel surface. All possibility of steel being exposed at joints is prevented by careful caulking with a tool slightly more rounded than is normally used. By adopting appropriate methods there is no loss of strength by using nickel-clad steel, instead of all steel, structures.—W. A. C. N.

Nickel and Nickel Alloys for Oil-Refinery Equipment. O. B. J. Fraser (*Refiner Natural Gasoline Manuf.*, 1933, **12**, 162–173; *C. Abs.*, 1933, **27**, 3433).—Compositions, properties, and corrosion data are given for several alloys.—S. G.

Monel Metal in Pickling Installations. A. Jaeschke (*Glashütte*, 1933, **63**, 132–133; *C. Abs.*, 1933, **27**, 2656).—Data are given on the manufacture of Monel metal. The two main properties which make it so suitable for use in pickling installations are (1) its high strength and resistance to the corrosive action of acids used in pickling, and (2) the ease with which it can be worked. It is resistant to almost all acid solutions except nitric and sulphuric acids. —S. G.

Platinum in 1932. Charles Engelhard (*Met. Ind.* (*N.Y.*), 1933, **31**, 134).—A brief review.—A. R. P.

The March of Platinum in Industry. Edmund M. Wise (*Metal Progress*, 1933, **23**, (4), 36–40).—A survey of the progressive adoption of platinum as a catalyst, as thermo-couple wire, in electrical contacts, in thermionic amplifiers, in ornamental work, and as laboratory ware. Some uses of the associated metals are also given.—P. M. C. R.

Silver and Its Uses in Chemical Plant. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 345–346).—The physical properties and chemical behaviour of silver are briefly reviewed, and its application to the manufacture of acetic acid and other chemical plant and the use of "doublé" (pure silver sheet rolled on to copper or other base metal) are described.—J. H. W.

Spinnerets of Tantalum. Anon. (*Siemens Z.*, 1933, **13**, 132).—Tantalum must be regarded as the most suitable material for spinnerets used in the manufacture of artificial silk.—M. H.

On the Application of the Hard Metal Widia in Technology. C. Agte (*Forschungen u. Fortschritte*, 1933, **9**, 42–43).—A short review.—J. W.

Proposed Revised Tentative Specifications for Zinc-Base Alloy Die-Castings. —— (*Amer. Soc. Test. Mat. Preprint*, **1933**, 8–11).—Appendix to Report of Committee B-6 on Die-Cast Metals and Alloys (see *J.*, this volume, p. 522). The alloys are to conform to the following composition—

	Alloy XXI.	Alloy XXIII.
Copper, %	2·5–3·5	0·10 (max.)
Aluminium, %	3·5–4·5	3·5–4·5
Magnesium, %	0·02–0·10	0·03–0·08
Iron (max.), %	0·100	0·100
Lead (max.), %	0·007	0·007
Cadmium (max.), %	0·005	0·005
Tin (max.), %	0·005	0·005
Zinc, %	remainder	remainder

The average expansion after exposure to water vapour at 95° C. for 10 days shall not exceed 0·0025 in. per in. for alloy XXI and 0·0010 for alloy XXIII. Tension and impact values are not necessarily determining factors in the acceptance of these castings, but when specified should conform to the following limits—

	Average.		Individual.	
	XXI.	XXIII.	XXI.	XXIII.
Tensile strength (min.), lb./in.^{2} .	44,000	35,000	35,000	30,000
Elongation (min.), % on 2 in. .	2·0	3·0	0·5	2·0
Charpy impact (min.), ft.-lb. .	6·0	12·0	4·0	8·0
After exposure to water vapour at 95° C. for 10 days—				
Tensile strength (min.), lb./in.^{2} .	30,000	30,000	...	...
Elongation (min.), % on 2 in. .	0·5	1·5	...	...
Charpy impact (min.), ft.-lb. .	0·75	14·0	...	...

The dimensions of the test-pieces are given in two illustrations.
—W. A. C. N.

Vibrations in Free Transmission Lines and Their Damping by Resonance Vibrators. Fritz Puritz (*Metallwirtschaft*, 1933, **12**, 35–38).—The vibrations of the masts and lines of overhead electrical transmission systems by the wind have been investigated, and the construction and testing of a damping device by the aid of which it is possible to prevent these vibrations from reaching the danger limit are described.—v. G.

Development of Underground H.T. Cables. J. Delon (*Congrès internat. d'Élect., Paris, Sect.* 7, *Rapport* No. 9, 1932, 1–16; *Sci. Abs.*, 1932, [B], **35**, 711).—A brief historical summary is given of the improvements in underground high-tension cable construction since 1881, showing the gradual increase of operating voltage up to the proposed 220 kv. A section of the paper is devoted to oil-filled cables, and others to lead coverings, methods of resisting corrosion, and protective devices.—S. G.

Manufacture of Cable and Overhead Equipment. A. L. Sanders (*Trans. S. African Inst. Elect. Eng.*, 1932, **23**, 191–202, discussion, 202–204; *erratum*, 273; *Sci. Abs.*, 1932, [B], **35**, 710).—The paper deals with (1) the history of the development of insulated cables, together with a supplement giving a short history of the manufacture of paper-insulated cables; (2) the development of telephone cables; (3) materials used in cable manufacture; (4) copper used for conductors of electric cables; (5) wire-drawing; (6) stranding the conductors; (7) paper used for insulation; (8) insulating and assembly of the cores; (9) drying; (10) impregnating; (11) lead covering; (12) routine testing; (13) armouring and finishing; and the Grid system.—S. G.

Metallurgy of Refining Equipment. R. L. Duff (*Refiner Natural Gasoline Manuf.*, 1933, **12**, 110–114; *C. Abs.*, 1933, **27**, 3426).—A discussion of the selection and applicability of alloys and metals for all important refinery equipment.—S. G.

XXII.—MISCELLANEOUS

(Continued from pp. 469–476.)

Metals in the Service of Human Life and Industry. (Sir) Harold Carpenter (*British Science Guild. Research and Development Lecture*, **1933**, 1–39; and (abstract) *Met. Ind.* (*Lond.*), 1933, **42**, 546).—Metals are the products of the physical universe which have contributed most to the material wants of humanity. In a great variety of ways metallic materials enter into the activities of life, and it is almost impossible to trace all the ramifications in which they are involved. In a wide sense industry means all the purposeful productive activities of mankind, and these include agriculture, fishing, mining, and metallurgy. In both material and mental directions metallurgy has great achievements to its credit. The metals used by engineers in the earliest days had already long been known. Subsequently, however, reciprocal developments in the two branches occurred. The earth's crust, possibly originally molten, has suffered much differentiation by geological, physical, and chemical processes, with the result that the various metals, mostly in the form of compounds, are segregated in particular districts. The industrial history of mankind may be conveniently divided into two major epochs, a Stone Age and a Metal Age, between which was a transitional period in which native metals were used as stones. The outstanding discovery of our present civilization was the smelting of a metal from a stone. The art of the metal-smith was one of the earliest to be developed, but the real expansion came when it was realized that metals could be smelted, and the products therefrom fashioned into useful articles for every-day use. The fascinating story of the subsequent production of iron and steel and the common non-ferrous metals is unfolded by C. In the next section the casting, mechanical, chemical, and physical properties of metals and alloys are considered. The last section is devoted to a consideration of the effects of science on metallurgy and the metal arts. The definite urge to progress and research is of comparatively recent date, and some of the outstanding examples of the results of such investigation are quoted—the development of aluminium, magnesium, and beryllium, the introduction of high-speed tool steels and of carbide cutting alloys, the advance of stainless steel, and the world-wide use of manganese steel.—W. A. C. N.

Ancient Egyptian Antimony Plating on Copper Objects. A Rediscovered Ancient Egyptian Craft. Colin G. Fink and Arthur H. Kopp (*Metropolitan Museum Studies*, 4, 1933, 163–167; *C. Abs.*, 1933, 27, 2628).—A copper ewer and basin of the Fifth or Sixth Dynasty were found to be plated with antimony. After a careful analysis and many tests it was possible to obtain bright antimony plates by the electrolytic displacement method with only such chemicals as were available 5000 years ago.—S. G.

The Antimony Industry During the Last Twenty Years. Kia Ho (*Science* (*China*), 1933, 17, 11–30; *C. Abs.*, 1933, 27, 2015).—A historical review, with figures for production and purity of product.—S. G.

International Foundry Congress. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, 8, 131–132).—A brief account of the papers presented at the meeting in Paris, September 1932.—R. G.

Electrical Precipitation. M. Shibusawa and S. Fukuda (*Congrès internat. d'Elect., Paris, Sect.* 12, *Report* No. 1932, 1932, 1–7; *Sci. Abs.*, 1932, [B], 35, 782).—The authors state that their previous research has shown that the rapidity with which charged particles are removed by electrical precipitation is proportional to the actual charge carried by the particle and to the intensity of the field through which the charged particles are carried, or are in movement. The measurement of the amount or value of the charge which can be carried by a particle is therefore very important in its bearing on the efficiency of electrical precipitation, and the present paper gives the results of their investigations on this subject. The following conditions have been arrived at as favouring rapid separation of the dust particles: (1) small diameter of the collecting and of the discharge electrodes; (2) high e.m.f. of the discharge; (3) high temperature of the gases; and (4) low density of the particles in the gas which is being cleaned.—S. G.

Report of Committee E-9 [of A.S.T.M.] on Research. H. F. Moore and C. L. Warwick (*Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 319–322).—The researches now being undertaken include the following: the effect of tin and arsenic on high-speed tool steels; the yield point of structural steel; fatigue of metals; effect of phosphorus and sulphur on steel; the effect of temperature on the properties of metals; mineral aggregates; corrosion of electroplated coatings; tin and lead-base die-casting alloys; light metals and alloys.—W. A. C. N.

High-Temperature Research. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, 8, 49–50).—Some remarks concerning the new research programme of the American Society for Testing Materials and the questions of overlapping and international co-ordination.—R. G.

Research and the American Society for Testing Materials. F. O. Clements (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 31–39).—Presidential address.—S. G.

Scope of Research Management. C. E. K. Mees (*Indust. and Eng. Chem.*, 1932, **24**, 65–66). **Logical Divisions of a Research Organization.** Francis C. Frary (*ibid.*, 1932, **24**, 67–68). **Principles of Research Laboratory Management.** G. W. Thompson (*ibid.*, 1932, **24**, 68–71). **Co-Ordination of Laboratory and Plant Effort.** C. M. A. Stine (*ibid.*, 1932, **24**, 191–193). **Preparatory Stage of Research.** M. L. Crossley (*ibid.*, 1932, **24**, 193–194). **Functions of a Laboratory Organization.** Robert R. Williams (*ibid.*, 1932, **24**, 194–198). **Direction of Investigation in the Experimental Stage.** H. L. Trumbull (*ibid.*, 1932, **24**, 199–202). A series of articles on "Management of Research" which considers the functions of laboratory organization and the co-ordination of laboratory and plant effort.—F. J.

Industrial Research as a Profitable Business. Anon. (*Metal Progress*, 1932, **22**, (2), 41–45).—An account of the research organization of the General Motors Corporation, Detroit, U.S.A., with a survey of the scope and activities of the various sections.—P. M. C. R.

Co-operative Chemical Engineering Research in the University. D. B. Keyes (*Indust. and Eng. Chem.*, 1932, **24**, 947–949).—Experience has clearly shown that between industry and the university the only co-operative problems which are mutually satisfactory are those that the university research workers are well adapted to undertake and those that are of such a nature that, on publication of results, will widely attract interest and respect. The necessity for strengthening the teaching staff by adding well-trained experienced research men who have shown research ability in industry is pointed out. Advantages of co-operative research, and examples of success attending such co-operation are discussed. Co-operative investigations, financed by industries or groups of industries and carried out in universities, under proper management, are bound to succeed.—F. J.

Information Service in Industrial Research Laboratories. Julian F. Smith and Irene F. Smith (*Indust. and Eng. Chem.*, 1932, **24**, 949–953).—The research director of to-day cannot stop at providing library facilities in the way of ample bookshelves and patent files. He must arrange for the information to be distributed to the laboratory's staff at minimum cost. The functions of such information service and the qualifications of the person in charge thereof are discussed. Its fundamental principles, cost and performance, measures of performance, current literature bulletins, research laboratory records, correlation of separate units, searches made by chemists, service in small laboratories, and the application of fundamental principles are also dealt with.—F. J.

A Banker's Viewpoint of Industrial Research. Broderick Haskell, Jr. (*Indust. and Eng. Chem.*, 1932, **24**, 953–955).—No more significant tribute to research can be made than to compare a list of industrial common stocks measured by the frequency with which they appear in the portfolios of investment trusts with a list of companies measured by their activity in industrial research. The order of names on each list is almost identical. For research in industry to be of sound commercial value and beyond the category of rank speculation, it must have as its foundation a vast accumulation of diversified experience, it must be served by large resources and trained judgment, and it must have opportunity for great latitude. The financing of research, publicity in research, and research at the present time are discussed. Industrial research is regarded as one of the strongest factors making for recovery from the present depression.—F. J.

Chemical Research in the Depression. Maurice Holland and W. Spraragen (*Indust. and Eng. Chem.*, 1932, 24, 956–960).—The data provided by a survey recently made by the [U.S.] National Research Council through its Division of Engineering and Industrial Research are discussed. They show that even in times of adverse business conditions the leaders of chemical industry should turn to research as a useful tool in maintaining their profits and reducing losses to a minimum.—F. J.

Stabilized Research—A National Research. L. V. Redman (*Indust. and Eng. Chem.*, 1932, 24, 1198–1199).—Presidential Address to the American Chemical Society.—F. J.

Report of Committee E-8 [of A.S.T.M.] on Nomenclature and Definitions. Cloyd M. Chapman and R. E. Hess (*Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 515–518).—A summary of the year's work and a glossary of terms and certain standard definitions.—W. A. C. N.

Organization of Scientific Research in France. Albert Ranc (*Chim. et Ind.*, 1932, Special No. (March), 862–866).—S. G.

Organization of Scientific Research in Germany. Jean Fleury-Bernheim (*Chim. et Ind.*, 1932, Special No. (March), 867–871).—S. G.

New Tools for High-Temperature Research. Robert B. Sosman (*Indust. and Eng. Chem.*, 1931, 23, 1369–1374).—Uniformity of temperature is most complete in a liquid which is stirred, and this condition is approximated in some of the newer fuel-fired furnaces in which the gases are in a state of turbulent flow. It is imitated in a new type of electric-resistance furnace, in which the air is artificially circulated by means of a fan. In electric-resistance furnaces in general most of the improvements have been in the material of the resistor rather than in the design of the furnace. The high-frequency induction method of heating is a new tool capable of producing almost perfect uniformity in a liquid conductor, but not in a solid. The most recently developed source of high-temperature heat is solar energy, which has been concentrated by a focusing mirror and heliostat at Jena, to give results comparable with those obtainable in laboratory furnaces. The thermo-electric pyrometer, assisted by potentiometric indicators and recorders, offers the best method for studying uniformity. The new thermocouple alloys are capable of considerable improvement in homogeneity and reproducibility. Attempts to introduce light-sensitive devices into the optical type of pyrometer have not reached finality. Materials of construction for high-temperature work are not yet sufficiently pure. Better design and improvement in conductivity of refractories have made for more uniformity in research work. The greatest need of research is an institution for the study and improvement of laboratory apparatus and for the manufacture and sale of items too infrequently in demand or too difficult to make to have a dependable market.—F. J.

Determination of Quality as a Basis for Commodity Standards. F. W. Reynolds (*Rev. Sci. Instruments*, 1932, 3, 371–377).—An extremely readable article dealing with modern developments of standardization. R. contends that standardization of commodities should be progressively dynamic, not static; it should not minutely circumscribe limits to stifle initiative, but should set up minimum requirements for essential features, leaving non-essentials to individual discretion; it should not try to force something new and untried on industry.—J. S. G. T.

On Drawing up Specifications. R. Digby-Smith (*Mech. World*, 1932, 92, 525–526).—Firms doing special work sometimes need products which are not covered by standard specifications, and, since goods ordered to customer's specification are usually priced slightly higher than the equivalent line of standard product, great care should be taken to introduce as few departures as possible from the standard line. The object of a specification is not to ensure the nearest possible approach to perfection, but rather that the work will be such as to meet all the practical requirements of the user, with sufficient reserve. The outstanding properties of a well-conceived specification are: (1) definitiveness: (2) brevity; (3) clarity; (4) permanence; (5) convenience. —F. J.

Standards. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 113–114).—A discussion of suggestions that British standards of design and construction are unduly high, and of the connection with standard specifications for materials.—R. G.

Report of Committee E–10 [of A.S.T.M.] on Standards. T. R. Lawson and C. L. Warwick (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 522–528).—A general summary of the work undertaken by the various Committees during the previous year, and of specifications issued as the result of their deliberations.—W. A. C. N.

The Rôle of the Trade Association in Standardization. Paul Gough Agnew (*Amer. Standards Assoc. Bull.*, 1930, (50), 3–6).—S. G.

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The Effect of Standardization on Engineering Progress. C. Le Maistre (*J. Roy. Soc. Arts*, 1931, **79**, 327–342; discussion, 342–351; and (abstract) *Mech. World*, 1931, **89**, 250–251, 268–270).—F. J.

Standardization. L. A. Legros (*Proc. Inst. Automobile Eng.*, 1930–31, **25**, 344–365; discussion 366–369; and (abstract) *Mech. World*, 1931, **89**, 300–301).—F. J.

The Calculation of Errors by the Method of Least Squares. Raymond T. Birge (*Phys. Rev.*, 1932, [ii], **40**, 207–227).—The method of least squares is developed with special reference to the reliability or probable error of quantities calculated from experimental data by the method of least squares, and the reliability of the probable errors thus calculated.—W. H.-R.

Machinery Breakdowns Caused by Cracks. Edward Ingham (*Colliery Engineering*, 1931, **8**, 310–311).—The part played by faulty alignment in causing over-stress and subsequent failure is emphasized. Other causes are (1) pounding and knocking due to excessive wear, (2) faulty design, (3) vibration. Methods of inspection are described.—P. M. C. R.

General, Plant, and Machinery. R. E. V. Hampson and J. N. Vowler (*Ann. Rep. Prog. Applied Chem.*, 1931, **16**, 5–24).—A summary of progress during 1931, with reference to various subjects of non-ferrous interest discussed at the 1931 meeting of the New International Association for Testing Materials. Other papers noted refer to heat transfer, lubrication, the use of non-ferrous metals for pressure vessels, the strength of welded joints, and various instruments.—H. F. G.

The Handling of Materials in a Mass-Production Factory. W. L. Beeby (*Proc. Inst. Mech. Eng.*, 1931, **121**, 559–571).—Describes briefly methods for conveying materials to and from or between machines in a mass-production factory. These include jack-lift or elevating trucks, different types of overhead runway, roller tracks, and moving belt conveyors. B. emphasizes the importance of designing the handling scheme so that material is handled as seldom as possible, for the shortest possible distance, with a continual flow which avoids accumulating finished material between operations.—W. H.-R.

Adapting the Conveyor to the Needs of Industry. Anon. (*Canad. Mach.*, 1931, **42**, 160–164).—Types of bearing for roller conveyors of varying capacity are discussed. Spiral conveyors are much used for small work, but even then special support is required. Belt conveyors, necessitating a straight run, require special connecting sections where the system branches. Types of each of the above are illustrated. An ingenious adaptation of the roller conveyor is used in the assembly and enamelling of refrigerator cabinets; here a turntable is included in the conveyor system.—P. M. C. R.

Modern Mechanical Handling Appliances. Maurice Pelou (*Science et Industrie*, 1932, **16**, 31–41).—Mechanical handling plant is considered by P. under two headings—for intermittent and for continuous delivery. The first covers the conveying of loads by isolated elements capable of independent handling and of reversed direction, where the drive may therefore be either continuous or interrupted: this includes overhead, railway and road conveyors. The second includes continuously operated conveyors arranged in series, working in a uniform manner and in the same direction throughout the system. These are further classified according to the presence or absence of a traction unit (cable, runner, chain, &c.). Characteristic types, with their advantages and limitations, are discussed and illustrated.—P. M. C. R.

Industrial Lighting. S. Anderson (*Machinery* (*Lond.*), 1930, **35**, 449–450). —Describes the advantages of a suitable system of lighting in factories and workshops and gives some data for the increase of production resulting from the adoption of a modern system.—H. F. G.

The Lighting of Factories and Large Buildings. E. W. Smith (*Gas World* (*Indust. Gas Suppt.*), 1931, **3**, (9), 10–17).—Read before the International Illumination Congress, Buxton, 1931. Applications of gas for purposes of factory lighting are discussed and illustrated.—J. S. G. T.

Temperature-Sensitive Compounds. Herbert Chase (*Chem. and Met. Eng.*, 1932, **39**, 345).—A list is given of compounds which change colour on heating, the precise nature of the change being given in each case. One of the applications of such compounds is in the form of pigments for detecting temperature changes in bearings and other machinery parts.—F. J.

Mineral Oils. Alfred W. Nash and A. R. Bowen (*Ann. Rep. Prog. App. Chem.*, 1932, **17**, 83–113).—A summary, with full references, is given of papers published during 1932 concerning, *inter alia*, lubrication and lubricating oils and greases; the adherence of lubricants to metals, *i.e.*, the rates at which various oils flow off surfaces of copper, aluminium, iron, and steel; the behaviour of non-acid oils in contact with different metals; and insulating oils, fuel oils, and bituminous paints.—H. F. G.

XXIII.—BIBLIOGRAPHY

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(Continued from p. 477.)

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XXIV.—BOOK REVIEWS

(Continued from pp. 478–480.)

Allgemeine und technische Elektrometallurgie. Von Robert Müller. Med. 8vo. Pp. xii + 580. 1932. Wien: Julius Springer. (R.M. 32.50.)

According to general usage, the term "electrometallurgy" covers the application of both electrolytic and electrothermal processes in the service of metallurgy. It should therefore be made clear at the outset that the present volume deals with only one of these sub-divisions—electrolytic processes. There is much to be said for thus restricting the scope of the work, for the principles underlying the two sub-divisions of the subject are essentially different, and considerable confusion of ideas has often arisen through not keeping them separate.

The introductory chapters deal with the general principles of electrolysis, and include an outline of general electrochemistry sufficient for a proper understanding of the electrometallurgical processes described later. A brief account of the modern theory of electrolytic dissociation might have been included with advantage, if only to indicate the general character of developments which have occurred in recent years. On the other hand, the important subject of electrolytic polarization is treated in a very satisfactory manner, and the section devoted to the principles of metallic corrosion forms a useful summary. A section of particular interest is that dealing with the electrolysis of molten alloys, a subject to which the author has largely contributed, but which has not yet found its way into the majority of text-books.

Following this preliminary general discussion which occupies the first 140 pages, is a systematic account of the electrometallurgy of the various metals. Under the heading of each metal there are set out the conditions under which it and its alloys are electrodeposited; its behaviour as an anode; details of the technical electrolytic processes whereby it is extracted and refined, together with production data; an outline of electroplating processes; and a summary of its properties and applications. The metals are considered in groups corresponding with those of the periodic classification, commencing with the very base metals which can be electrodeposited only from molten electrolytes. A general account of the electrolysis of fused salts and of the manufacture and properties of electrodes for this purpose precedes the detailed treatment of the electrometallurgy of the alkali and alkaline-earth metals, aluminium, the rare-earth metals, and metals of the vanadium group. Similarly, the systematic account of the electrolytic extraction and refining of metals such as copper silver, gold, zinc, cadmium, tin, lead, antimony, bismuth, iron, cobalt, nickel, and members of the platinum group, all of which are electrodeposited from aqueous solutions, is preceded by a general survey of the principal features of such processes, including a good summary of the effects of conditions of operation on the physical character of the metallic deposits. Due reference is made to the electrochemistry of the rarer metals, even in cases where technical applications have not yet ensued.

Whilst not pretending to be an exhaustive treatise, the book succeeds admirably in presenting a thoroughly sound, well ordered, and well authenticated account of the principles and technical operation of all electrolytic processes which have found application in metallurgy. Full references to the scientific, technical and patent literature are supplied, and due attention has been given to recent developments in all parts of the world. The diagrams are clearly drawn and informative, the printing and general make up of the book are excellent, and, apart from a few mis-spellings of the names of foreign authors and journals, the text is satisfactorily free from errors.—H. J. T. ELLINGHAM.

Gmelins Handbuch der anorganischen Chemie. Achte völlig neu bearbeitete Auflage. Herausgegeben von der Deutschen Chemischen Gesellschaft. Bearbeitet von R. J. Meyer. System-Nummer 30: **Barium.** Sup. Roy. 8vo. Pp. xvi + 390, with 30 illustrations. 1932. Berlin: Verlag Chemie G.m.b.H. (R.M. 64, subscription price R.M. 56.)

The treatment of the metal barium and its compounds follows the method adopted successfully in the case of other elements. It commences with an account of the history of the element, followed by an account of the minerals of barium and the distribution of these throughout the earth. The methods of obtaining barium compounds from minerals constitutes the next section. Here the methods used on the large scale for the production of the sulphide, oxide, hydroxide, nitrate, chloride, carbonate, silicate, and aluminate from heavy spar are described. The preparation and properties of metallic barium are considered next, in a section of 37 pages. The treatment of the compounds follows, and these are dealt with in the order: compounds with hydrogen, oxygen, and nitrogen; amides, hyponitrites, nitrites, nitrates, fluorides, chlorides, chlorite, hypochlorite, chlorate, bromides, hypobromite, bromate, perbromate, iodides, iodate, periodates, sulphides, sulphites, sulphates, persulphate, thiosulphate, selenide, selenate, telluride, tellurate, boride, borates, carbide, carbonyl, carbonates, percarbonate, thiocarbonate, silicide, silicate, phosphide, phosphates, arsenide, arsenites,

arsenites, antimonites, and antimonates. Double salts with similar salts of other metals are described, and numerous compounds with organic substances, including many barium salts of organic acids.

The work of compilation has been carried out thoroughly and with discrimination, and a very complete account is given of the knowledge of barium at the moment. The book is a very satisfying one, and can be recommended without hesitation.—James F. Spencer.

Eisen- und Stahllegierungen. Patentsammlung geordnet nach Legierungssystemen. Von A. Grützner. Pp. viii + 316. 1932. Berlin: Verlag Chemie, G.m.b.H. (R.M. 32.)

This book is an appendix to the section on the metallurgy of iron in the eighth edition of Gmelin's "Handbuch der anorganischen Chemie"; it contains a classified list of German, English, French, American, Swiss, and Austrian patents on iron and steel alloys. The alloys are classified systematically on the system adopted in the Handbuch, and their composition ranges, special properties, and sphere of usefulness are given briefly, together with the name of the patentee, number of the patent, and year of issue. The list includes all patents granted between 1880 and March 1932, and should thus be of considerable reference value to all steel metallurgists.—A. R. Powell.

Korrosion II. Bericht über die Korrosionstagung 1932 am 17 Oktober 1932 in Berlin. Veranstaltet vom Verein deutscher Ingenieure, Verein deutscher Eisenhüttenleute, Deutsche Gesellschaft für Metallkunde und Verein deutscher Chemiker. Demy 8vo. Pp. v + 61, with 35 illustrations. 1933. Berlin: VDI-Verlag, G.m.b.H. (R.M. 4.)

This report of the proceedings of the second German corrosion conference contains only 7 papers, with very brief discussions. Of these, the first deals with the importance of chemical reactions in corrosion and the other 6 with various means of protecting metals—generally iron and steel—from corrosion; the protective devices considered include paints, lacquers and varnishes, enamels, cement and concrete, rubber derivatives, and phosphate films. Very little information on the non-ferrous metals is given, but recent work on all the subjects discussed is ably, if at times briefly, reviewed.—A. R. Powell.

Sherardizing. A Text-Book for Architects and Engineers. By G. Petrie and A. C. Mills. Fcap. 8vo. Pp. iv + 54, with 5 illustrations. 1932. Wolverhampton: Zinc Alloy Rust-Proofing Co., Ltd. (2s. post free.)

This small book is, as its sub-title indicates, a text-book for architects and engineers. As such, it is very valuable, and should be read by all who have to consider the rust-proofing of finished articles, whether as consumers or manufacturers.

Sherardizing, the invention of an Englishman, has been much neglected in Great Britain in the past, although widely adopted in America. There is no doubt that it has many advantages, giving as it does a uniform coating, highly resistant to corrosion despite irregularities in the surface of the basis metal. To-day it appears to be coming into its own, and the list of articles given by the authors as being regularly treated is remarkable in length and variety, ranging from wing-bolts and nuts to steel casements and iron pumps.

The description of the Sherardizing process gives an adequate general idea, but cannot attempt to impart knowledge which is largely an art. The real value of the publication lies in the practical manner in which the possibilities, scope, finishes, and limitations and costs of the treatment are dealt with. The relations between the customer, Sherardizer and the manufacturer are dealt with. It is pleasing to see the necessity for perfect cleanliness of surface and correct composition of the Sherardizing mixture emphasized, as lack of control of these factors has been to a great extent responsible for failures in the past, which have contributed in no small measure to the slow development of the practice in this country.

Some of the authors' chemical explanations are descriptive rather than complete, and an obvious error has crept in where zinc dust is said to decompose water with the liberation of nascent oxygen; but these are not at all material to the general thesis.

The authors adhere to the Preece test for protection evaluation. The Wernlund hydrogen peroxide–acetic acid test is probably superior.—P. S. Lewis.

Kohäsionsfestigkeit. Von W. Kuntze. 8½ × 10¾ in. Pp. 62, with 77 illustrations in the text. 1932. Berlin: Julius Springer. (R.M. 11.)

This brochure, appearing at the same time as Part 20 of the serial publication *Mitteilungen der deutschen Materialprüfungsanstalten*, contains, in effect, a review of recent theoretical and practical investigations into the elastic and plastic properties of materials which have been carried out at the Staatliches Materialprüfungsamt, Berlin-Dahlem. Professor Kuntze with Professor Dr. G. Sachs, who is well known to members of the Institute of Metals, has been responsible for much of the advance which has occurred within recent years in this comparatively new field of research; his views, as set out in this brochure, can be accepted as authoritative. Dr. Krisch, who contributes three short sections to the work, has also done some work in this field. What exactly is meant by cohesion? The fundamental phenomenon is simplicity itself, and can be illustrated by the fact that when one end of, say, a rod, is moved, the rest of the rod follows. But why? Do I hear you say, " A childish question, it cannot do anything else "? Then I would ask, " And why cannot it do anything else "? and ultimately you would be compelled to answer, " Because of cohesive force, the force that makes the parts of a rod hold together." This is clearly arguing in a circle, and leads nowhere. This so-called cohesive force is what holds the parts of a body together when the body is stretched, rolled, or submitted to any of the working processes familiar to the practical metallurgist; in plastic deformation of a material cohesion is temporarily overcome, to assert itself again in the altered configuration after slip has occurred. It is clear, then, that the study of elastic and plastic strains can throw much light on the nature of cohesive force. This brochure sets out in considerable detail practical details of such study, and discusses some of the results hitherto obtained. Amongst the subjects discussed are: the influence of heterogeneity on tenacity, tensile and notched-bar tests, elastic fatigue, plastic flow, the practical point of view being stressed throughout. The book is very well printed on good paper; the illustrations and diagrams are very clear. A bibliography comprising references to 88 published works is appended. The price, considering the specialized character of the book, is not excessive, although perhaps a little high for British metallurgists, with the present rate of exchange.

—J. S. G. Thomas.

Elektrische Lichtbogenschweissung. Handbuch für die Anwendung der Lichtbogenschweissung in der gesamten Industrie. Von Karl Meller. (" Elektrizität in industriellen Betrieben," Herausgegeben von W. Phillipi. Band III.) Zweite, wesentliche erweiterte Auflage. Sup. Roy. 8vo. Pp. xii + 398, with 374 illustrations. 1932. Leipzig: S. Hirzel. (Geh., R.M. 26; geb., R.M. 27.80.)

After a short historical introduction, Part I of this book discusses the different arc-welding processes and the fundamental characteristics of the electric arc. Part II describes the various types of welding plant, both a.c. and d.c.; their theoretical principles; static and dynamic characteristics; mechanical construction; and efficiency. Welding accessories are also described. Parts III, IV, and V deal with the arc-welding of steel, cast-iron, and the non-ferrous metals in 138, 14, and 3 pages, respectively. The section on steel includes a detailed account of welding costs, illustrated by diagrams and nomograms relating electrode costs, welding speeds, thickness of material, &c. A comparison is drawn between a.c. and d.c. welding and between arc and oxy-acetylene welding. There are then two short sections on cutting by means of the arc and the training of welders, and two long sections on testing welded joints and applications of arc welding.

Although there is an immense amount of information in the book, it is not quite comprehensive. The review of welding machines is extremely thorough, but dismisses very briefly the Alexander and Langmuir processes and does not mention the valve-rectified welder. Even the lengthy section on steel welding will be found wanting if information is required about alloy steels, and, as pointed out above, the space devoted to the non-ferrous metals is so inadequate as to be useless. The author is cautious in his views on the scope of arc welding, and, consequently, the number of varied applications which are described, is all the more impressive. He is cautious, too, when discussing the many phases of welding concerning which there is controversy, and one would have valued a more definite expression of opinion from an authority so well qualified to give it.

Although there are only three pages dealing specifically with his work, the non-ferrous welder will find this book of great value.—H. W. G. H.

Die Elektrische Warmbehandlung in der Industrie. Von E. Fr. Russ. Med. 8vo. Pp. v + 259, with 239 illustrations. 1933. München und Berlin: R. Oldenbourg. (Geb., M. 14.)

The field of electric heat-treatment furnaces is covered by this work, which provides a description of a wide variety of furnaces, and indicates the diverse services to which they are applied.

About two-thirds of the book deals with a description of individual furnaces, which are profusely illustrated—there are 239 figures, mostly reproductions of photographs. The remainder of the volume briefly explains the general principles and describes the constructional materials. The particular value of this volume lies in the fact that it gives a fairly up-to-date account of the latest applications of electric annealing and heat-treatment furnaces. The author's own designs are, of course, prominent, but many other German furnaces, and some American ones, are included. The British work on this subject, which is of first-class importance, is almost neglected.

Technical Data on Fuel. Third Edition, revised and considerably enlarged. Edited by H. M. Spiers. Cr. 8vo. Pp. xv + 302, with 57 figures and 210 tables. 1932. London: British National Committee, World Power Conference, 63 Lincoln's Inn Fields, W.C.2. (12*s*. 6*d*. net.)

The first edition of this book was published in 1928; the fact that a third edition is called for in 1932 is sufficient evidence that the work has been welcomed by fuel technologists. In the issue of this new edition, opportunity has been taken for a thorough revision of the work; the material treated is about 75 per cent. greater than that contained in the first edition, and about 33 per cent. greater than that of the second edition. The use of thinner paper has enabled the book to be reduced to pocket size; in one way this is an advantage, in another a disadvantage, as the print is now clearly visible through the blank unprinted pages provided for the insertion of notes. New material inserted in this edition includes: tables of logarithms and antilogarithms, sines, cosines, &c. (considering that the primary purpose of such tables is to expedite calculation, their clearness leaves something to be desired), British standard test sieves, thermometric lag, humidity tables, steam tables, properties of saturated vapours, including mercury, radiation from flames, permeability of refractory materials to gases, specific heats of waste gases from gaseous fuels.

Tables of especial interest to metallurgists include those relating to the specific gravity, melting and boiling points, and thermal expansion of metals and alloys, the composition of alloys, expansion of stainless steel, nickel, Monel metal, and aluminium, mechanical properties of copper, Duralumin, and "Y"-alloy at various temperatures, creep stress, uses of metals and alloys. There are sections devoted to refractories, solid, liquid and gaseous fuels, stack losses, and a bibliography. Here is meat indeed for the metallurgist and the fuel technologist. Where I have checked the data, I have found them reliable. Collections of chemical and physical data catering for the needs of the pure scientist (if the designation be permitted) we have in plenty, to mention only Kaye and Laby's "Tables," the "International Critical Tables" and the volume issued by the Société Française de Physique. Well, here in *Technical Data on Fuel* we have something of the same kind, and yet something entirely different, the practical scientist's Kaye and Laby. And anyone familiar with this latter work will know that this is, indeed, praise of *Technical Data on Fuel*. The book is published at a very reasonable price and will, no doubt, find its way on to the working desk of all metallurgists and fuel technologists. It is essentially a book to be used. I welcome the appearance of a third edition. My copy of the second edition is decipherable only with difficulty, through continual use in laboratory and workshop.—J. S. G. THOMAS.

Pulverized Fuel Firing. By Sydney H. North. Cr. 8vo. Pp. ix + 193, with 62 illustrations. 1932. London: Sir Isaac Pitman & Sons, Ltd. (7*s*. 6*d*. net.)

Where exactly are we in the matter of industrial fuel? A little while back, Sir Frank Smith, Secretary of the Department of Scientific and Industrial Research, confidently asserted that the hydrogenation of coal was an economic proposition; his statement was quickly and equally confidently contradicted by Mr. H. T. Tizard, his predecessor in that office. What of low-temperature carbonization? The virtues of more than one process have been lauded to the skies. Where are they to-day? And what of pulverized fuel? Initiated in the United States in 1915,* it was introduced into Great Britain in 1923, and was instantly boomed as *the* industrial fuel *par excellence*. Very little, save for occasional journalistic reference to the firing of a transatlantic liner with colloidal fuel, a suspension of pulverized fuel in fuel oil, has been heard of it lately. It is therefore all the more refreshing to read that "its adoption for firing large units has rapidly increased, and a few years only has [*sic*] seen the new form of firing gain an established position" and "developments point to the probability that pulverized fuel firing will, during the next few years, witness a very great extension of its application." Published data suggest that progress in America and Germany has been considerable; in Great Britain "progress has also been remarkable, though no figures are available relative to consumption." This last quotation epitomises the whole fuel position—all is nebulous.

This little book will do much to clarify the position so far as pulverized fuel firing is concerned. It gives up-to-date information on modern processes of fuel combustion, furnace equipment, dust collectors, and pulverizing mills. Important installations are illustrated, and a considerable amount of valuable data is arranged in tabular and diagrammatic form. Although the book is intended primarily for engineers concerned with land and marine boilers fired with pulverized fuel, it is not without interest to the metallurgist, for Chapter XI is devoted to the use of pulverized fuel in metallurgical industries, including the production of nickel and copper.

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* Writers on the subject appear to be unaware of the fact, to which my attention has been drawn by a member of the Publication Committee of the Institute, that cement kilns in Great Britain have been fired with pulverized fuel for the last 50 years. Verily, there is no new thing under the sun!—J. S. G. T.

The book is one that can be confidently recommended to fuel technologists and industrialists generally; it is clearly printed on good paper, is well bound and illustrated and is very reasonable in price.—J. S. G. THOMAS.

Annual Tables of Constants and Numerical Data, Chemical, Physical, Biological, and Technological. 4to. Volume VIII (1927–1928) Part I. Pp. xl + 1101. Part II. Pp. xxi + 1102–2706. 1931. (500 francs.) Volume IX (1929). Pp. l + 1607. 1932. (400 francs.) New York: McGraw-Hill Book Co., Inc.; Paris: Gauthier-Villars et Cie.

The issue of these further volumes emphasizes in a very marked degree the vast amount of investigation which is being carried on at the present time and the almost impossible task which confronts anyone who sets out to become acquainted with all that is being published in even a circumscribed sphere. The publication of these annual summaries of data is, indeed, a boon to those who want recent information quickly. They also serve to maintain the historical sequence of research work on particular subjects. They facilitate comparisons between the results obtained by different observers, and also assist in establishing the bases for further work. But there are some inherent disadvantages. In the first place, there is no attempt at a critical discussion of results bearing on similar themes, nor is there any description of the methods by which they were attained. Bare facts, as originally presented by the authors, are inserted, and although those who have been responsible for the compilation may have used discriminatory powers, the data, nevertheless, suffer from the lack of ordered and thoughtful discussion and comparison. The reader has therefore to use his own discretion and to sum up the relative importance of the details that are given as best he may, or else turn to the original papers, to which references are invariably given. In the second place, these summaries, cannot, in the nature of things, even now be complete. The very wide extent of the survey of inorganic and organic materials and the exceedingly larger number of chemical and physical properties which have now to be taken into consideration, involving a search in magazines and journals the world over, make the task of cataloguing the results gigantic and almost incapable of reaching finality, even over a short period.

These are general criticisms, however, which were no doubt foreseen when the original volume was contemplated. They do not detract from the great value of this collection of data both to the research worker, to whom it is necessary that he should know what the results of previous workers were, or to the mere inquirer who is simply in search of facts. The information is given clearly, mostly in tabular form, but, where necessary, curves are added to assist in correlation. In all references and general textual matter both the English and the French languages are used, which widen very considerably the sphere which the volumes may serve. It is impossible—nor is it desirable—to enumerate the various scientific fields which have been covered. Suffice it to say that an attempt has been made to record all recent information published within the periods named, thus forming a compendium of statistical knowledge, which is being increased year by year, and which is of inestimable value to those to whom facts are essential. Their relative importance compared with others already published, and obtained possibly by other methods, rests finally with the reader.—W. A. C. NEWMAN.

Mechanical Catalog 1932–33. Twenty-second annual volume. 4to. Pp. 452. 1932. New York: American Society of Mechanical Engineers.

The twenty-second annual edition of this useful catalogue provides information descriptive of the products of 306 American manufacturers of mechanical apparatus and related materials classified into eleven sections for ready reference. These sections, which amply illustrate the scope of the book, are as follows: power plant equipment; measuring and testing apparatus; power transmission machinery; materials handling equipment; metals, alloys, and other materials; foundry, rolling-mill, and forge equipment; metal-working machinery, machine tools, and shop equipment; compressors, blowers, and pumps; heating and ventilating equipment, refrigerating machinery; specific industry machinery, general industrial equipment; electric motors and control. Finally, there is a 63-page index, showing the suppliers of various plant and the page on which their advertisement appears.—A. R. POWELL.

Marlborough's German Technical Words and Phrases. English–German and German–English Dictionary. Third Edition, enlarged and revised by E. M. Rolfes. Demy 8vo. Pp. iv + 188. 1931. London: E. Marlborough & Co., Ltd. (7*s*. 6*d*. net.)

This is essentially a technical dictionary, in that it contains only those words which are used in a scientific, trade, or professional sense. The book is well arranged, and contains a large selection of useful words, but the metallurgical terms are not by any means complete, *e.g.* such common words as Hütte and its derivatives, Rotguss, Kupferstein, Lagermetall, and the terms used for the mechanical properties of metals are not included. The book will probably be found much more useful by business men than by the scientific worker.—A. R. POWELL.

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

1933 OCTOBER Part 10

I.—PROPERTIES OF METALS

(Continued from pp. 481-489.)

Beryllium and Its Alloys. Jean Challansonnet (*Aciers spéciaux*, 1933, 8, 166–179).—Describes the discovery, minerals, and deposits of beryllium, the chemical, physical, and mechanical properties of the pure metal, its metallurgy and electrochemical extraction, the use of the pure metal in electrodeposition and as a deoxidizer, the light and ultra-light alloys of beryllium, its alloys with copper, nickel, and iron, and its use in special steels.—J. H. W.

The Deposition of Sputtered [Cadmium] Films. R. W. Ditchburn (*Proc. Roy. Soc.*, 1933, [A], **141**, 169–187).—Phenomena associated with the depositions of films of sputtered cadmium are investigated experimentally.—J. T.

The Heat of Dissociation of the Cadmium Molecule, Determined Thermo-Optically. Heinrich Kuhn and Sven Arrhenius (*Z. Physik*, 1933, **82**, 716–728).—*Inter alia* the molecular heat of dissociation of cadmium (Cd_2) is calculated from the decrease of the band absorption of cadmium vapour with increase of temperature and found to be 2·0 ± 0·5 k. cal.—J. S. G. T.

Measurement of the Temperatures of Copper and Its Alloys During Casting. H. Miething and C. Winkler (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, (Suppt.), 80–83).—From *Giesserei*, 1931, **18**, 181–184. Cf. this *J.*, 1931, **47**, 418.—W. N.

The Freezing Point of Iridium [With an Appendix on: Preparation and Purity of Iridium]. F. Henning and H. T. Wensel (Appendix: Ernest Wichers) (*U.S. Bur. Stand. J. Research*, 1933, **10**, 809–821; and *Research Paper*, No. **568**).—The ratio of brightness for red light of a black body immersed in freezing iridium to that of a similar black body immersed in freezing gold was measured both directly and indirectly. The indirect method consisted in determining the ratio of brightness at the iridium and platinum freezing points and calculating the result from the previously determined platinum to gold ratio. The two methods, agreeing with each other within the limits of experimental error, yielded a value for the iridium to gold ratio of 4380 at wave-length 0·652μ. This fixes the freezing point of iridium on the International Temperature Scale as 2454° C.—S. G.

Photo-Electric Sensitivity of Magnesium. R. J. Cashman and W. S. Huxford (*Phys. Rev.*, 1933, [ii], **43**, 811–818).—Gas-free surfaces of magnesium prepared by distillation in a high vacuum have a long wave limit of from 5000 to 5200 A. The formation of a thin surface film of oxide or nitride sensitizes the metal to light of longer wave-lengths, an effect which has also been observed for the alkali metals. With continued oxidation the threshold changes to about 3800 A., which is the value previously taken to be that of the pure metal.—W. H.-R.

The Sublimation of Magnesium in a Vacuum and Casting in an Atmosphere of Argon. J. Hérenguel and G. Chaudron (*Industrie chimique*, 1933, **20**, 86).—Abstracted from *Compt. rend.*, 1932, **195**, 1272. See *J.*, this volume, p. 227.—E. S. H.

The Gyromagnetic Ratios for Nickel and Cobalt. S. J. Barnett (*Phys. Rev.*, 1933, [ii], **43**, 384).—Abstract of a paper read before the American Physical Society. In an elaborate investigation of the rotation of both iron and Permalloy by magnetization (*Proc. Amer. Acad. Arts Sci.*, 1931, **66**, 273–348) the gyromagnetic ratios for the two substances were found to be, respectively, 1·04 × m/e and 1·05 × m/e, with errors probably less than 0·5%. Successful observations have now been made on the less tractable substances nickel and cobalt, but the ratios are somewhat less precise. The ratios obtained for those substances are about 1·06 × m/e and 1·07 × m/e. The experimental method had to be modified to reduce the effects of certain sources of error, including magnetostriction, before any success was obtained with cobalt. Inasmuch as serious errors, not suspected by other investigators, have been eliminated in all of this work, the results obtained are far more reliable than those obtained by others, who have always obtained 1 × m/e within the limits of their supposed experimental errors (except Einstein and de Haas, who, in 1915, thought that they had found 2 × m/e). The ratios obtained in this investigation agree, within the experimental error, with those of L. J. H. Barnett and S. J. B. in 1925 (*Proc. Amer. Acad. Arts Sci.*, **1925**, 127–216) as the result of an elaborate investigation of the magnetization of many ferromagnetic substances by rotation. The mean then obtained was 1·06 × m/e, with an error estimated as some 2%.—S. G.

Sodium. H. N. Gilbert, N. D. Scott, W. F. Zimmerli, and V. L. Hansley (*Indust. and Eng. Chem.*, 1933, **25**, 735–741).—The more important industrial uses of sodium are mentioned briefly. Its physical and chemical properties are given and safe and convenient methods for using sodium in chemical reactions are suggested, as well as the precautions necessary to prevent accidents in handling and storing. In metallurgy, sodium has been used for removing antimony from lead, for modifying the structure of silicon–aluminium alloys, and for a similar purpose in the case of special brasses. Sodium–lead alloys and sodium amalgams are often used instead of sodium because reactions are thus more easily controlled. Their preparation is described. —F. J.

Influence of Rate of Shear on Shearing Strength. James Jamieson (*Amer. Soc. Mech. Eng. Preprint*, **1933**, 30).—Modern theory indicates that strength of materials is intimately connected with the conditions of shearing stresses in the material. J. has conducted simple shear tests on lead tube, which are sheared at a constant rate and the variation in the torque applied is measured during the test. The results indicate the importance of the rate of shear, and increasing rates are accompanied by an increase in strength. The curves show that lead possesses a definite upper yield-point, a characteristic of steels, but not usually of non-ferrous alloys.—W. P. R.

Plasticity, Strain-Hardening, and Creep. H. Hencky (*Amer. Soc. Mech. Eng. Preprint*, **1933**).—A mathematical treatment of the inelastic behaviour of metals.—W. P. R.

Calorimeter with High-Frequency Measurement of the Heat Expansion of the Metal Block into which the Specimen is Dropped. Hans Esser and Walter Grass (*Arch. Eisenhüttenwesen*, 1933, **6**, 353–356).—Up to the present the heat content of the specimen has been determined by measuring the rise in temperature of the metal block into which the hot specimen is dropped. A more accurate method consists in measuring the expansion of the block by making it act as a condenser in a high-frequency alternating circuit. The expansion causes a change in the capacity of the condenser and this is compensated for by the aid of a second condenser working in a second alternating circuit of constant frequency. The heat expansion of the block corresponding with the measured change in capacity gives the relative heat content of the specimen with an accuracy of 0·5%.—J. W.

Diffusion in Crystals. Georg v. Hevesy (*Naturwiss.*, 1933, **21**, 357–362; and *Z. Elektrochem.*, 1933, **39**, 490–500).—The loosening of the lattice necessary for diffusion can be determined only in a general manner from the rate of self-diffusion just above or just below the melting point. Diffusion and conductivity run parallel in electrolytes, and in this case the rise in conductivity at the melting point and the temperature coeff. of conductivity are a measure of the temperature dependence of the lattice loosening. For the comparison of various electrolytes the increase in the rate of movement of one kind of ion at the melting point gives the best results. The relation between the rate of diffusion and the temperature is discussed theoretically, and is similar to the reaction velocity. Self-diffusion is generally slower than the diffusion of foreign atoms. Cases of one-sided diffusion, *e.g.* hydrogen in palladium, and of diffusion spreading out over a surface have also been investigated. In pure self-diffusion the change in entropy is zero and in approximate self-diffusion (gold into silver) it is negligible. In place exchange reactions between solid bodies the heat effect is a measure of the change in entropy; in this case the chemical affinity at the surfaces of the reactants and the rise in temperature produced by the heat of reaction play a greater part the greater is the temperature coeff. of the rate of place exchange. Further aspects of the subject are also discussed.—J. W.

Total Reflection of X-Rays by Thin [Metal] Sheets. A. I. Alichanow and L. A. Arzimowic (*Z. Physik*, 1933, **83**, 489).—The total reflection of various thicknesses of metals deposited on various supports, *viz.*, layers of silver and tungsten deposited on glass, layers of silver deposited on aluminium, and *vice versa*, and layers of silver deposited on platinum and tungsten is investigated and discussed. Experimental and theoretical results are in agreement.—J. T.

The Electron Theory of Metallic Conduction. J. C. Slater (*Science*, 1933, **77**, 595–597).—An address delivered at the Massachusetts Institute of Technology, giving an elementary account of the older Drude–Lorentz theory of metallic conduction, and the recent wave-mechanics theory of Sommerfeld. —W. H.-R.

Magnetism and Crystal Lattice Rearrangements. X-Ray Investigations Relating to α-Iron. F. Regler (*Z. Physik*, 1933, **82**, 337–354).—Rearrangements occurring in the crystal lattices of ferromagnetic substances subjected to the action of magnetic fields, and the numerical interpretation of these rearrangements, as revealed by the X-ray determination of fine structure, are discussed.—J. S. G. T.

Magneto-Striction.—III. Alfred Schulze (*Z. Physik*, 1933, **82**, 674–683). —The equation $\Delta l/l = C(J^2 - J_0^2)$, for the change of length, Δl, of material subjected to a magnetic field, J, is established for iron single crystals, single- and poly-crystalline nickel, and for alloys of nickel with iron and with tungsten.—J. S. G. T.

On Irregularities in Magnetization. K. J. Sixtus (*Phys. Rev.*, 1933, [ii], **44**, 46–51).—Cold-drawn polycrystalline nickel–iron wires were submitted to tension and torsion in a magnetic field, and a study was made of the patterns formed when iron oxides were deposited from a suspension in ethyl acetate, as recommended by Bitter (*ibid.*, 1931, **38**, 1903; 1932, **41**, 507). The patterns consisted of parallel lines, but differed from those of Bitter (*loc. cit.*) for single crystals, in that the spacing was irregular and the lines appeared consistently in the same places after changing the direction and magnitude of the applied field. By applying the theory of Becker (*Z. Physik*, 1930, **62**, 253; **64**, 660) it is concluded that the lines are perpendicular to the direction of induction. —W. H.-R.

Thermomagnetic Hysteresis in Steel. W. Y. Chang and William Band (*Proc. Phys. Soc.*, 1933, **45**, 602–609).—A new hysteresis of negative form of the thermomagnetic e.m.f. in a steel wire is described. The phenomenon is discussed in terms of Gerlach's theory of spontaneous magnetization, and Broili's results for nickel (*Ann. Physik*, 1932, **14**, 3) are explained.—J. T.

Photo-Conductivity. Foster C. Nix (*Rev. Modern Physics*, 1932, **4**, 723–766).—A general account of photo-conductivity, including photo-conduction in metallic selenium, and other semi-conductors. It deals essentially with previously published work, and contains a lengthy *bibliography*.—W. H.-R.

Recent Developments in the Study of the External Photo-Electric Effect. Leon B. Linford (*Rev. Modern Physics*, 1933, 5, 34–61).—The general experimental facts, and the classical theories of the photo-electric effect in metals are briefly described. The quantum mechanical theories introduced by Sommerfeld, Fowler, and Nordheim are described in greater detail, including developments due to Wentzel (Sommerfeld's "60 Geburtstag Festschrift der Modernen Physik," edited by P. Debye, Leipzig, 1928), Fröhlich (*Ann. Physik*, 1930, 7, 103), Tamm and Schubin (*Z. Physik*, 1931, 68, 97), and Penney (*Proc. Roy. Soc.*, 1931, [A], 133, 407); the work of Tamm and Schubin is considered to give the best general theory. The last section of the paper deals with "Special Photo-Electric Phenomena," including (*a*) the effect of temperature, (*b*) saturation phenomena, (*c*) the preparation of surfaces, (*d*) space-charge effects, (*e*) spectral selective effects of composite surfaces, and (*f*) the vectorial effect. In (*b*) the "patch" theory originally proposed by Langmuir is considered more satisfactory than the "film barrier" theory of Nottingham (*Phys. Rev.*, 1932, [ii], **41**, 793). The paper is essentially a review of previously published work.—W. H.-R.

Extension of Fowler's Theory of Photo-Electric Sensitivity as a Function of Temperature. A. T. Waterman and C. L. Henshaw (*Phys. Rev.*, 1933, [ii], **44**, 59–60).—A theoretical note. Fowler's application of the Fermi–Dirac statistics to explain the temperature variation of the apparent photo-electric threshold for frequencies near the threshold value is extended so as to include frequencies removed from the threshold.—W. H.-R.

Experiments on the Transmutation of Elements by Protons. M. L. E. Oliphant and Lord Rutherford (*Proc. Roy. Soc.*, 1933, [A], 141, 259–281).—Results obtained by the bombardment of molecules of lithium, iron, oxygen, sodium, aluminium, nitrogen, beryllium, fluorine, gold, lead, bismuth, thallium, uranium, thorium, and boron with protons or molecular ions at energies up to 200 k.v. are described and discussed.—J. S. G. T.

II.—PROPERTIES OF ALLOYS

(Continued from pp. [illegible].)

Prevention of Grain-Growth in Wrought Aluminium Alloys. D. R. Tullis (*Metallurgia*, 1933, 8, 129–130).—The addition of certain elements to light aluminium alloys will retard the grain-growth phenomena which occur in forgings, &c., and also prevent the formation of excessively large grain structure in the cast billet. Titanium is used in the "R.R." type of alloys to prevent the formation of excessively coarse grains in the cast material, but titanium will not prevent the formation of columnar crystals in chill-cast billets, and in subsequent forging and heat-treatment it will not prevent the grain-growth phenomena. Such phenomena are prevented, however, when boron is introduced into the molten alloy. The effectiveness of the result depends on the amount of treatment given to the metal prior to casting and subsequent forging. Metal which has been treated by this process also resists the combined effects of plastic deformation and heat-treatment without exhibiting the grain-growth phenomena. Photomicrographs are given of the results of a number of tests carried out on an aluminium–zinc alloy containing 14% of zinc treated by this process.—J. W. D.

An Investigation on the Ternary Alloys of Aluminium–Silver–Magnesium. "Silver-Duralumin." Benzaburo Otani (*Kinzoku no Kenkyu*, 1933, 10, (6), 262–270).—[In Japanese.] The equilibrium diagram of the alloys of aluminium and the compound AgMg has been investigated by means of thermal analysis, electrical resistance measurements, and microscopic examination. O. found a ternary compound AlAgMg, the product of a peritectic reaction melt + AgMg ⇌ AlAgMg at 500° C., and the solubility of this compound in aluminium is 14% at 538° C., 5·4% at 520° C., 4·4% at 500° C., 2·4% at 400° C., and 0·4% at 300° C. of AgMg. The effect of heat-treatment on the mechanical and physical properties of the forged alloys has also been studied. With a suitable heat-treatment it has been found that the alloy containing 6% of AgMg and 4% of copper shows high strength.—S. G.

The Manufacture and Use of Light Alloys. W. C. Devereux (*J. Roy. Aeronaut. Soc.*, 1933, **37**, 145–167).—A lecture read before the Coventry Branch of the Royal Aeronautical Society, together with a report of the discussion. See *J.*, this volume, p. 121.—H. S.

Testing of Light Piston Alloys. M. v. Schwarz and P. Sommer (*Automobiltech. Z.*, 1933, **36**, 341–342).—Extract from *Forschungsarb. Metallkunde u. Röntgenmetallographie*, 1932, (4), 1–47. See this *J.*, 1932, **50**, 726. —P. M. C. R.

Strong Light Alloys of To-Day. Leslie Aitchison (*Proc. Inst. Automobile Eng.*, 1932–1933, **27**, 383–417; discussion, 418–433; and (abridged) *Metallurgia*, 1933, **8**, 15–17).—The characteristics and industrial applications of wrought alloys are discussed under the headings of medium-strength alloys, high-strength alloys, alloys strong at high temperatures, and corrosion-resisting alloys. Alloys containing 80% or more of aluminium or magnesium are included. Among subjects discussed are: the effect of heat-treatment on the mechanical properties of aluminium alloys containing copper or magnesium silicide, the mechanism of ageing, the mechanical properties of extruded aluminium alloys containing small percentages of magnesium or silicon, the effect of heat-treatment on the mechanical properties of Duralumin "H," Elektron alloys, the effect of cold-work on Birmabright sheet and "MG 7" sheet, alloys strengthened by precipitation heat-treatment, *e.g.*, super-Duralumin, "Y" alloy, "RR 56," Lautal, hardness of various alloys. All are treated in considerable detail. The desirability of reducing weight on automobile construction is stressed and the materials discussed are available for this purpose.—J. S. G. T.

On Some New Aluminium Alloys. Edmund Richard Thews (*Chem.-Zeit.*, 1933, **57**, 501–502).—The following table shows the composition and mechanical properties of some recently introduced aluminium alloys:

Alloy.	Condition.	Composition, %	Yield-Point, kg./mm.^{2}.	Tensile Strength, kg./mm.^{2}.	Elongation, %.
Hydronalium .	soft sheet	Mg 7–9, Si < 1, Mn < 1	15–20	31–35	16–22
	hard sheet		30–36	38–43	4–9
B.S. Seewasser I	soft	Mg 7·5, Si 0·2, Mn 0·2–0·6	...	33–36	18–25
	hard		...	45–55	3–6
" " II	soft	Mg 9·5, Si 0·2, Mn 0·6	...	35–40	18–25
	hard		...	50–60	3–6
Mangal . .	hard	Mn 1·5	16–20	18–25	5–2
Pantal . .	aged	Mg 0·8–2, Mn 0·4–1·4, Si 0·5–1, Ti 0·3	18–25	30–35	15–12
	aged and worked		33–36	36–42	10–2
Bondur . .	aged	Cu 4·2, Mn 0·3–0·6, Mg 0·5–0·9	28–30	40–45	21–61
	aged and worked		35–45	44–60	15–2

Duralumin is somewhat similar to B.S. Seewasser. Albondur is Bondur coated on both sides with a thin layer of the purest aluminium.—A. R. P.

"Wilmil M." Anon. (*Met. Ind.* (*Lond.*), 1933, **43**, 112).—A short note describing the mechanical properties of "Wilmil M," an improved aluminium-silicon alloy.—J. H. W.

Resistance Alloys for Temperatures up to 1300° C. [Megapyr]. A. Grunert, W. Hessenbruch, and K. Ruf (*Heraeus Vacuumschmelze* [*10th Anniv. Volume*], 1933, 169–180).—The alloy "Megapyr" containing 30% chromium, 5% aluminium, and 65% iron has been developed for making heating spirals for electric furnaces operating at temperatures up to 1350° C. The alloy melts at 1530° C. and solidifies in a coarsely crystalline form, hence its working requires a special technique (not described). The rate of grain-growth of strips and wire rises rapidly with the temperature of annealing, so that when mounted in the furnace the winding requires adequate support. The tensile strength is 130 kg./mm.^{2} in the cold-worked state and 70 kg./mm.^{2} after annealing at 1200° C.; the elongation rises with annealing temperature from 1% at 20° C. to 14% at 800° C. and then falls to 3% at 1200° C., and the life of the alloy at 1200° C. is about double that of the best 80 : 20 nickel–chromium alloy. Gases containing sulphur have practically no action on Megapyr at high temperatures and very little scaling occurs after prolonged heating. The alloy has a density of 7·1, specific electrical resistance 1·4 (20° C.) and 1·42 (1200° C.) ohms. mm.^{2}/m., and a loading capacity of 1·1 watts/cm.^{2} of heating surface at 1200° C.—A. R. P.

Creep and Structural Stability of Nickel–Chromium–Iron Alloys at 1600° F. (870° C.) W. A. Tucker and S. E. Sinclair (*U.S. Bur. Stand. J. Research*, 1933, **10**, 851–862; *Research Paper*, No. 572).—A study was made of the creep characteristics at 870° C. of 15 alloys covering a range from 1 to 75% nickel and from 3 to 55% chromium. The results were compared with those of a previous investigation at 540° C. on similar alloys. In the investigation at 540° C. of the nickel–chromium–iron system, it was found that the alloys containing little or no iron, 50–80% nickel, and 20–50% chromium exhibited the greatest resistance to creep. At 870° C. the strongest alloys are those containing approximately equal parts of nickel and chromium, and not more than 30–40% iron. As part of a metallographic study the attempt was made to distinguish between the effect on structure of elevated temperature alone and of elevated temperature and stress combined. A comparison was made between the structure of specimens used in the creep test and that of the unstressed specimens of the same alloys annealed at 870° C. for periods ranging from 100 to 1000 hrs. or quenched in iced brine from that temperature. In nearly all cases the quenched specimens were similar in structure to the annealed materials, which indicates that these alloys were not readily heat-treated. Carbide precipitation and agglomeration of the carbide at the grain boundaries were most pronounced in both the binary iron–chromium alloys and the ternary iron–chromium–nickel alloys of higher chromium content. Prolonged heating of both stressed and unstressed specimens did not produce any pronounced changes in the structure of the binary iron–chromium alloys or the ternary alloys except those containing 50% or more of nickel.—S. G.

The Equilibrium Diagram of the Copper–Tin Alloys. Matsujiro Hamasumi (*Kinzoku no Kenkyu*, 1933, **10**, (4), 137–147).—[In Japanese.] This is a supplement to the previous paper (see this *J.*, 1930, **44**, 495, and 1931, **47**, 651) on the same subject, in which the equilibrium of bronzes containing 15–40% of tin was fully studied. (1) For the purpose of filling in the omissions, the liquidus and solidus lines of the copper-rich side containing less than 15% tin and the tin-rich side containing more than 40% tin were established by means of thermal and differential thermal analyses. (2) The molecular formula of the compound containing about 60% of tin, formerly named ε or CuSn, has been found by microscopic examination to be Cu_6Sn_5. A special heat-treatment was adopted to obtain the completion of the reaction Cu_3Sn + melt $\longrightarrow$ Cu_6Sn_5. (3) The nature of the change of the compound Cu_6Sn_5 occurring at nearly 170° C. was studied by the change of electrical resistance at high temperatures, by the dilatometric method, and by a method of precision differential thermal analysis having a sensitivity 10 times greater than that of the usual method. The results of these methods show that the change is similar in nature to the A_2 transformation of iron, but, from an X-ray study which is still in progress, it is considered likely to be an allotropic transformation of the compound Cu_6Sn_5. (4) The eutectic point of the phases Cu_6Sn_5 and Sn was thermally and microscopically established as 227° C. and 0·8% copper. The results of the previous and present papers are graphically summarized in Figs. 13 and 14 of the present paper.—S. G.

The Strength of Bronze [Bearing] Alloys. Anon. (*Maschinenkonstrukteur*, 1933, **66**, (9/10), 72).—The resistance to deformation of bearing bronzes of various compositions is quoted from a recent publication of the U.S. Bureau of Standards.—P. M. C. R.

The Effect of Addition Elements on the Polymorphism of Iron. V. N. Svetchnikoff (*Rev. Mét.*, 1933, **30**, 200–210).—The saturation curves of the γ-phase in binary alloys of iron have been submitted to mathematical analysis. The curves may be considered with sufficient precision to be curves of the second degree. This conclusion has been verified for the binary systems of iron with aluminium, vanadium, molybdenum, chromium, and nickel. In systems in which the A_3 point falls and the γ-field is enlarged, the curves representing the A_3 and A_4 points are regarded as portions of the same curve of the second degree and joined by an imaginary curve. The curves for the systems mentioned above are ellipses, whilst those of the iron–beryllium and iron–tin systems are hyperbolæ. The effects of the additions are to rotate the axes of the curves with respect to the axis of concentration and to change the lengths of the axes of the curves. Yensen's hypothesis of the absence of γ-phase in iron appears probable.—H. S.

Surface Tension of Type Metal Alloys. H. Vance White (*Bull. Virginia Polytech. Inst. Eng. Exper. Sta. Series Bull.* No. 13, 1933, 1–35; *C. Abs.*, 1933, **27**, 3692).—The surface tension of various alloys does not vary greatly. Impurities in type metal alloys do not appreciably affect the surface tension. Slight oxidation on casting has little effect. Zinc greatly increases the surface tension.—S. G.

On the Electrical Resistance of Magnesium and Its Alloys. Kiyoshi Takahashi and Washirô Eda (*Kinzoku no Kenkyu*, 1933, **10**, (4), 127–136).—[In Japanese.] The specific electrical resistivity of pure magnesium and its binary alloys with aluminium, zinc, cadmium, silver, tin, copper, and nickel has been determined by means of the potentiometer. The results show that the effect of aluminium is the greatest, and that of copper is smallest, the order being aluminium, tin, zinc, silver, cadmium, nickel, copper. The difference in specific resistance due to the constitution of the alloys is discussed. The specific resistance has been determined for 10 useful alloys, including Elektron, Dow metal, &c.—S. G.

The Solubility of Silver in Mercury.—II. Robert E. Deright (*J. Physical Chem.*, 1933, **37**, 405–415).—Amalgams containing as little as 0·06% (atomic) of silver have been prepared and analysed with an accuracy of about 1 part in 1000, and 128 determinations of the solubility (N) of silver in mercury over the range 20°–80° C. have been made. Several forms of silver and intermetallic compounds have been used as the solid phase. N is related to T, the absolute temperature, by the equation $\log N = 0{\cdot}5894 - 1105{\cdot}8/T$. The term "solubility" in a metallic system has a limited significance unless the particle size is specified.—J. S. G. T.

Standard and Precision Weights of Molybdenum–Chromium–Nickel Alloy [Contracid]. L. Dede (*Heraeus Vacuumschmelze [10th Anniv. Volume]*, **1933**, 81–83).—The nickel–chromium alloy "Contracid B 7 M" containing 7% of molybdenum has a density of 8·40, *i.e.* about the same as the ordinary brass weights, and hence the usual tables for reducing weighings to *vacuo* can be employed when using weights of this alloy. Unlike platinum alloy weights, Contracid weights do not adsorb moisture; they are, like platinum alloy weights, quite unattacked by any of the ordinary laboratory atmospheres. This alloy should therefore be useful for making standard weights.—A. R. P.

Electrode Material [Contracid] for Spark Spectroscopy. L. Dede (*Heraeus Vacuumschmelze [10th Anniv. Volume]*, **1933**, 84–85).—For absorption spectra in the region above 2200 A. the two Contracid alloys B 7 M and BMWC are recommended for electrodes, since they give a uniformly bright spectrum with a regular line distribution.—A. R. P.

Properties of the Alloys of Nickel with Tantalum. Eric Therkelsen (*Met. Ind.* (*Lond.*), **1933**, 43, 175–178).—Abstracted from *Metals and Alloys*, 1933, 4, 105. See *J.*, this volume, p. 494.—J. H. W.

The Temper-Hardening of Alloys. II.—Abnormal Phenomena with the Silver-Rich Aluminium–Silver Alloys during Heat-Treatment. Denzo Uno and Sadamu Yosida (*Kōgyō Kwagaku Zasshi* (*J. Soc. Chem. Ind. Japan*), **1933**, 36, (4); *C. Abs.*, 1933, 27, 3692).—[In Japanese, with English abstract in supplemental binding, p. 172.] A transition occurs at 450° C. during heating where heat absorption and contraction take place, although on cooling the transition takes place at 400° C. with heat evolution and expansion. This is in contrast to the previously observed transition at 600° C., where expansion and heat absorption occur on heating and the reverse changes take place at the same temperature on cooling. The abnormal expansion at 200° C., as well as the contraction at 450° C., depend on the spontaneous evolution or absorption of heat during the tempering.—S. G.

The White Alloys of Tin. I.—The Bearing Metals. Anon. (*Tin*, **1933**, (May), 15–18).—The white alloys of tin are roughly classified and the requirements and properties of white bearing metals are described.—J. H. W.

Special Alloys. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 227–228).—The composition and principal mechanical properties and applications of the following "trade alloys" are given: Coleco bearing metal, Coles metal, composition metal (ounce metal), Constructal 2 and 8, Colorado metal, Cornish bronze, Cooper's alloy, Corronil, Corronium, and Chronit.—J. H. W.

Hardness of Low Melting Point Alloys at Different Temperatures. II.—Binary Alloys Whose Components Combine Chemically. W. P. Schischokin and W. Ageewa (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1932**, 119–136; *C. Abs.*, 1933, 27, 3692).—[In Russian.] Cf. this *J.*, 1931, 47, 16. The following alloys made of purest materials were investigated: lead–bismuth, thallium–bismuth, thallium–lead, and tellurium–bismuth, and also pure aluminium, magnesium, and tellurium. For all systems the following data were determined: Brinell hardness at various temperatures, melting points and temperature coeff. of hardness. The specimens were previously annealed for 100–200 hrs. at temperatures between 100° and 250° C. The results were as follow: (1) *Lead–bismuth.* The hardness curves of the system at room temperature showed maxima at 25, 40, and 80% bismuth and minima at 35 and 50% bismuth. With increasing temperatures the hardness decreased, and the minima and maxima flattened out gradually. The minimum observed at room temperature at 50% bismuth, with increasing temperature is gradually displaced toward the eutectic composition (56·25% Bi). The minima are due to the formation of compounds. The temperature coeff. of hardness shows a maximum at the eutectic composition. (2) *Thallium–bismuth.* The room temperature–hardness curve shows a maximum at 23·6% thallium and a minimum at 35·5–37·5% thallium; this indicates an intermetallic phase. The maxima and minima gradually flatten out and disappear with increasing temperatures. The curves for temperature coeff. of hardness show a minimum corresponding apparently with an intermetallic phase, and two maxima corresponding with two eutectics. Logarithmic hardness curves for high-thallium alloys have a break indicating a transformation. (3) *Thallium–lead.* Hardness curves showed a flat minimum at 28–40% lead, flattening out at high temperatures. The temperature coeff. of hardness is rather uniform, with a minimum at the above composition and a maximum at 70% lead. (4) *Tellurium–bismuth.* Hardness curves showed sharp maxima at 49·1 and 90·7% tellurium, and a minimum at 60% tellurium. This system represents a unique case among metallic systems, in that the hardness of the compound Bi_2Te_3 (60% Te) does not exceed the hardness of the components. The temperature coeff. of hardness is a minimum at 60% tellurium and a maximum at 90% tellurium. Consideration of the above results indicates that the formation of intermetallic compounds, in almost all cases investigated, is shown by the minima in the temperature coeff. of hardness. The study of hardness of metals at elevated temperatures made it possible to determine certain relationships between the temperature coeff. of hardness and the following properties—melting point, atomic volume, coeff. of expansion, and hardness. Results are given for magnesium, aluminium, zinc, cadmium, tin, tellurium, thallium, lead, and bismuth. With the exception of tellurium and bismuth, the atomic volume varies inversely with hardness. With the exception of tin, the curves for the temperature coeff. of hardness run parallel with change in coeff. of expansion and the change in attractive atomic forces. Inverse proportionality is found between the temperature coeff. of expansion and the melting point. This is in agreement with the empirical generalization of Grüneisen, that the total percentage change in volume from absolute zero to the melting point is the same for all elements. In the binary eutectic systems the temperature coeff. of hardness is higher than in pure metals, the maximum coeff. being observed in eutectic and nearly eutectic compositions. —S. G.

On the Age-Hardening of Cold-Worked Metals and Alloys. Tadashi Kawai (*Kinzoku no Kenkyu*, 1933, **10**, (7), 302–330).—[In Japanese.] Tensile strength and hardness are usually employed as a measure of age-hardening by cold-working, but the yield-point is also a convenient measure of the age-hardening phenomenon. K. therefore studied the effects of the dimensions of the test-piece, degree of stretching, heating after stretching, repeated stretching, grain-size of material, rate of cooling in previous annealing, &c., on the age-hardening and determined the age-hardening for iron and various steels and non-ferrous metals and alloys by means of the yield-point. He then investigated the relation between the results of high-temperature tests and age-hardening. With regard to the mechanism of age-hardening, K. is of opinion that the hardening is principally due to the stabilization of internal stress and the change in the coherence between slip planes caused by cold-working. Moreover, K. confirmed, from the results of experiments, that the serration which is observable on the stress–strain diagram in high-temperature tests of iron, steel, some copper alloys, nickel, and Duralumin is the combined effect of age-hardening and yielding.—S. G.

On the Boiling of Some Metals and Alloys at Atmospheric Pressure. W. Leitgebel (*Z. Metallkunde*, 1933, **25**, 168–169).—Abstracted from *Z. anorg. Chem.*, 1931, **202**, 305–324; cf. this *J.*, 1933, **50**, 736.—M. H.

Mechanical Properties of Metals at Low Temperatures. J. B. Johnson and Ture Oberg (*Met. Ind.* (*Lond.*), 1933, **42**, 393–394, 402).—Abstracted from *Metals and Alloys*, 1933, **4**, 25–30; see *J.*, this volume, p. 295.—J. H. W.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 497–498.)

The Effect of Temperature on the Reflection of X-Rays from Bismuth Crystals. A. Goetz and R. B. Jacobs (*Phys. Rev.*, 1933, [ii], 43, 213).—Abstract of a paper read before the American Physical Society. Previous experiments by Goetz and Hergenrother on the influence of temperature on the reflectivity of bismuth crystals for X-rays have been continued with higher accuracy. It has been found that the Debye–Waller relation for the temperature effect does not hold, and that the deviation from it cannot be ascribed in any simple manner to the occurrence of anharmonics of higher orders at high temperatures which should be expressed as well in the temperature coeff. of the thermal expansion. The existence of a thermal hysteresis for the integrated as well as the maximum reflection for Bi (111) Mo k_a was found, and thus the existence of a two-phase system within a crystal (amorphous and ideal crystal phase), as has been suggested previously, seems to find support.—S. G.

The Structure of Magnesium, Zinc, and Aluminium Films. G. I. Finch and A. G. Quarrell (*Proc. Roy. Soc.*, 1933, [A], **141**, 398–414).—An electron diffraction camera in which a metal film is swept by a diffuse beam of electrons is described. Oxide-free surfaces of magnesium, zinc, and aluminium on platinum, and vapours of these metals in transit between source and receiver, were examined by electron diffraction. Oxides of magnesium and zinc formed on the corresponding metal have also been examined. It has been found that (i) the structure of the thin aluminium foil is that of a face-centred tetragonal lattice, and thus differs from that of the normal structure, which, however, is obtained with sufficient film thickness; (ii) thin oxide layers of magnesium and zinc also exhibit abnormal crystal structures; (iii) heating the receiver causes the crystals to be preferentially oriented; (iv) metal vapours do not diffract, but scatter the electrons. The mechanism of crystal growth in the films as influenced by the substrate is discussed. Magnesium, zinc, and aluminium vapours are found to be monatomic.—J. S. G. T.

A Critical Study of the Intensity Formula for the Powder Method of Crystal Analysis. F. C. Blake (*Phys. Rev.*, 1933, [ii], **43**, 376).—Abstract of a paper read before the American Physical Society. By combining the Thomson and Lorentz factors into a single factor, and the usual structure factor and the atomic form factor into another single factor, the intensity formula consists of the product of these two together with the form or multiplicity factor, the Debye temperature factor, and the absorption factor, treated by Claassen and Rusterholz. It is possible from a knowledge of these 5 factors to study intensity as a function of the wave-length for metals of different atomic numbers. Calculated results can be compared with experiments by means of densitometer experiments properly interpreted. The comparison has been made for aluminium using molybdenum and copper rays, and agreement found for molybdenum rays. The reasons for disagreement when copper rays are used are discussed. There are other factors not properly handled in the intensity formula. These are discussed.—S. G.

On the Theory of Real Crystals. Adolf G. Smekal (*Phys. Rev.*, 1933, [ii], **44**, 308–309).—A note criticizing the views of Zwicky (*Phys. Rev.*, 1933, [ii], 43, 765; *Helv. Phys. Acta*, 1933, **6**, 210). S. considers that there is no theoretical proof of the existence of a secondary structure in crystals, and that the experimental evidence is open to question.—W. H.-R.

IV.—CORROSION

(Continued from pp. 499–502.)

Corrosion of Nickel and Monel Metal by Sulphured Grape Juice. E. M. Mrak and W. V. Cruess (*Indust. and Eng. Chem.*, 1933, 25, 367–369).—Experiments made for the purpose of determining the rates and extent of corrosion of nickel and Monel metal in " fogs " of natural and sulphured grape juice are described. Red and white grape juices were used, with and without the addition of sulphur dioxide, the juices being sprayed under highly aerated conditions into a bell-jar in which the strips of metal were suspended. The tests showed that sulphurous acid greatly increases the corrosive action of grape juice on nickel but not on Monel metal. In the case of Monel metal some constituent of red grape juice, possibly anthocyanin pigments, causes a greater corrosion by the juice than sulphurous acid. In most cases Monel metal proved more resistant than nickel to corrosion by the media used in these tests.—F. J.

Corrosion–Accelerated Wear. Horace J. Young (*Automobile Eng.*, 1933, 33, 295–297).—The causes of the localized wear of cylinders, cylinder liners, and bearings are discussed, and it is suggested that such wear may be due to corrosion. Corrosion of pins and journals of a crankshaft is said to result from lubricating oil contaminated with combustion products and with contaminants entering the combustion zone. A method of testing corrosive oil by using white-metalled steel specimens is described. The effects of such a corroding medium on the steel and white bearing metal are considered, and the influence of such corrosion on the bearings and cylinder liners of all types of internal combustion engines, both large and small units, is discussed.
—J. W. D.

The Influence of Corrosion Pits, &c., on Fatigue. D. J. McAdam, Jr. (*Amer. Soc. Mech. Eng. Preprint*, 1933).—The paper is divided into 8 sections : (1) is a brief introduction emphasizing the importance of the effects of notches on the fatigue limit; (2) discusses the theoretical effect of notches on " two-dimensional " and " three-dimensional " stress distribution; (3) considers static stress distribution as determined by various experimental methods; (4) presents original data showing the influence of prior stressless corrosion on the fatigue limit of steels and aluminium alloys; (5) discusses the effect of mechanically formed notches, and the influence of work-hardening whilst forming the notch; (6) deals with the effect of completely and incompletely encircling grooves, surface roughness, surface hardness on the percentage drainage due to notches; (7) discusses the effect of size of notch and size of specimen; and (8) deals with practical applications of the subject.
—W. P. R.

The Current Limits in the Anodic Polarization of Metals in Aqueous Solutions. Erich Müller and Kurt Schwabe (*Z. Elektrochem.*, 1933, 39, 414–423). —The criticisms by W. J. Müller (cf. *J.*, this volume, p. 423) of the theory of passivity put forward by M. and S. (see this *J.*, 1932, 50, 610) are answered and his conclusions are in their turn criticized. Fresh observations on the coating resistance are put forward, based on the results obtained with 2 zinc electrodes in an $\frac{m}{2}$ zinc sulphate solution.—J. H. W.

New Methods of Examining Metals from the Point of View of their Heterogeneity and their Resistance to Corrosion. —— Prot and (Mlle.) N. Goldovsky (*Compt. rend.*, 1933, 196, 136–137).—A heterogeneous alloy or set of metals is immersed in an electrolytic solution and the alteration of the hydrogen-ion concentration is measured by means of an indicator. This use of an indicator and of a colloidal stabilizer (gelatine) constitutes a practical test of heterogeneity liable to become a source of dangerous corrosion, especially in the case of light alloys, and also furnishes a rapid, convenient, and non-destructive control of heat-treating, riveting, and welding operations. The indicators are chosen to give a range of p_H 4 to p_H 12. The usual tests for corrosion are not suitable for measuring pinhole corrosion. For this purpose, the test-pieces are immersed in sea-water for some days, in the case of Duralumin, and then placed on photographic paper which shows the nature and extent of this form of corrosion.—J. H. W.

V.—PROTECTION

(Other than Electrodeposition.)

(Continued from pp. 502–506.)

Calorizing. Anon. (*Mech. World*, 1933, **93**, 214).—The applications of Calorizing, including the protection of heat-resisting alloys when heated above 1000° C. and of nickel–chromium alloys for service in an atmosphere of sulphurous gases, are enumerated. The nature of the coating formed is described and the corrosion-resistance of Calorized steel compared with that of untreated steel is graphically represented.—F. J.

Sherardizing and Oxidizing Castings. Anon. (*Z. ges. Giesserei-Praxis: Eisen-Zeit.*, 1933, **54**, 221–222).—For sherardizing, a mixture of 0·15 m.^{3} of zinc dust, containing not more than 0·19% of lead and 9% of zinc oxide, with 0·85 m.^{3} of fine quartz and 50 grm. of naphthalene, is heated to 380° C. in a drum. The castings are then put in and left for at least 2 hrs. While cooling, the drum is rotated 15–20 times per minute for $\frac{1}{2}$–1 hr. The Chemag and the Citoxit processes for protective oxidized finishes to iron castings are described.—J. H. W.

Critical Observations on the So-Called "Ageing Phenomena" of Zinc-Sprayed Castings, with Special Regard to the Mechanical–Technical Properties of Cast Iron. Willi Claus (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 286–288).—The elongation, tensile strength, Brinell hardness, percussion resistance, and bending strength of cast iron and cast iron sprayed with zinc and aged for 5-weekly periods up to 60 weeks have been investigated. It was found that the elongation during this period was very small (about 0·13–0·14%), that the static mechanical properties showed a tendency to increase, and that the dynamic property, although lower at the end of this period, was still greater than that of cast iron. Six references are given.—J. H. W.

The Scientific Study of Protective Painting. S. C. Britton and U. R. Evans (*Electrochem. Soc. Preprint*, **1933**, Sept., 9–21).—The factors which produce failure in paint films on iron and steel have been studied and details of tests designed to assess the effects of the nature of the metal, the presence of scale, rust, water, and salt between the paint film and the metal, the composition of the paint, and the nature of the conditions to which the painted metal is exposed, are given. Promising results in the protection of iron and steel by sprayed aluminium coatings have been obtained.—A. R. P.

On the Study of Protective Films Against Corrosion Formed on the Surface of Aluminium Alloys. Hikozô Endô and Masayoshi Tagaya (*Kinzoku no Kenkyu*, 1933, **10**, (5), 179–199, 227–242).—[In Japanese.] In this investigation specimens were dipped in various salt solutions and the metal surfaces examined for formation of insoluble protective salt coatings. As a result of a preliminary examination various protective coatings were successfully obtained from the following salt solutions: (1) 2% potassium permanganate, 2% sulphuric acid, 2% manganese dioxide; (2) 1% calcium oxide, 1% calcium sulphate or zinc oxide, and 0–1% potassium permanganate, &c. These were adopted for aluminium and its alloys. The period of immersion was 30–40 minutes. With baths in the boiling condition: (3) 10% dibasic sodium phosphate or potassium phosphate, 3% sodium hydroxide or 4% sodium carbonate and saturation with magnesium phosphate; (4) 0–10% dibasic sodium phosphate, 0·5–5% sodium hydroxide, 0–3% magnesium phosphate, 1·0–3·0% potassium bichromate, and 0·5–3% aluminium sulphate or $KAl(SO_4)_2,12H_2O$; (5) 1% selenious acid and 1% sodium carbonate, &c. These were adopted for magnesium and its alloys. The time of immersion was a few hours. It was found that the most promising method of protective coating consisted of a chemical treatment of the metal surface as above, followed by a coating of lanolin, Bakelite varnish, or special rubber. The protective coatings were only a few thousandths of an inch in thickness and were not appreciably affected by dimensional changes of the alloys. It has been found by other authors that such films can resist severe bending or other mechanical treatment and form a satisfactory base for certain paints, lacquers, &c.—S. G.

VI.—ELECTRODEPOSITION

(Continued from pp. 506–512.)

The Electrodeposition of Bismuth from Perchloric Acid Solutions. M. Harbaugh and F. C. Mathers (*Electrochem. Soc. Preprint*, **1933**, Sept., 155–160).—Good deposits of bismuth can be obtained from baths containing bismuth oxide 5·3 and perchloric acid 13·5 oz./gall.; the bath has a decomposition voltage of 1·62 v., a cathode efficiency of 100%, and a throwing power of 7–9%. The deposits are a little smoother when 0·03% of glue and 0·08% of cresol are added to the bath; in all cases they contain 0·3–0·5% of perchlorate as well as traces of addition agents, if present in the bath. Large amounts of ammonium perchlorate and traces of nitric acid or nitrates have no effect on the operation of the baths, but chlorides or sulphates cause precipitation of basic bismuth salts. Since most perchlorates are soluble, the method cannot be used for refining bismuth, but it can be used for the deposition of alloys of bismuth with lead, copper, or arsenic.—A. R. P.

Ensuring Clean Cadmium-Plated Coatings. E. E. Halls (*Synthetic and Applied Finishes*, 1933, **4**, (37), 16–17, 20; *C. Abs.*, 1933, **27**, 3883).—Satisfactory cadmium deposits are assured when attention is given to operating conditions as well as to initial cleansing and final thorough washing of the work. The use of iron, stoneware, or rubber-lined wood for vat construction, and raw material of controlled purity with periodic filtration of the electrolyte assist in the prevention of contamination. Chemical control is essential to maintain a sufficient cyanide concentration to keep cadmium in solution, and to determine effective anode area. Ball-form anodes in iron-wire cages are economical and facilitate control.—S. G.

Chromium Plating from Ammonium Chromate–Sulphate Baths. Raymond R. Rogers and John F. Conlon (*Electrochem. Soc. Preprint*, **1933**, Sept., 319–324).—The range of composition at which bright chromium plates can be obtained in the system chromic acid–sulphuric acid–ammonia has been determined, and the results are shown in a ternary diagram; they may be summarized as follows: (*a*) except when the concentration of chromic acid or ammonium sulphate is very small, all solutions containing ammonium bichromate, chromic acid, and ammonium sulphate give bright deposits until the solution becomes saturated with respect to one of its constituents; (*b*) solutions of chromic acid and ammonium sulphate with small proportions of sulphuric acid give bright deposits, but these become frosty and brittle when more of the latter is added. Three typical baths in the bright deposit range have been investigated to determine the conditions under which the best deposits are obtained, and the current efficiency, throwing power, and continuity of the deposit under these conditions; none of the baths is superior to the ordinary chromic acid bath.—A. R. P.

The Electrodeposition of Magnesium. D. M. Overcash and F. C. Mathers (*Electrochem. Soc. Preprint*, 1933, Sept., 131–136).—Magnesium can be deposited by electrolysis of the Grignard reagent derived from ethyl iodide in the form of loose, poorly adherent crystals. Addition of dimethylaniline produces brighter and more adherent deposits, but in neither case is there any anodic corrosion so that the life of the bath is short. Cathode current efficiencies start at 80–85%, but fall off slowly with continued electrolysis. The ethyl bromide Grignard reagent gives deposits starting at a current efficiency of 55%, but the bath (with dimethylaniline) has a high resistance and is less stable than the iodide bath. Neither type of bath appears to be of any commercial value.—A. R. P.

The Electrodeposition of Nickel and Chromium. J. W. Cuthbertson (*Metallurgia*, 1933, 8, 109–110).—See *J.*, this volume, p. 88. There are 2 processes by which articles may be electrolytically plated with chromium: (1) from a dull solution; (2) from a bright solution. The former is worked at a higher current density than the latter, and the deposit obtained is dull greyish in colour and must be finished. As finishing presents difficulties owing to the hardness of the deposit, this type of plating is gradually being replaced by plating from a bright solution. The production of a bright deposit is possible only if the solution is worked between certain comparatively narrow limits as regards temperature, current density, and composition. The solution required and the operations of the bath in these processes using different anodes are discussed and the procedure in chromium plating an article is given in detail. Consideration is also given to the danger of contamination by foreign elements, to the prevention of gassing, to the results obtained from chromium electrodeposits, and to the difficulties of plating complex articles.
—J. W. D.

Practical Plating. The Deposition of Nickel.—Solutions. E. A. Ollard (*Met. Ind.* (*Lond.*), 1933, 43, 59–60, 107–109).—See *J.*, this volume, p. 449. The composition of various solutions used in nickel deposition, the function of addition agents, the effects of different impurities, the chemical composition and physical structure of the anodes, and the working conditions of the baths are discussed.—J. H. W.

Throwing Power and Current Efficiency of the Nickel Plating Solution at Low and High p_H. Russel Harr (*Electrochem. Soc. Preprint*, 1933, Sept., 203–217).—An apparatus for determining the throwing power of plating solutions using bent wire cathodes giving readily reproducible results is described, and the results obtained with nickel-plating solutions containing 40 and 60 oz./gall. of nickel sulphate crystals at various temperatures and current densities and at p_H 2 and p_H 6 are tabulated. Under all the conditions tried the throwing power at p_H 6 is better than at p_H 2, and in both cases is improved by raising the temperature, especially in solutions of p_H 2, which have a poor throwing power at room temperature. At p_H 6 throwing power decreases with increase in current density, whereas at p_H 2 it increases; a similar, but much less marked, effect is produced by increasing the nickel sulphate content from 40 to 60 oz./gall. Ferrous sulphate has no effect on throwing power, but ferric sulphate (stable only at p_H 2) considerably reduces it. Hydrogen peroxide has little effect at p_H 6, since it decomposes rapidly during plating, but at p_H 2 it reduces throwing power seriously by its action in keeping any iron present in the ferric state.—A. R. P.

The Adhesion of Electrodeposited [Nickel] Coatings to Steel. A. W. Hothersall (*Electrochem. Soc. Preprint*, 1933, Sept., 85–97).—To determine the adhesion of electrodeposited nickel to steel a cylindrical test-piece 1·5 in. long and 1 in. diam. is stopped off with wax and nickel is deposited on the exposed end to a thickness of not less than 0·1 in.; the wax is then removed and the test-piece machined so as to form an annular ring overlapping the cylinder at the outside and with a central hole drilled into the steel. The overlap is allowed to rest on the top of a thick-walled hollow cylinder, into which the steel cylinder fits loosely, and this is then forced downwards by a plunger which passes through the hole in the deposit. The adhesion value in tons/in.^{2} of nickel deposited on thoroughly cleaned metals is as follows: mild steel 28·1, nickel steel 32·1, nickel–chromium–molybdenum steel 21·3, 60 : 40 brass 19·2, 70 : 30 brass 23·7, copper 18·5, nickel 22·8, manganese–brass 22·3, aluminium 3·5. In all cases the base metal failed before the deposit was torn off. Poor adhesion is caused by inefficient cleaning (presence of a film of oxide, grease, or adsorbed colloidal matter), a layer of defective metal formed in the early stages of deposition, or a surface layer of the basis metal which is initially weak or which is embrittled by co-deposited hydrogen. Adhesion is considered to be due to the cohesive force between the two metals: only in rare cases do the crystals of the deposit continue the crystal structure of the basis metal.—A. R. P.

A New Bath for the Direct Nickeling of Zinc. George W. Nichols (*Electrochem. Soc. Preprint*, **1933**, Sept., 149–154).—The rate of chemical replacement of nickel by zinc is retarded by addition of hydroxy-organic acids such as citric, malic, and, particularly, lactic acids, of certain alcohols such as ethyl and methyl alcohol, but not glycerol, and of some sugars, particularly dextrose. Good electrolytic deposits of nickel directly on to zinc can be obtained by addition of 0·7 oz./gall. of ammonium lactate to a bath containing nickel ammonium sulphate 10, sodium chloride 5, and boric acid 2 oz./gall.; excessive amounts of lactate cause treeing at points of high current density. Increasing the nickel content of the bath increases the lactate–nickel ratio necessary to prevent streaking, and tends to produce deposits containing numerous hair cracks: the best deposits are obtained at $p_{\rm H}$ 3·7–4·3. Baths buffered with citrate, malate, or dextrose give yellower and more matte deposits than do lactate baths, and the yellow tone cannot be removed by burnishing.—A. R. P.

Platinum Plating. Alan E. W. Smith (*Met. Ind.* (*Lond.*), 1933, **43**, 201–202).—A number of corrosion tests in different media and at temperatures up to 500° C. were carried out on brass, platinum plated on a silver-plate undercoat, and a comparison was made between the corrosion resistance of this form of plating and that of nickel- and chromium-plating and 2 stainless steels when immersed in a 2% solution of iodine in alcohol. It was found that platinum plating is similar to chromium plating in being "non-corroding," but in failing through the porous nature of the deposit. Chromium plating is harder and cheaper, but platinum plating has a far more pleasing colour and a better throwing power.—J. H. W.

New Continuous High-Speed Zinc-Plating Process. Anon. (*Automotive Ind.*, 1933, **69**, 182).—An account of a new method of electrodepositing zinc on steel plate. Several sheets of standard size are plated per minute by a continuous automatic process, which is briefly described. By the same process steel can be coated with smooth and bright deposits of brass or copper.
—P. M. C. R.

Metal Cleaning before Electro-Plating. Anon. (*Engineer*, 1933, **156**, 45–46).—Non-adherence of electrodeposited metal can usually be ascribed to insufficient cleaning of the surface to be plated. Simple removal of grease by means of an organic solvent is far from satisfactory, and the essentials of a perfect cleaning process involve emulsification and peptization. A form of metal cleaner which has proved to be efficient contains aluminate and silicate of potassium and sodium, and this solution acts in two ways simultaneously: it emulsifies vegetable and animal fats and at the same time the suspended colloidal matters scour the surface and mechanically remove all dirt and mineral oils.—W. P. R.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-Refining.)

(Continued from pp. 512–513.)

Depolarization by Graphite Anodes in the Electrolysis of Aluminium Oxide. M. de Kay Thompson and R. G. Seyl (*Electrochem. Soc. Preprint*, **1933**, Sept., 123–129).—The decomposition voltages of alumina in molten fluoride baths have been calculated (C) by the third heat theorem for platinum and graphite anodes at 1000° and 1300° C. Actual measurements (M) have also been made of these voltages at temperatures between 971° and 1231° C. using both types of anodes. For a 20% solution of alumina the values for 1000° C. are: platinum C 2·24, M 2·25; graphite C 1·09, M 1·38 volts; and for 1300° C.: platinum C 2·09, M 1·75; graphite C 0·81, M 0·88 volts. Hence the depolarization (difference between the decomposition voltages at attackable and unattackable anodes) is 0·87 (C) at both temperatures and 1·15 (M) at 1000° C. and 1·28 (M) at 1300° C. This shows that depolarization by the graphite anode is not complete at any temperature in this range, *i.e.* the evolved oxygen is not reduced to the pressure at which it is in equilibrium with carbon. There is no overvoltage on platinum anodes and no overvoltage of aluminium deposition.—A. R. P.

The Reduction of Chromium from Chromium Oxide by Means of Gases. H. Gruber and W. Rohn (*Heraeus Vacuumschmelze* [*10th Anniv. Volume*], **1933**, 117–127).—When chromic oxide is reduced by a current of hydrogen over a bath of molten iron or nickel, action ceases when the alloy contains 17% chromium. By carefully purifying the hydrogen from water vapour, &c., by passing it through a tube cooled with carbon dioxide snow and acetone or packed with phosphoric anhydride the chromium content of the alloy can be increased to 25–31%. With carbon monoxide as reducing agent, reaction ceases when the alloy contains 3·5% chromium, and with ammonia when the alloy contains about 18–19% chromium. Addition of hydrocarbons to the hydrogen to give a mixture containing not more than 50 grm. of carbon per m.^{3} of hydrogen, or the use of coal gas—producer gas mixtures of similar composition, results in a more rapid reduction of the chromium oxide without introducing more than 0·05% carbon into the alloy. For large-scale work an induction furnace lined with magnesite is necessary to give efficient circulation of the molten metal; temperatures above 1750° C. increase at first the rate of absorption of chromium by the metal, but cause crusts to form round the sides, so that the efficiency of absorption falls off. For a surface of 350 cm.^{2} gas speeds exceeding 30 m.^{3}/hr. produce no further increase in the rate of reduction.—A. R. P.

Preparation of Carbon-Free Chromium Alloys from Carbonized Ferrochromium. H. Gruber (*Heraeus Vacuumschmelze* [*10th Anniv. Volume*], **1933**, 128–138).—Treatment of molten ferrochromium (70–75% chromium, 6–4% carbon, remainder iron) with chromite–fluorspar mixtures or with hammerscale in the high-frequency induction furnace yielded alloys containing not less than 0·51% carbon with a serious loss of chromium into the slag. By using chromic oxide in an atmosphere of hydrogen, 10 kg. of alloy can be decarburized to 0·04% carbon in 6½ hrs. with the consumption of 8 m.^{3} of hydrogen and without any loss of chromium. Hydrogen is more efficient than water-gas, and pure chromic oxide is much better than powdered chromite; a temperature of at least 2000° C. is required. Both carburized nickel–chromium alloys and chromium metal can be decarburized in a similar way. Nickel–chromium alloys containing up to 70% chromium can be prepared by reducing chromium oxide with carbon over a bath of molten nickel and subsequently decarburizing with chromic oxide in hydrogen.

Vanadium or titanium alloys with iron or nickel or both can be prepared in a similar way. Decarburization is in all cases accelerated by reducing the gas pressure above the molten metal bath.—A. R. P.

The Metal Displacement Equilibrium of Lead with Cadmium or Silver in Their Molten Chlorides, Bromides, or Iodides. Dymitr Hewskyj and Karl Jellinek (*Z. Elektrochem.*, 1933, 39, 444–453).—A method of measuring the metal displacement equilibrium in salt melts is described. It is shown that with electrolysis of molten salt mixtures the equilibrium at the cathode sets in rapidly. The equilibrium $Cd + PbCl_2 \rightleftharpoons CdCl_2 + Pb$ at 600° C. with and without dilution of the metal phase with bismuth was determined chemically and by electrolysis of a melt of cadmium and lead chlorides with a cathode of molten bismuth. In all cases, the same molar fraction number resulted, and the melts behaved as ideal solutions. The equilibria $Cd + PbBr_2 \rightleftharpoons CdBr_2 + Pb$ at 600° C., and $Cd + PbI_2 \rightleftharpoons CdI_2 + Pb$ at 500° C. were measured. All these reactions obey the molar fraction-effect law, and for equal temperatures, the value of the factor is independent of the halogen. The equilibria $Pb + 2AgCl(Br)(I) \rightleftharpoons PbCl_2(Br_2)(I_2) + Ag_2$ were measured at 800° C. They also obey the molar fraction-effect law and behave as ideal solutions. The silver in the molten lead is diatomic, but the silver ion in the melt is monatomic. The value of the molar fraction factor is strongly dependent on the halogen. Lead can precipitate much less silver from the iodide than from the chloride melt. Analytical methods for determining small amounts of cadmium when a large amount of lead is present, and small amounts of bismuth in ternary alloys containing a little lead and cadmium are given.—J. H. W.

The Kinetics of the Deposition of Small Amounts of Mercury by Means of Iron and Copper. Vladimír Majer (*Z. Elektrochem.*, 1933, 39, 439–444).—The kinetics of the deposition of mercury from very dilute solutions of $HgCl_2$ (10^{-5} to 10^{-7} grm.mol./litre) with metallic copper and iron have been investigated. Observations were made of the effect of the phase boundary surface, the vigour of stirring, and the temperature of the reaction constant. For the deposition by iron, with a phase boundary surface of 1·30 cm.^{2}, at 55° C. and with stirring, the reaction constant was found to be 0·045 min.$^{-1}$. The deposition with copper was investigated under the same conditions, and showed a progressive reduction in the reaction velocity. The reaction tends to a condition of equilibrium which does not agree with thermodynamic considerations. On the assumption that a known amount of mercury cannot be deposited from solution, it is possible to transform the reaction equation to the usual form from considerations of diffusion. The observed reaction constant was 0·037 min.$^{-1}$. The difference in the kinetics of mercury deposition with iron and copper was traced to the various factors investigated.—J. H. W.

A Study of the Changes in Mass of the Anode of the Aluminium–Lead Cell. Charles E. Welling (*J. Sci. Lab. Denison Univ.*, 1933, 28, 147–151; *C. Abs.*, 1933, 27, 3884).—Aluminium–lead cells containing an approximately 2% solution of ammonium phosphate were studied to determine the relation of the loss of weight of aluminium to the leakage current. Decrease in weight of the anode was negligible, and in no way proportional to that required by Faraday's law for the current measured. A *bibliography* is given.—S. G.

Faraday and His Electrochemical Researches. Robert S. Hutton (*Electrochem. Soc.*, **1933**, Sept., 1–18).—An address commemorating the 100th Anniversary of Michael Faraday's discovery of the fundamental principles of electrochemistry, giving a brief account of his life and work, with copious extracts from his diary.—A. R. P.

March of Electrochemistry. Charles L. Mantell (*Chem. and Met. Eng.*, 1933, **40**, 120–122).—A historical account of the commercial developments of the electrochemical industries from 1800 to the present day.—F. J.

VIII.—REFINING

(Continued from p. 513.)

An Electrolytic Copper Refinery. Anon. (*Engineer*, 1933, **156**, 153–155).—Description of the now completely electrified copper refinery at Montreal with a capacity of 75,000 tons per year.—W. P. R.

Copper Product Perfected. B. H. Strom (*Eng. and Min. J.*, 1933, **134**, 281–282).—Describes the production of copper sheets by electro-deposition at the Raritan Copper Works, New Jersey, U.S.A. The plant capacity is 6000 linear ft. of copper sheet, 3 ft. wide, and varying in gauge from 0·0017 to 0·013 in. or from 1 to 7 oz./ft.^{2}. The production is accomplished in two steps; the first operation involving electrolysis on a revolving antimonial lead cathode. Sheets up to 1 oz. thickness are produced. Heavier sizes are made by building up these sheets in a loop cell.—R. Gr.

Continuous Lead Refining. Anon. (*Eng. and Min. J.*, 1933, **134**, 285–286).—Summarizes the development of the continuous method of refining for arsenic, antimony, copper, gold, silver, and zinc, now practised at Port Pirie, South Australia, and its advantages.—R. Gr.

Electrodeposition of Lead from Dithionate Baths. R. L. Bateman and F. C. Mathers (*Electrochem. Soc. Preprint*, **1933**, Sept., 301–308).—Lead can be satisfactorily refined by electrolysis in baths containing 4–5% of lead dithionate and 1·5–2% of free dithionic acid using at 20° C. a current density of 1 amp./dm.^{2} at 0·3 v. with an electrode separation of 4·4 cm. To prevent treeing and to obtain smooth adherent deposits, colloidal addition agents must be present; the best results are obtained with 0·005% of glue together with 0·005% of one of the following: β-naphthol, cresol, phenol, resorcinol, clove oil, aloes residue. Anode and cathode current efficiencies are approximately 100%, but there is a tendency for the concentration of the free acid to diminish and that of the lead salt to increase; this is overcome by withdrawing a portion of the bath, removing the lead by addition of sulphuric acid, and returning the filtrate to the bath. The bath is prepared by treating manganese dithionate solutions (produced by the action of sulphur dioxide on manganese dioxide suspensions at 0° C.) with an excess of barium hydroxide, crystallizing out the barium dithionate, removing the barium with the theoretical quantity of sulphuric acid, and adding the requisite quantity of lead carbonate to the resulting dithionic acid solution.—A. R. P.

The Electrolytic Refining of Mercury. E. Newbery and S. M. Naude (*Electrochem. Soc. Preprint*, **1933**, Sept., 57–68).—After a trial of numerous electrolytes, satisfactory results were obtained only with mercurous perchlorate solution made by dissolving 20 grm. of mercuric oxide in 20 c.c. of 75% perchloric acid, diluting to 80 c.c., and reducing to the mercurous salt by electrolysis. Two types of laboratory cell are described, in one of which the electrolyte is mechanically stirred, while in the other it is stirred by convection currents set up by the electrolysis; stirring is essential to prevent formation of crusts of solid salts on the anode. No solid metal makes a satisfactory cathode, hence pure mercury is used; if not otherwise available, this is obtained by electrolysis, using a platinum or stainless steel cathode to begin the operation and withdrawing the metal cathode when sufficient mercury has accumulated. Electrolysis is conducted at room temperature using 1 amp./dm.^{2} at 0·5 v.; the impurities, except precious metals, accumulate in the electrolyte, which must therefore be occasionally purified by crystallizing out the mercurous perchlorate and redissolving it in very dilute perchloric acid. With very impure mercury a preliminary purification is advisable; this may be done by blowing air through the metal at just below the boiling point or by spraying the metal several times through dilute nitric acid. Electrolytic mercury is shown to be practically "spectroscopically pure."—A. R. P.

IX.—ANALYSIS

(Continued from pp. 514–515.)

On the Carrying Out of Technical Spectrographic Analysis. Otto Feussner (*Arch. Eisenhüttenwesen,* 1932–1933, **6**, 551–557).—To obtain reproducible spectrograms which can be evaluated quantitatively the following points are important: (1) alternating extinction of the light by the electrodes during the discharge must be avoided; (2) the spectral lines must be obtained of regular darkness throughout their length by correct focussing of the quartz condenser lens; (3) the relation between the capacity and inductance and the magnitude of the discharge tension during the discharge must be kept constant; (4) during the photometric measurements the course of the darkening curve must be considered and the entrance of extraneous light avoided. These points and other important questions for obtaining good results are critically discussed with reference to experimental work, and new electrical apparatus for obtaining reproducible discharges is described.—J. W.

X-Ray Analysis of Metals and Alloys. John Iball (*Met. Ind.* (*Lond.*), 1933, **43**, 121–123).—A description is given of the spectrum camera which examines the type of structure of metals and alloys, and of the precision camera which measures the size of the unit cell of the structure. The precision camera is useless without the information given by the spectrum camera, but with this knowledge, the dimensions of the unit cell can be measured with an accuracy of about 1 in 10,000.—J. H. W.

Control Through Spectroscopy. E. S. Dreblow and A. Harvey (*Indust. and Eng. Chem.*, 1933, **25**, 823–825).—Certain details regarding the actual use for control purposes of spectroscopy in three industries are known and are here reported, *viz.*, the detection of Sb and impurities in Pb (the British Post Office Engineering Dept. has specified that Pb sheathing of aerial cable must contain between 0·8 and 1·07% Sb, and has recommended the adoption of the spectrographic test); control of impurities in steels; and control of impurities, *e.g.* Pb, in Cu–Zn alloys.—F. J.

Spectrographic Analysis. Anon. (*Eng. and Min. J.*, 1933, **134**, 353).—Brief note on the use of spectrographic analysis.—R. Gr.

Short Microchemical Contributions—VIII. [Detection of Sodium and Cadmium]. L. Rosenthaler (*Mikrochemie,* 1933, **13**, 83–84).—Working details for the identification of Na as Na–UO_2 acetate are given. Cd in 0·1% solution gives an immediate crystalline precipitate with hexamethyldiamino-*iso*propyl diiodide consisting of stars and skeletal clusters; Zn gives crystals only on evaporation of the solution almost to dryness.—A. R. P.

Some Dithizone (Diphenylthiocarbazone) Reactions. H. Wölbling and B. Steiger (*Angew. Chem.*, 1933, **46**, 279–281).—A solution of dithizone in CCl_4 yields characteristic colour reactions with the following six groups of metals: (I) Ag, Zn, Cd, Sn^{IV}, Pb, Mn; (II) Sn^{II}, Fe^{II}; (III) Sb, Bi; (IV) Cu; (V) Au and the Pt metals, and (VI) Hg. Group I gives no reaction in acid solutions; the effect of group II may be overcome by oxidizing the metals to Sn^{IV} and Fe^{III}. Group III gives no reaction in the presence of tartaric acid, Cu fails to react in the presence of HCOOH, and the members of group V can be removed by reduction to the metallic state. Hence the test can be made specific for Hg. In the presence of other metals, the solution is treated with Cu to precipitate Hg and the members of group V; the Hg is then extracted with HNO_3 and the solution shaken with a CCl_4 solution of dithizone. A pink CCl_4 layer indicates Hg; sensitivity 0·01 mg.—A. R. P.

Quantitative Separation of Small Amounts of Zinc from Material Rich in Iron. Franklin G. Hills (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1933, **5**, 201).—The method depends on the precipitation of the Zn with H_2S in a slightly acid solution containing citric acid and a large excess of Na citrate.

Co and some Ni, as well as all the Pb and Cu, precipitate with the Zn and must be separated in the usual way.—A. R. P.

Improvements in the Vacuum Fusion Method for Determination of Gases in Metals. Lewis Reeve (*Amer. Inst. Min. Met. Eng. Preprint*, 1933, July, 1–21).—A modified apparatus is described and illustrated for the determination of oxides, nitrides, and dissolved gases in metals, more especially steel. Some tests on welded joints in steel showed that iron and manganous oxides are reduced at 1050°–1150° C., silica at 1300° C., and alumina at 1570° C. —A. R. P.

Estimation of Small Amounts of Antimony in Copper. Bartholow Park and E. J. Lewis (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1933, 5, 182–183).—For the determination of Sb in the purest refined Cu 500 grm. are dissolved in HNO_3 (*d* 1·4), the solution is diluted to 2 l., and NH_4OH added until a slight permanent precipitate is formed, which is redissolved in HNO_3, and 10 c.c. of 3% $KMnO_4$ solution are added to the boiling liquid, followed, after 5 minutes, by 15 c.c. of 5% $MnSO_4,5H_2O$ solution. After boiling for 10–20 minutes, the solution is set aside over-night and the precipitate collected on a suction filter, washed free from Cu with cold H_2O, and dissolved in 50 c.c., of HCl (*d* 1·19). The solution is diluted, saturated with H_2S, and filtered next day; the precipitate is dissolved in HCl, and the solution evaporated to 10 c.c.; 0·1–0·2 c.c. of this Sb solution is placed in a hole in a graphite electrode and, after drying, arced for 1 minute using 10–12 amp. at 50 v. The intensities of the lines at 2598 and 2878 A. in the spectrogram are compared with those of standards prepared from pure Cu (Sb-free) to which known weights of Sb have been added.—A. R. P.

Iodometric Determination of Copper, Iron, Zinc, and Aluminium in the Presence of One Another.—R. Lang and J. Reifer (*Z. anal. Chem.*, 1933, 93, 161–172).—The sulphate solution of the metals (free from Cl') containing 3–5 c.c. of H_2SO_4 (*d* 1·84) is neutralized with NH_4OH, diluted to 50–60 c.c., cooled, treated with 2 grm. of KHF_2 and 2–3 grm. of KI, and titrated with $Na_2S_2O_3$ for Cu. The liquid is then acidified with 10–15 c.c. of $5N$-H_2SO_4, 3 grm. of H_3BO_3 and 1 grm. of KCNS are added, and the liberated I_2 is titrated with $Na_2S_2O_3$ for Fe. A few crystals of Na_2SO_3 are added, the solution is boiled and filtered, and the filtrate is treated with 5 grm. of H_3PO_4, then with Br to oxidize the Na_2SO_3 and $Fe^{\cdot\cdot}$, cooled, treated with $Na_2S_2O_3$ until any blue colour is just discharged, and titrated for Zn with $K_3Fe(CN)_6$ and $Na_2S_2O_3$ as previously described (*J.*, this volume, p. 453). A filtered aliquot portion of the solution is then made ammoniacal after addition of tartaric acid to prevent precipitation of Al, &c., then treated with 8-hydroxyquinoline to precipitate the Al.—A. R. P.

Microchemical Determination of Gold in Gold Alloys. Julius Donau (*Mikrochemie*, 1933, 13, 165–178).—The alloy (up to 5 mg.) is inquarted with Ag in a quartz-glass tube through which a current of H_2 is passed, and the bead is parted in the usual way. This method obviates cupellation losses [and is unsatisfactory if tin is present.—*Note by Abstractor*].—A. R. P.

An Investigation into the Electrolytic Separation of Lead as Peroxide in Non-Ferrous Alloys. I.—A New Method for the Determination of Small Amounts of Lead in Copper and Copper-Rich Alloys. B. Jones (*Analyst*, 1933, 58, 11–26).—The metal is dissolved in HNO_3 and the solution evaporated until the colour just changes from blue to green, 3 c.c. of HNO_3 (*d* 1·42) are added, the liquor is diluted to 200 c.c., and any Sb_2O_5 or SnO_2 filtered off and dissolved in fuming H_2SO_4 using HNO_3 to destroy the paper. The H_2SO_4 solution is diluted and poured into an excess of NaOH solution containing Na_2S to precipitate adsorbed Pb, Cu, Fe, &c.; the precipitate is collected, washed, and dissolved in HNO_3. The two HNO_3 solutions are then electrolyzed with 2 amp. using a rotating (400 r.p.m.) gauze anode inside a gauze cathode. The PbO_2 deposit on the anode is dissolved in HCl and the solution evaporated to dryness. The residue is boiled with 8 drops of 1 : 1 HCl and 50 c.c. of H_2O, and the solution treated with $K_2Cr_2O_7$ to precipitate $PbCrO_4$, which is determined colorimetrically with diphenyl carbazide. If much Mn is present, $HMnO_4$ will form during electrolysis; this must be reduced from time to time by adding $N_2H_4 \cdot 2HNO_3$. Modifications of the process are described for use when Bi, P, or As are present in large amounts.—A. R. P.

Microanalysis of Magnesium as a Triple Ferrocyanide of Magnesium, Calcium, and Hexamethylenetetramine. L. Debucquet and L. Velluz (*Compt. rend.*, 1933, **196**, 2006–2007).—Mg can be completely precipitated by a 10% solution of ferrocyanide of calcium, potassium, and hexamethylenetetramine, $CaK_2Fe(CN)_6 \cdot (CH_2)_6N_4 \cdot 6H_2O$ (mol. wt. 578) in hexamethylenetetramine. The solution is made up by simple mixing of solutions of 8·4 grm. of $K_4Fe(CN)_6 \cdot 3H_2O$ in 100 c.c. of water and 4·4 grm. of $CaCl_2 \cdot 5H_2O$ and 11·2 grm. of $(CH_2)_6 \cdot N_4$ in 200 c.c. of water. The Mg is precipitated with the solution, filtered, washed, redissolved in water in a graduated tube, and shaken with a solution of gum arabic and $FeCl_3$. The resulting Prussian blue is compared with that of a blank containing a known quantity of the triple cyanide reagent. The error by this method is always less than 5%, and usually less than 3%.—J. H. W.

Potentiometric Determination of Small Quantities of Mercury. Karl Schwarz and Theodor Kantor (*Mikrochemie*, 1933, **13**, 225–234).—The method depends on the titration of the Hg solution with KI using an amalgamated Pt wire as indicator electrode; 1–1000 μ grm. of Hg can be determined with an accuracy of 1–3%.—A. R. P.

Two Special Analytical Methods. I.—Rapid Determination of Nickel in Heat-Resistant Alloys. II.—The Determination of Small Quantities of Aluminium (0·05–0·4%) in Heat-Resistant Alloys. H. Ipavic (*Heraeus Vacuumschmelze [10th Anniv. Volume]*, 1933, 302–306; 306–309).—(I.—) The alloy (0·06–0·07 grm.) is dissolved by boiling with 7 c.c. of HCl (*d* 1·19), 3 c.c. of HNO_3 (*d* 1·40), and 3 c.c. of $HClO_4$ (*d* 1·59), and the solution is evaporated until fumes of the latter are evolved, whereby all the Cr is oxidized to CrO_4''. After dilution with 150 c.c. of water, 5 c.c. of 20% tartaric acid, and, if much Mn is present, 5 c.c. of 30% $K_4P_2O_7$ are added, followed by NH_4OH to slight alkalinity, and the Ni is titrated with KCN and $AgNO_3$ in the usual way with KI indicator. Cu and Co are counted as Ni, but are rarely present in amounts exceeding 0·4%. (II.—) The alloy (3 grm.) is dissolved in *aqua regia* and the solution evaporated with 25 c.c. of 1 : 1 H_2SO_4 until copious fumes are evolved. After cooling, dilution with water, and boiling, the SiO_2 is removed and the solution neutralized with KOH, then treated with 30 drops of 1 : 1 H_2SO_4, diluted to 400 c.c., and electrolyzed for 4 hrs. using a Hg cathode and a Pt spiral anode with a current of 6 amp./40 cm.^{2} of Hg surface; in this way all the Cu, Mo, Fe, Ni, Co, Mn, and Cr are deposited in the Hg, leaving only Al with traces of the other metals in solution. The Al is precipitated with NH_4OH and purified by digestion with KOH solution, being finally weighed as Al_2O_3.
—A. R. P.

Determination of Potassium by Sodium Cobaltinitrite. J. E. Schueler and R. P. Thomas (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1933, **5**, 163).—The various procedures which have been proposed for determining K volumetrically as $K_2NaCo(NO_2)_6$ have been critically examined and the following modification is recommended: The K solution (25 c.c.) is made just alkaline to phenolphthalein with NaOH, then just acid with $CH_3 \cdot COOH$, 10 c.c. of 95% C_2H_5OH are added, and the solution is cooled to 5°–6° C. The K is then precipitated with 5 c.c. of 30% $Na_3Co(NO_2)_6$ and the mixture set aside over-night at 5°–6° C. The precipitate is collected in a Gooch crucible, washed with a cold, saturated solution of $K_2NaCo(NO_2)_6$, dissolved in 150 c.c. of hot H_2O to which are added 5–10 c.c. of HNO_3, and titrated with 0·1*N*-$KMnO_4$ (1 c.c. = 0·0005672 grm. K).—A. R. P.

The Oxalate Method of Determining Strontium from the Point of View of Residues and Substitution. K. N. Potchinok (*Zhurnal Prikladnoi Khimii (Journal of Applied Chemistry)*, 1932, **5**, (8), 1078–1087).—[In Russian, with German summary.] The determination of Sr as SrC_2O_4 was investigated from the point of view of the methods of residues and substitution, in accordance with the alternative techniques developed by Tananaev. It is considered that these methods enable both a theoretical interpretation and a quantitative estimation of the errors involved, to be made. Four variants of the method of residues were employed: (1) a known volume of $SrCl_2$ (*N*/10) solution was heated with twice the equivalent of *N*/10-$(NH_4)_2C_2O_4$, the precipitate filtered off, and the filtrate titrated direct with standard $KMnO_4$; (2) the same as method 1, except that the two solutions, on mixing, are diluted to a mark, and aliquot parts are withdrawn, filtered, and titrated; (3) the same as method 1, except that the precipitate is washed and the whole of the filtrate and washings are titrated; (4) three times the equivalent of $(NH_4)_2C_2O_4$ is used, and thereafter the procedure is as in 1. It is concluded that methods 1 and 4 are the most accurate, the average errors being 0·21% and 0·06%, respectively. The method of substitution gives accurate results if the precipitate is washed with a saturated solution of SrC_2O_4. The deviations from the true content are 0·2%. The separation and volumetric estimation of Ca and Sr when present together are possible if H_2SO_4 is used. The error, if about 25 c.c. of *N*/10 solution of either metal are present, does not exceed 0·5%.—M. Z.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

(See also "Testing" and "Pyrometry.")

(Continued from pp. 515–516.)

Evaporation of Metals in Vacuum. Hiram W. Edwards (*Rev. Sci. Instruments*, 1933, [N.S.], **4**, 449).—The technique of the evaporation of small quantities of metal *in vacuo* is very briefly discussed. A new alloy, called "Pancro," composed of aluminium and magnesium, and having a uniformly high reflection coeff. throughout the visible spectrum, is mentioned.—J. T.

Improving Automatic Control by Recorder Chart Interpretation. W. R. Clendinning (*Chem. and Met. Eng.*, 1933, **40**, 123–125).—A method of chart reading is described, in an effort to set up certain basic principles of control, to assist in devising new controls and to simplify the improvement and more effective use of the old ones. Most attention is given to the time factor which is the least well known, but the most important, feature of satisfactory control. —F. J.

A New Temperature Regulator. Anon. (*Engineer*, 1933, **155**, 659).—A short illustrated description of a thermostatic electric regulator for maintaining a constant temperature in type metal and tin furnaces, &c.—W. P. R.

Ventilating a University Laboratory. T. R. Davis (*Heating and Ventilating*, 1931, **28**, (10), 55–58; *Public Health Eng. Abs.*, 1932, **12**, AC, 15).—The problem of proper outside air supply and fume exhaust was of major importance in the building discussed. Practically all fume exhaust is accomplished through sidewall hoods, constructed of an acid-proof asbestos composition. The mechanical exhaust systems are 5 in number, namely, downdraught tables, wall hoods, general rooms, Kjeldahl hoods, and toilet rooms. Air pressures in the laboratories were kept lower than surrounding areas, thus preventing the escape of fumes from laboratories into adjoining rooms.—S. G.

Cooling of Crystals for X-Ray Scattering Measurements. P. S. Williams (*Rev. Sci. Instruments*, 1933, [N.S.], **4**, 334–336).—Apparatus for maintaining crystals at temperatures down to that of liquid air and suitable also for high-temperature work is described.—J. S. G. T.

Apparatus for Demonstrating the Liquefaction of Helium. Franz Simon and J. Elston Ahlberg (*Z. Physik*, 1933, **81**, 816–820).—Cf. *J.*, this volume, p. 372. A comparatively simple form of apparatus for liquefying helium, utilizing expansion of the gas, and the Joule–Thomson effect.—J. S. G. T.

A New Accurately-Focussing Röntgen Spectrometer. Tryggve Johansson (*Z. Physik*, 1933, **82**, 507–528).—Discusses the theory and construction of an X-ray spectrometer, employing a crystal bent into a circular arc.—J. S. G. T.

A Demountable Metal X-Ray Tube. E. P. Miller (*Rev. Sci. Instruments*, 1933, [N.S.], **4**, 379–380).—A metal X-ray tube comprising a chromium-plated brass cathode and a solid copper target drilled to permit water-cooling is described. The use of a chromium-plated cathode decreases the amount of gas liberated from the surfaces and reduces stray radiation.—J. S. G. T.

A Calcium Target for X-Ray Tubes. H. Kersten and Joseph Maas (*Rev. Sci. Instruments*, 1933, [N.S.], **4**, 381).—A calcium-silica target which may be used for several hours, and which does not emit gas when bombarded, is described.—J. S. G. T.

XI.—PHYSICAL AND MECHANICAL TESTING AND RADIOLOGY

(Continued from pp. 516–520.)

Practical Aids to Inspection. J. Pettitt-Herriot (*Aircraft Eng., Workshop and Prodn. Section*, 1933, **5**, (50), 21).—The iron dust method of detecting cracks in magnetic materials is described. For non-magnetic materials, immersion in hot paraffin oil, wiping, and coating with finely divided chalk is recommended.—H. S.

A Practical Method of Determining the Thermal Conductivity of Small Metal Rods. P. Vernotte (*Science et Industrie*, 1933, **17**, 17–20, 77–79, 125–127, 186).—The theoretical basis of conductivity determinations is discussed, and the difficulty of the usual experimental methods is indicated. In the method elaborated by V., a small rod of diam. 3–4 mm. and a few cm. in length is inserted, to three standard depths, in a furnace of known radiating power. Variations in the amount of heat radiated must then be due to the inserted rod, and the heat radiated by the rod must depend on the thermal interchanges between (*a*) furnace and rod, (*b*) rod and atmosphere, and also on the thermal conductivity of the rod. By taking readings in the three standard positions of the rod, (*a*) and (*b*) are eliminated. The thermal exchanges are considered and equations representing them are deduced. Errors due to dissipation of heat by the furnace and its leads are shown to be negligible. Two types of furnace are described, one completely enclosing the specimen, the other, of tubular form, the length of which is traversed by the specimen bar. Experimental details of the measurement of furnace radiation and furnace temperature, calibration of thermo-couples, and construction of furnaces, and actual results are quoted for both types of furnace.—P. M. C. R.

Behaviour of the Damping Effect in Vibrational Tests. Max Hempel (*Z. tech. Physik*, 1933, **14**, 232–234).—A short account of the measurement and general evaluation of the dependence of the damping effect on the load and the number of alternations.—J. W.

Fatigue Testing. J. W. Cuthbertson (*Engineering*, 1933, **136**, 55–57, 80–82).—Describes apparatus for determining the fatigue limit by means of the modification of the alternating bend test known as the load-deflection test. C. points out the advantages of continuous loading, which overcomes the difficulties associated with the overstraining effects of applying the loads in sudden increments.—W. P. R.

Fatigue Tests of Helical Springs. Progress Report No. 2 of Sub-Committee on Heavy Helical Springs of the Special Research Committee of Mechanical Springs (*Amer. Soc. Mech. Eng. Preprint*, **1933**).—W. P. R.

The Mechanical Testing of Metals. The Transverse Test. T. F. Russell (*Met. Ind.* (*Lond.*), **1933**, **43**, 191–193).—In the case of a simple beam subjected to bending by central loading between the supports, both the angle through which the ends of the beam turn and the deflection at the centre are proportional to the load, within the elastic limit and under certain experimental conditions. Transverse testing machines which make use of this principle are briefly described.—J. H. W.

The Schenck Autographic Extensometer. Walther Saran (*Engineering*, **1933**, **136**, 161–162).—An illustrated description of an instrument which automatically records dynamic extension and compression in any member of a built-up structure or machine. By means of a time record taken simultaneously, the amplitude and frequency of the stresses imposed during working conditions can be ascertained. The extensometer contains no lever or other mechanism to magnify the movements, and the record is examined by means of a special microscope. Reproductions of records obtained by mounting the instrument on the front axle of a motor car are included in the text.—W. P. R.

The Elastic Behaviour of Brittle Polycrystals. H. Schlechtweg (*Naturwiss.*, **1933**, **21**, 465–466).—The elastic behaviour of brittle isotropic bodies, such as cast iron, is discussed theoretically.—J. W.

Use of a New Hardness Ratio. H. S. Kipling (*Proc. Inst. Automobile Eng.*, **1932–1933**, **27**, 557–558).—The application of the standard Brinell and diamond impression hardness tests enables the following conditions of steel to be detected and distinguished: cold-worked steel in production, ordinary cold-worked steel, brittleness due to impurities, annealed steel, heat-treated steel, and steel difficult to machine when of standard hardness.—J. S. G. T.

Light Brinell and Diamond Hardness Testing Machine. Anon. (*Machinery* (*Lond.*), **1933**, **42**, 316–317).—A brief illustrated description. By the operation of a crank, the specimen is forced against the indenter until the desired load, as indicated on a dial, is reached. The machine is calibrated for loads from 5 to 125 kg.—J. C. C.

Portable Hardness-Testing Machine. Anon. (*Mech. World*, **1933**, **94**, 649).—A small hardness-testing machine, the "Impressor," using a ball of 1 mm. diam. under a load of 30 kg., is illustrated and described. The claims made for the machine are low cost, portability, simplicity of construction, ease of operation, and negligible defacement of material by the impression. The table holding the specimen is brought up into contact with the ball attached to a lever. The lever works on a fulcrum to one side of the ball, and is supported by a pillar at a greater distance on the other side. The lever is loaded on the latter side, and the load is applied by turning a handle, which relieves the lever of the support of the sliding pillar.—F. J.

Standard Herbert Pendulum Hardness Tester. A Simplified Model. Anon. (*Met. Ind.* (*Lond.*), **1933**, **43**, 124).—A simplified form of the Herbert pendulum hardness tester has been designed for straightforward shop testing. It is provided with a 1-mm. steel ball, but a spherical diamond can be supplied as an extra. If T is the time for 10 swings, with the steel ball, the Brinell hardness $B = 10T$, when $T > 28$ and $B = 0{\cdot}36T^2$, when $T < 28$. With the diamond, $B = 13{\cdot}5D$, when $D > 22{\cdot}5$, and $B = 0{\cdot}54D^2 + 30$, when $D < 22{\cdot}5$, D being the diamond time-hardness number.—J. H. W.

Simplified Pendulum Hardness Tester. Anon. (*Engineer*, 1933, **156**, 68; and *Mech. World*, 1933, **94**, 716).—See preceding abstract.—W. P. R.

Strain Lines, a New Method for Determining the Distribution of Stress in Machine Parts. O. Dietrich and E. Lehr (*Technique moderne*, 1933, **25**, 149–150).—Abstract from *Z.V.d.I.*, 1932, **76**, 973–982. See *J.*, this volume, p. 38.—R. B. D.

On the Application of Interference Fringes to Stress Analysis. Max Mark Frocht (*J. Franklin Inst.*, 1933, **216**, 73–89).—The photo-elastic method of determining stress distribution in two-dimensional systems is reviewed. A method is suggested for the experimental determination of the sum of the principal stresses, thus eliminating the point by point exploration required by existing methods, and giving photographically a stress-pattern of constant $P + Q$ curves. This pattern is to be used with the regular $P - Q$ stress-pattern now obtained photo-elastically, and from the two the principal stresses P and Q can be evaluated. The construction and calibration of the apparatus are discussed, and some preliminary experimental verifications and possible future applications are considered.—P. M. C. R.

A Miniature Testing Machine. Anon. (*Maschinenkonstrukteur*, 1933, **66**, 102).—The apparatus described is claimed to give considerable accuracy in the rapid determination of yield-point, ultimate tensile stress, elongation, reduction of area, and Brinell hardness. Results are slightly below those obtained on full-size machines for similar materials; the chief advantages of the machine are its portability and the small size of the test-pieces, which can therefore be taken from finished products, and which can be easily and quickly prepared. Illustrations are appended.—P. M. C. R.

RADIOLOGY

Recent Progress in X-Ray Inspection of Welds. Herbert R. Isenburger (*Amer. Soc. Mech. Eng. Preprint*, **1933**).—The perfection of a cheap sensitive X-ray paper and the introduction of X-ray equipment made specially for industrial use are recent developments. I. gives comparative costs of weld inspection using various class of X-ray equipment and using X-ray film and the new X-ray paper.—W. P. R.

XII.—PYROMETRY

(Continued from p. 521.)

An International Comparison of Temperature Scales between 660° and 1063° C. Wm. F. Roeser, F. H. Schofield, and H. A. Moser (*U.S. Bur. Stand. J. Research*, 1933, **11**, 1–6; *Research Paper*, No. 573).—This paper reports an intercomparison of the temperature scales (in the range 660°–1063° C.) in use at the National Physical Laboratory, the Physikalisch-Technische Reichsanstalt, and the Bureau of Standards since 1927. It is shown that the methods used in realizing the International Temperature Scale have yielded results differing by as much as 0·7° C. at 850° C., due primarily to a difference of 0·4° C. at the freezing point of silver, one of the basic fixed points of the International Temperature Scale. After exchanging samples of silver and thermocouples, the various scales have been brought into agreement, within 0·1° C., at all points in the range covered.—S. G.

Methods for Servicing Noble Metal Thermocouples. R. S. Bradley (*Amer. Refract. Inst. Tech. Bull.* No. 39, 1933, 1–6).—Platinum–rhodium couples which receive constant use should be overhauled every 6 months. The homogeneity of each wire is tested at points spaced not more than 1 in. apart by hooking a standard wire of the same composition round it and heating the intersection. No e.m.f. should be developed. Good pieces of wire are then held in a fixture, welded together, and made into couples by use of a carbon arc or an oxy-gas or oxy-acetylene flame. Annealing is carried out by passing a current ($14\frac{1}{2}$ amp. for 0·022 in. diam. wire) for about 1 hr. until the darker portions, which have surface contamination, become a bright red. Calibration is carried out by comparison with a standard couple placed in the same protection tube.—J. C. C.

New Temperature Recorders. Anon. (*Mech. World*, 1933, **93**, 266).—An instrument is illustrated and described which depends on the expansion of ether. The whole of the operating mechanism of the recorder, with the pen, is contained behind a rotating chart. A two-point thread recorder designed for use in cases where it is desired to record only two temperatures on a chart, is also described.—F. J.

The Pyrograph. Anon. (*Power Eng.*, **1932**, 268).—A description is given of the Pyrograph, a temperature-measuring instrument, in which the resistance averages 18 ohms/m.v. and the current sensitivity is 0·43 micro-amps./mm. deflection.—F. J.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 521–522.)

Examining the Material of Castings. Joh. Mehrtens (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 247–248).—Describes the examination of large pieces of castings with a microscope.—J. H. W.

Pipes in Castings. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 307–308, 329–330).—Piping is usually considered to be a shrinkage phenomenon, but the percentage linear shrinkage of different metals and alloys does not show much variation, and castings of 2 alloys with the same linear shrinkage may have very different pipes. If, however, the contractions of volume in the solid state and in the liquid state are tabulated as percentages of the total contraction of volume, it is found that those metals and alloys with large contraction values in the solid state show the greatest tendency to piping. The length of the pipe also depends on the gas content, and thus on the density of the head of the ingot. Thus the heads of bronze ingots gassed in various ways had the following densities and pipe lengths respectively: 8·860, 3 mm.; 8·830, 10 mm.; 8·815, 15 mm.; 8·540, 16–24 mm.; 7·113, entirely porous.—J. H. W.

Six Competitive Types of Castings. D. Basch (*Machinist* (*Eur. Edn.*), 1933, **77**, 427–428E).—The casting properties of a number of non-ferrous metals and alloys, using sand, permanent mould, semi-permanent mould, moderate- and high-pressure die, and centrifugal casting methods are tabulated, and an order of preference for each property considered is indicated. The relation of design and material selection to the requirements of the casting and the finishing operations available are discussed, and the characteristics and defects of sand, permanent-mould, die- and centrifugal castings are outlined.—J. H. W.

The Use of Silicon in the Foundry. J. Arnott (*Bull. Assoc. Tech. Fonderie*, 1933, **7**, 23–25).—Abstracted from *Found. Trade J.*, 1931, **44**, 397–398. Cf. this *J.*, 1931, **47**, 431.—W. A. C. N.

Refining the Grain in Aluminium Alloys. D. R. Tullis (*Bull. Assoc. Tech. Fonderie*, 1933, **7**, 64–66).—Abstracted from *Found. Trade J.*, 1931, **44**, 321–326, 328. Cf. this *J.*, 1931, **47**, 604–605.—W. A. C. N.

Refining Molten Aluminium and Aluminium Alloys. H. Kalpers (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 285–286).—Aluminium and aluminium alloys tend to take up water either from the atmosphere or from the furnace gases and oil. The absorption of water vapour can be kept low by careful handling and can be further diminished by introducing chlorine gas or, as more recently discovered, chlorides such as boron dichloride, vanadium chloride, or titanium tetrachloride. Zinc chloride is also used where the zinc remaining in the alloy is not objectionable, as it is in Silumin (Alpax) and other corrosion-resisting alloys. Carbon tetrachloride is a good agent for removing the oxide, and is usually used with an alkali fluoride. Manganous chloride and antimony pentafluoride can be used instead of carbon tetrachloride.—J. H. W.

Manufacture of a Stirring Kettle in Silumin. Anon. (*Z. ges. Giesserei-Praxis: Der Modellbau*, 1933, **54**, 331–332).—The moulding, coring, and casting of a kettle required to resist the action of acetic acid, ammonia, concentrated nitric acid, hydrogen sulphide, sulphur, and carbonic acid in Silumin are described. The kettle was 2100 mm. (82·7 in.) high, 1380 mm. (54·3 in.) diameter, and 30–40 mm. (1·18–1·57 in.) thick, with an outlet pipe from the centre of the bottom 1000 mm. (39·4 in.) long.—J. H. W.

Compressed Gas Cylinders in Light Alloys. E. Franchi (*Alluminio*, 1933, **2**, 127–138).—The manufacture of cylinders in Avional (Duralumin), Anticorodal, and Lautal, in an Italian works, is fully described together with the equipment used in testing the cylinders. The micrographic structure of the alloys, and their mechanical properties have also been studied. Lautal cylinders cracked at 700 atm., and Avional cylinders at 600 atm.—G. G.

Bronze Foundry Practice. —— Detourmignies (*Rev. Fonderie moderne*, 1933, **27**, 189–196; discussion, 196).—Read before the Association Amicale et Mutuelle de Fonderie. Describes in some detail the manufacture of high resistance brass and of a number of bronzes of different compositions. The discussion is briefly reported.—J. H. W.

The Casting of Bronze Gears. F. W. Rowe (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 91–93).—From *Found. Trade J.*, 1930, **42**, 449–450, 469–470. Cf. this *J.*, 1930, **44**, 786.—W. A. C. N.

The Fusion of Copper Alloys in the Cupola. T. Mauland (*Bull. Assoc. Tech. Fonderie*, 1933, **7**, 67).—Extract from *Foundry*, 1931, **59**, (13), 64–65. Cf. this *J.*, 1932, **50**, 127, 709.—W. A. C. N.

Melting of Brass Swarf in a Reverberatory Furnace. E. T. Richards (*Bull. Assoc. Tech. Fonderie*, 1933, **7**, 15–19).—Extracted from *Giesserei*, 1932, **19**, 5–9. Cf. this *J.*, 1932, **50**, 390.—W. A. C. N.

Casting Door Plates and Handles in Brass and Nickel Brass. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 224–225).—The correct practice for moulding and casting brass and nickel-brass door-plates and handles and for avoiding failures is described. The composition of the alloys used, the amount of permissible impurities, and the use of aluminium, preferably as a copper-aluminium alloy, for improving the fluidity of thin castings are discussed. —J. H. W.

Causes of Waste in Valve Taps. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 245–246).—The casting of valve taps in 65 : 35 brass is described and the causes of rejects are explained.—J. H. W.

The Vertical Centrifugal Casting of Non-Ferrous Alloys. R. C. Stockton (*Met. Ind.* (*Lond.*), 1933, **43**, 97–98).—Centrifugal casting is adopted when the casting can be made only with difficulty in sand, as in the case of the nickel–copper–tin–iron alloy used for valve fittings and having a large shrinkage, or to develop certain physical properties, as the small grain-size and regular dispersion of the hard constituent of gear and bearing bronzes and white metal. The methods of overcoming the difficulties that the process entails are explained, and the physical properties which the resulting castings possess, and of which the large decrease in grain-size is the most characteristic, are described.—J. H. W.

General Remarks on Pressure-Casting. G. d'Ardigny (*Rev. Fonderie moderne*, 1933, **27**, 205–211).—Pressure-casting has many advantages, such as great economy of space and handling and the uniformity of the product. The necessary equipment is expensive, but this is offset by economy in the castings which can often be used in the " as cast " condition. The process is a difficult one, for which good knowledge and experience of the alloys are necessary, and each particular case requires special study, whilst any mistake may be disastrous.—J. H. W.

Die-Casting of Silumin. J. Dornauf (*Alluminio*, 1933, **2**, 139–153).—The mechanism of solidification of a metal especially during die-casting has been studied. The structure and mechanical properties of Silumin, and of its modifications, Silumin " β " (containing manganese and magnesium) and Silumin " γ " (heat-treated Silumin " β "), and the effects of composition, modification with sodium, and heat-treatment on these alloys are described. Suitable moulds for casting test-pieces are illustrated, and the best melting conditions, types of mould, position of heads, feeders, and spines are discussed. —G. G.

Die-Casting. F. A. W. Livermore (*Mech. World*, 1933, **93**, 165–167).—The chief advantages claimed for die-castings are enumerated and other general points discussed, among them, from the point of view of economical production, being the minimum permissible wall-thickness. The following data are given, the figures being for minimum hole diam., minimum wall-thickness, and draft, respectively, *viz.* aluminium alloys $\frac{3}{32}$–$\frac{1}{8}$ in., $\frac{3}{32}$–$\frac{1}{8}$ in., 0·005–0·025; zinc alloys $\frac{1}{16}$ in., $\frac{1}{32}$–$\frac{3}{64}$ in., —; lead–tin alloys $\frac{1}{32}$ in., $\frac{1}{32}$–$\frac{1}{16}$ in., 0·002–0·015. The casting of internal threads below $\frac{1}{2}$ in. diam. is not recommended. Whenever possible, engravings or letters should be " raised," *i.e.* in relief on the castings, and, as shrouding is easily possible in die-casting, it should be done on one side in the case of bevel- or spur-wheels. Brass die-castings can now be successfully produced.—F. J.

Progress in Die-Casting. M. Stern (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 120–121).—From *Trans. Amer. Found. Assoc.*, 1930, **1**, (12), 723–736. Cf. this *J.*, 1931, **47**, 179.—W. A. C. N.

Die-Cast Pistons. Anon. (*Automobile Eng.*, 1933, **23**, 161–164).—A description of the methods employed in the manufacture of pistons of ordinary pot construction in the heat-treated alloy " Y " and an alloy known as Lo-Ex which has a high silicon content and low expansion qualities, and of the manufacture of the Invar strut piston which has a head of a heat-treated copper–magnesium alloy giving a Brinell hardness of 125–150 and a skirt of Invar, the nickel–iron alloy containing 32–34% nickel. The procedure adopted in alloying and melting is fully described, and the manufacture of dies and the type of mould and core used in the manufacture of the composite piston are considered in full detail with special reference to manipulation and casting. The plant used for heat-treatment of the pistons and the method of treatment are also described.—J. W. D.

Nicrosilal Castings. Anon. (*Mech. World*, 1933, **93**, 81).—The use of Nicrosilal for ingot-moulds for aluminium is briefly described, the composition and chief properties of this material being mentioned.—F. J.

Plates, Frames, and Cores of Aluminium. Hugo Hollweg (*Z. ges. Giesserei-Praxis: Der Modellbau*, 1933, **54**, 249–251).—Discusses the application of aluminium to the construction of mould frames and cores.—J. H. W.

Improvement of Moulding Methods in the Aluminium Foundry. T. D. Stay, E. M. Gingerich, and H. J. Rowe (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 115–117).—From *Foundry*, 1930, **58**, (23), 72–75. Cf. this *J.*, 1930, **44**, 703. —W. A. C. N.

The Green-Sand Metal Casting Specialist. A. Heinz (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 305–307).—Green-sand metal casting has not yet found general application [in Germany]. The reasons for this and the differences between green-sand and dry-sand casting are discussed.—J. H. W.

Casting a Large Cover in Green Sand. A. Heinz (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 54, 266–267).—The moulding, gating, and casting of a large casting in green sand are described.—J. H. W.

Report on Routine Methods for Testing Green-Sands. Anon. (*Found. Trade J.*, 1933, 49, 49–52, 56, 68).—Report by the Sands and Refractories Sub-Committee of the Institute of British Foundrymen presented to that Institute.—J. H. W.

The Testing of Green-Sands. Routine Methods Proposed by the I.B.F. Anon. (*Met. Ind.* (*Lond.*), 1933, 43, 131–133).—Abstract of the discussion of a report presented to the Institute of British Foundrymen by the Sands and Refractories Sub-Committee of the Institute (see preceding abstract).—J. H. W.

Sand Control in the Modern Foundry. H. W. Dietert (*Bull. Assoc. Tech. Fonderie*, 1931, **5**, 132–133).—From *Trans. Amer. Found. Assoc.*, 1930, **1**, (2), 53. Cf. this *J.*, 1930, **44**, 709.—W. A. C. N.

The Classification of Sands. [A. A. Grubb] (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 735–736).—Extracted from *Trans. Amer. Found. Assoc.*, 1930, **1**, (10), 510–515. Cf. this *J.*, 1931, **47**, 182.—W. A. C. N.

Contribution to the Study of the Permeability of Foundry Sand. H. Viez (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 122–125).—Abstracted from the *Internat. Foundry Congress, Milan, Memoirs*, **1931**, 595–403. Cf. this *J.*, 1932, **50**, 641.—W. A. C. N.

Tests on the Permeability and Hardness of Moulds. [H. W. Dietert] (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 737).—Extracted from *Trans. Amer. Found. Assoc.*, 1930, **1**, (10), 509. Cf. this *J.*, 1931, **47**, 182.—W. A. C. N.

Influence of Heat on the Permeability of Natural Moulding Sands. W. M. Saunders and W. Saunders, Jr. (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 739–741).—From *Trans. Amer. Found. Assoc.*, 1930, **1**, (7), 259. See this *J.*, 1932, **47**, 53.—W. A. C. N.

Influence of Humidity on the Properties of Dry-Sand Cores. H. L. Campbell (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 55–56).—From *Trans. Amer. Found. Assoc.*, 1927, **35**, 158. Cf. this *J.*, 1927, **38**, 629; 1928, **39**, 658.—W. A. C. N.

New Tests for Sand Cores. [Edward R. Young] (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 738–739).—Extracted from *Trans. Amer. Found. Assoc.*, 1930, **1**, (10), 486. Cf. this *J.*, 1931, **47**, 182.—W. A. C. N.

Shockless Jolt Moulding Machine with Pneumatic Pressing Device and for High Lift Stroke. —— Weil (*Iron and Steel Ind.*, 1933, **6**, 388).—A description of a moulding machine which serves for moulding high castings, the moulds of which can be withdrawn without tilting, with or without a stripper plate. The machine likewise allows of the efficient moulding of shallow castings, as the presser plate can be adjusted in height. All operations, as jolting, pressing, vibrating, lifting, are effected by compressed air and regulated in their correct sequence through a common control and only one lever. The maximum pressure of the machine is 6500 kg., and it is capable of producing in continuous operation up to 60 half boxes per hr.—J. W. D.

The Dust Hazard in Air-Pressure Abrasive Blasting [Sand-Blasting]. L. Greenburg and C. E. A. Winslow (*Arch. Gewerbepath. u. Gewerbehyg.*, 1932, [v], 3, 577–599; *Bull. Hygiene*, 1933, **8**, (1), 26–27).—The process of cleaning castings by sand-blasting or by means of steel shot generates much dust, 90% of which is silica when sand is used. A description is given of the dust hazards for the workers, and of means for their protection. The castings may be treated in closed chambers, either in barrels, on tables, or in cabinets, from which the dust is removed by exhaust draughts. The efficiency of these devices for abating the dust risk was carefully tested by dust estimations; it was found that while many were inefficient, the dust content of the air to be breathed could readily be kept below the danger limit. The use of steel shot instead of sand in itself greatly reduced the hazard by lessening the number of dust particles, of which the quartz content fell to 3% in contrast to 90% in the dust from sand-blasting. Some blasting is done by workers manipulating the blast in special chambers; these workers are protected by helmets into which fresh air is driven at a positive pressure. Here again, if the helmet is in order the dust hazard can be overcome, but dust helmets with no positive pressure device are quite inefficient. Throughout the enquiry dust sampling was done with the Greenburg–Smith Impinger, whereby the dusty air impinges at a high velocity on a submerged wetted surface, and then bubbles through water which collects the dust. Full details are given of the results obtained.—S. G.

Foundry Ventilation. John H. Vogt (*Indust. Hygiene Bull.*, 1931, **7**, (9), 33–34; (10), 37–39; *Public Health Eng. Abs.*, 1932, **12**, IHS, 5).—Describes methods for the control of dust, vapours, and gases disengaged in the processes of foundry operations and gives the regulations of the New York State Industrial Code for protecting the health of foundry workers. It is noted from the rules that suitable ventilation is highly important for safeguarding the health of foundry workers. V. for the purpose of discussion, divides the rules into 3 classes: (1) the provision and maintenance of general ventilation; (2) the control of generated dust, fumes, vapours and gases by the use of devices effectively to catch and remove the deleterious materials at the points of their origin; (3) the maintenance of proper and sufficient heat. A number of operations affecting the health of workers in iron, steel, and brass foundries are described, and the devices that might be used to guard the health of foundry workers are described.—S. G.

Binding Materials for Cores. —— Ebert (*Maschinenkonstrukteur*, 1933, **66**, 104–105).—The various products—organic and inorganic, natural and artificial—commonly used in core-making are enumerated; sulphite lye, molasses, resin, flour, quelline, dextrin, and tar, linseed and other oils are specially considered, and their correct proportions and special uses and limitations are indicated.—P. M. C. R.

XIV.—SECONDARY METALS, SCRAP, RESIDUES, &c.

(Continued from p. 523.)

Copper Wire Scrap. R. G. Arend (*Engineer*, 1933, **156**, 71).—In a wire works a bench is used solely for the purposes of dealing with short lengths of wire by autogenously welding them together to form one long length of wire. This is a more profitable method of using wire scrap than remelting. In dealing with a poor class of wire scrap, A. points out that crucible melting is not to be advised, as it is uneconomic, since bundled scrap is bulky, and in melting down only a small proportion of the crucible capacity can be utilized. Moreover, crucible melting does not allow any appreciable refining operations.—W. P. R.

Scrap and the Copper Market. Samuel Tzach (*Eng. and Min. J.*, 1933, **134**, 293–295).—An economic survey of the subject.—R. Gr.

Electrometallurgical Preliminary Refining of Precious Metal Alloys. W. Graulich (*V.D.I.-Nachrichten*, 1933, **13**, (32), 4).—A brief account is given of two new electrolytic methods due to Carl, and of Siemens and Halske's method for the treatment of double scrap.—J. W.

Smelting of Tin Waste and Electrolytic Refining of Recovered Tin. N. N. Muratch (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1932**, 29–41).—[In Russian.]—S. G.

XV.—FURNACES AND FUELS

(Continued from pp. 523–524.)

FURNACES

High Temperature Gas-Fired Furnaces. Anon. (*Mech. World*, 1933, 93, 359).—A gas-fired furnace stated to be capable of attaining a temperature of 2000° C. is illustrated and described. The furnace is designed to utilize the principle of surface-combustion by allowing the air and gas to impinge on a ring of tubes placed concentrically in the combustion chamber. The burning gases are compelled to pass downwards, thus giving up heat to the external surface of the combustion chamber before passing to a double-walled chimney pipe, which serves to heat the incoming air on the counter-current principle. The obvious difficulties of surface combustion are discussed and are overcome by not mixing the gases prior to their entering the furnace and by reducing resistance to flow within the furnace.—F. J.

Photoelectric Control of Gas Furnaces. Anon. (*Mech. World*, 1933, 93, 123).—A brief description of an application of photoelectric cells to the fuel-supply to gas-burners. The equipment shuts off automatically the main gas supply whenever the flame of the gas-burners, for any reason, becomes extinguished.—F. J.

Waste-Heat Boilers Effect Fuel Saving. Anon. (*Eng. and Min. J.*, 1933, 134, 352).—Note on the use of recuperators with a producer plant utilizing wood as fuel.—R. Gr.

The Development in Time and Space of the Combustion in Technical [Furnace] Firing. Kurt Rummel and Hellmuth Schwiedessen (*Arch. Eisenhüttenwesen*, 1932–1933, 6, 543–549).—The evaluation of a stationary combustion process by determining the distribution of temperature, and the speed and composition of the gas over a definite plane does not give a correct idea of the combustion in an enclosed space. A qualitative evaluation is possible by collecting the carbon dioxide, oxygen, carbon monoxide, and hydrogen fields into a single field of equal rate of combustion (isocaloric field). From this the integral of the rate of delivery of unburnt gas to any desired cross-section of the furnace can be calculated and the combustion correlated with that of a space enclosed by a surface of equal combustion (the reaction space). Finally, it is possible to reach conclusions on the rate at which the combustion proceeds to a definite stage of completion (*i.e.* to determine the average rate of firing), and on the time and path of combustion of the gases. Some examples of the results obtained in various types of furnace are given.
—J. W.

The Brackelsburg Furnace. Anon. (*Mech. World*, 1933, 93, 50–52, 54).—A furnace for melting material of high melting-point, *e.g.* cast iron, is illustrated and described. The furnace consists of a cylindrical shell lined with high-grade refractory. A pulverized-fuel burner is inserted at one end and flue gases escape at the other. When working, the furnace is rotated continuously, therefore there is no slag line and no excessive attack of the lining at one particular level. The motion also mixes the metal and liberates non-metallic inclusions.—F. J.

[Contribution] to the Knowledge of the High-Frequency Induction Furnace.—VIII. Werner Bottenberg (*Mitt K.W.-Inst. Eisenforschung*, 1933, 15, 55–58).—A laboratory vacuum high-frequency induction furnace is described, the coil of which lies inside a water-cooled hollow steel cylinder. The furnace can be used for casting *in vacuo*. The processes of melting and degassing metals are described, and some examples of the use of the furnace are given.
—J. W.

Low-Temperature Heat-Treatment Furnace. Anon. (*Mech. World*, 1933, **93**, 431–432).—Heat-treatment up to a temperature of 700° C. for steels, aluminium, and other non-ferrous materials may be carried out in an electrical resistance furnace, which is illustrated and described. A method of forced air circulation is employed, using a centrifugal fan to force air at a sufficient pressure to overcome the resistance to flow through the packed work in the basket.—F. J.

Birlec Forced Air Circulation Furnaces. Anon. (*Machinery* (*Lond.*), 1933, **42**, 416–417).—Cf. *J.*, this volume, p. 458, and preceding abstract. A brief description of a forced air circulation electric heat-treatment furnace suitable for temperatures up to 700° C.—J. C. C.

Nomographic Chart for Determining Heating Unit Design. Temple C. Patton (*Chem. and Met. Eng.*, 1933, **40**, 150–151).—In designing a heating element, the engineer is usually influenced by 2 factors, *viz.* the heat which must be evolved and the line voltage available. A chart, the solution of which is briefly explained, is given for the purpose of providing an easy, quick, and accurate graphical method of determining the length and gauge of wire required in a small heating element.—F. J.

FUELS

Flame Temperatures of Combustible Gas-Oxygen Mixtures. H. H. Lurie and G. W. Sherman (*Indust. and Eng. Chem.*, 1933, **25**, 404–409).—Experiments for determining the flame temperatures of combustible gas-oxygen mixtures are described. The theory, experimental results, combustion mechanics, and flame temperature calculations of oxy-acetylene and oxy-hydrogen are discussed. For mixtures of 550, 800, and 1005 B.th.u. (138·7, 201·6, and 253·5 cal., respectively) city gases with oxygen, the flame temperatures lie between 3410° K. (the temperature of the oxy-acetylene flame) and 2933° K. (the temperature of the oxy-hydrogen flame). The practical application of these oxygen–gas mixtures lies essentially in the field of welding, since the cost of oxygen is still too great for the large quantities thereof demanded in furnace work. Moreover, cheap refractories to withstand these temperatures are not available.—F. J.

Limits of Inflammability of Natural Gases Containing High Percentages of Carbon Dioxide and Nitrogen. G. W. Jones and R. E. Kennedy (*Amer. Gas J.*, 1933, **139**, (1), 13–15).—Limits of composition relating to the inflammability of mixtures of methane, and ethane with carbon dioxide and nitrogen and mixtures of propane with nitrogen are given.—J. S. G. T.

The Heats of Combustion of Carbon Monoxide in Oxygen and of Nitrous Oxide in Carbon Monoxide at Constant Pressure. J. H. Awbery and Ezer Griffiths (*Proc. Roy. Soc.*, 1933, [A], **141**, 1–16).—The following values of the heats of combustion (expressed in international joules per mole) of the respective substances have been determined: carbon monoxide in oxygen, 282,730; nitrous oxide in carbon monoxide, 364,340; heat of formation of nitrous oxide, 81,610. The accuracy is of the order 2 or 3 parts per 1000. The value of the heat of combustion of carbon monoxide in oxygen is equivalent to $67{\cdot}5_7$ k.-cal.$_{15^\circ}$ per mole.—J. S. G. T.

A Bomb Calorimeter Determination of the Heats of Formation of Nitrous Oxide and Carbon Dioxide. R. W. Fenning and F. T. Cotton (*Proc. Roy. Soc.*, 1933, [A], **141**, 17–28).—The heats of formation of nitrous oxide and carbon dioxide at a constant pressure of 1 atm. and at 20° C. are: N_2O, $-19{\cdot}74 \pm 0{\cdot}07$ k.-cal.$_{15^\circ}$ or $-82{,}600 \pm 290$ international joules per mole; CO_2, $67{\cdot}65_5 \pm 0{\cdot}03_5$ k.-cal.$_{15^\circ}$ or $283{,}090 \pm 150$ international joules per mole. A form of adiabatic bomb calorimeter is described.—J. S. G. T.

The Analysis of the Dry Combustion Gases as a Basis for Technical Firing Calculations [for Furnaces]. Hellmuth Schwiedessen (*Arch. Eisenhüttenwesen*, 1933, **6**, 321–326).—A review of the basic principles.—J. W.

Chlorine Determination in Coal. W. A. Selvig and F. H. Gibson (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1933, **5**, 189–191).—The coal is burnt in oxygen in a bomb calorimeter and the chloride determined in the washings by addition of standard silver nitrate and titration of the excess with ammonium thiocyanate. Water extraction of the coal does not always remove all the chloride present.—A. R. P.

A Rapid Volumetric Method for Determination of Sulphur in Coal and Coke. Comparison of a Modified Benzidine Method with the Standard Methods. Evald L. Skau and I. Laird Newell (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1933, **5**, 180).—The coal or coke (1 grm.) is burnt in a silica tray in a gold-lined bomb calorimeter containing a few c.c. of water and filled with oxygen at 20–30 atm. After cooling for 5 minutes, the oxygen is slowly released and the interior of the calorimeter flushed out with 150 c.c. of a saturated solution of benzidine sulphate. The solution is treated with 60 c.c. of saturated benzidine hydrochloride solution, the precipitate is collected and washed free from acid with cold saturated benzidine sulphate solution, and the filter and precipitate are returned to the beaker, macerated with 100 c.c. of water, and titrated with $0{\cdot}0624N$-sodium hydroxide solution (phenolphthalein indicator) raising the solution to boiling near the end-point (c.c. NaOH × 10 = % sulphur).—A. R. P.

XVI.—REFRACTORIES AND FURNACE MATERIALS

(Continued from pp. 521–526.)

Refractories. Anon. (*Refractories Bull.* (*John G. Stein & Co., Ltd.*), 1933, (13–18)).—In this series of 2-pages monthly Bulletins features and properties of refractories are dealt with, which include the slagging of a firebrick; silica, slags, and slagging; thermal spalling; temperature gradients, the handling of refractories, and specifications for refractories. In the Bulletin dealing with specifications, the properties of refractories are viewed under three heads, depending on whether the constructional, the high-temperature, or the chemical characteristics of the materials are considered.—J. W. D.

Refractory Brick. G. Milani (*Corriere ceram.*, 1932, **13**, 183–187, 202–207, 243–249, 275–281; *Ceram. Abs.*, 1932, **12**, 157).—M. gives the raw materials, chemical composition, manufacture, behaviour and properties, tests and uses of (1) refractory clay brick (neutral); (2) silica brick (acid); (3) magnesia brick (basic); (4) chromium brick (neutral); (5) bauxite brick (neutral); and (6) special bricks for different industries.—S. G.

Cement for Furnace Settings. Anon. (*Mech. World*, 1933, **93**, 224).—The properties of Sairset, a high-temperature air-setting cement of high alumina content, are described. Diaspore, a mono-hydrate of alumina, is used as the base, and the cement is suitable for steam-boiler plant and many other types of furnace setting, including the laying of firebricks, the protection of the working face of firebrick walls, and the pointing-up of cracks and worn surfaces.—F. J.

Refractories for Industrial Furnaces.—IV. F. H. Norton (*Fuels and Furnaces*, 1932, **10**, 575–584; *Ceram. Abs.*, 1933, **12**, 67).—Cf. *J.*, this volume, p. 385. The thermal characteristics of heat flow and heat capacity of common types of refractories and insulators are discussed. Values of thermal conductivity, measurement of thermal conductivity, efficient use of furnace insulation, computation of the heat flow through insulated walls, the economy of insulation, construction of insulated walls, heat content of walls, recuperators, and some typical calculations are taken up.—S. G.

Elastic Distortion and Plastic Deformation of Refractory Brick at 20° C. and at Higher Temperatures. K. Endell and W. Müllenseifen (*Ber. deut. keram. Ges.*, 1933, **14**, 16–28; *Ceram. Abs.*, 1933, **12**, 301).—A new device for

the determination of elastic and plastic distortion of refractory brick at room temperature is described. The results obtained on 10 different refractory bricks with this apparatus make it possible to detect a new relation between torsion stresses and the specific distortion in the elastic and plastic range. A relation between the modulus of elasticity and resistance to compression is set up for ceramic materials, slags or clinker, and glasses. The sphere of refractory brick is divided into three groups with increasing modulus of elasticity and resistance to compression. The following causes, which may be active separately or in combination, for high distortion of certain refractory bricks have been detected: (1) grain-size combination, grain bond, type of bonding medium; (2) smooth crystallographic rearrangement (SiO_2); (3) cleavage planes in crystals, *e.g.*, periclase. Reference is made to the significance of these characteristics on the elastic and plastic deformability and resistance to temperature changes of refractory brick. Curves for softening under tension of different refractory bricks up to 1500° C. were determined in a torsion apparatus in which heat could be applied to the specimen under test.
—S. G.

The Thermal Expansion of Refractories to 1800° C. R. A. Heindl (*U.S. Bur. Stand. J. Research*, 1933, **10**, 715–735; *Research Paper* No. 562).—The linear thermal expansions of the following 36 materials were measured: African chrome sand; Cuban, Grecian, Friable African, Rhodesian Imperial, Indian, and Turkish chrome ores; Austrian, Californian, and electrically-fused magnesites; a periclase brick; a spinel brick; 2 types of fire-clay brick and 2 types of fireclay; Kentucky, Tennessee, and English ball clays; Georgia kaolin and an English china clay; an 80% alumina brick; artificial corundum; diaspore; bauxite; 5 mullites, each of which was prepared from different raw materials; 2 zircon bricks and a furnaced zirconium silicate; silicon carbide, a silica brick, and an insulating brick. Data are also given for artificial graphite which had been preheated several times to 1800° C. Measurements were made below 1000° C. in both an oxidizing and a reducing atmosphere. Above 1000° C. the materials were tested in a reducing atmosphere only. When the refractoriness of the materials permitted, they were tested up to 1800° C. Petrographic analyses of the materials were carried out before and after the several heat-treatments.—S. G.

Characteristics of Some Special Refractories.—I. —II. —III. Marcel Lépingle (*Rev. mat. constr. trav. publ.*, No. **279**, 1932, 225–228; No. **280**, 6–8B; No. **281**, 29–31B; *Ceram. Abs.*, 1932, **12**, 157, 193, 227).—(I.—) Refractories may be classified into 3 groups: (1) ordinary silico-aluminous refractories; (2) extra-aluminous refractories, and (3) special refractories. The second group contains refractories the main constituent of which is natural silicate of aluminium with ball clay as bonding agent. These refractories are characterized by their high refractoriness and mechanical resistance and their great resistance to erosion and fluxes. Refractories containing bauxite or corundum, the main constituent of which is fused alumina, have a softening temperature under load reaching 1700° C., their fusing temperature is 1900°–1950° C., and they have a high resistance to pressure and a slight variation in linear dimensions but are sensitive to sudden changes of temperature. They are used in gas and liquid fuel burning furnaces. Silicon carbide refractories can be used only in a reducing atmosphere, and their softening temperature depends on the amount of clay used as bonding agent. Such products are highly resistant to changes in temperature and are used in oil-fired furnaces. They are resistant to erosion and abrasion and are characterized by the constancy of their linear dimensions. Zirconium refractories have a remarkable chemical passivity and are therefore mostly used in the chemical and metallurgical industries. Different English, French, Belgian, and German refractories are compared briefly and the qualities of 5 Belgian refractory products are discussed. (II.—) L. briefly reviews the manufacture of English and

German special refractory products, together with their chemical analyses and characteristics. (III.—) Data are given on refractory products of Czechoslovakia, U.S.A., Sweden, and Spain.—S. G.

Highly Refractory Special Materials for High Temperatures. —— Gallus (*Wärme*, 1932, 55, 644–646; *Ceram. Abs.*, 1933, 12, 157).—G. discusses the reasons for utilizing refractory special materials such as corundum, silicon carbide, magnesite, zirconium silicate, chromium ore, sillimanite, carbon, alumina, zirconia, thoria, beryllia, and boron nitride.—S. G.

Materials with the Highest Melting Point and Their Utilization. Curt Agte (*Feuerfest*, 1933, 9, 1–4; *Ceram. Abs.*, 1933, 12, 192).—Binary compounds of the highest melting metals of groups IV, V, and VI of the periodic system when combined with carbon, nitrogen, and boron possess melting points which in some cases exceed the melting point of metals having the highest melting temperature. They are produced by (1) heating the metal or oxide with carbon until the formation of carbide; (2) heating the metal in a nitrogen current until the nitride is obtained, and (3) calcining the metal with boron in required mixing proportion. An especially high melting point is shown by tantalum carbide and hafnium carbide, and even higher melting points are obtained with mixtures consisting of tantalum carbide and zirconium carbide or hafnium carbide (the highest melting point ever ascertained for solid bodies). The compounds show an electrical conductivity similar to that of metals, sometimes a "super-conductivity." Their hardness lies between 8 and 10 of Mohs' scale. Chemically they are indifferent. These materials may be utilized as radiators, furnace material, abrasives, and as hard components for hard metals.—S. G.

The Influence of the Quality and Quantity of the Binding Clay on the Physical Properties and Especially on the Mechanical Properties of Fireclay Bricks. S. Sachs (*Sprechsaal*, 1933, 66, 435–438, 453–456, 469–471, 487–489).—The mechanical strength of the unburnt brick is determined by the loss in weight under the action of a stream of falling shot, and that of the burnt brick by compression tests and by loss in weight under the combined action of blows and friction in a rotating drum. In all cases the individual properties determined are greatly dependent on the variables, and show little relation to one another. Bricks with non-uniform grain size have especially good properties.—J. W.

Introducing Binary Kaolins into the Fireclay Mix in Order to Increase its Alumina Content and Refractoriness. P. P. Budnikov and B. I. Endovitzkii (*Domez*, 1932, (1/2), 11–13).—[In Russian.] See *J.*, this volume, p. 387.—S. G.

Gas Permeability of Fire-Brick and Iron Ores at High Temperatures. I.—Fire-Brick. Yoshiaki Tadokoro (*J. Japanese Ceram. Soc.*, 1932, 40, 619–637; *Ceram. Abs.*, 1932, 12, 158).—[In Japanese.] T. improved his arrangement for measuring the gas permeability of refractories and other materials by continued heating, and experiments have been made of 5 kinds of fire-brick. The permeability u was calculated by the following formula: $u = Q/T \cdot (Pt + h)/P \cdot 273/(273 + t) \cdot 1/(Ah)$; where Q = volume of gas in cubic centimetres, T = time in seconds, Pt = atmospheric pressure in grm./cm.^{2}, h = pressure of gas in water head in cm., P = normal pressure or 1033 grm./

Table I. Chemical Composition.

Brick.	SiO_2	Al_2O_3	Fe	FeO	Fe_2O_3	CaO	MgO	TiO_2	Cr_2O_3	Na_2O	K_2O
(*a*) Silica	92·5	1·2	0·2	0·5	2·3	2·8	0·5	...	...	0·1	0·2
(*b*) Agalmatolite	62·3	31·1	...	...	3·2	0·6	0·4	0·7	...	0·3	1·1
(*c*) Magnesia	7·1	2·4	...	...	6·4	1·3	82·7	...	...	0·1	0·2
(*d*) Chrome	12·0	17·2	...	...	18·1	0·4	30·0	...	22·1	0·4	0·1
(*e*) Grog	62·3	31·6	...	...	3·4	0·5	0·5	1·1	...	0·2	0·4

cm.^{2}, t = room temperature in ° C, and A = area of test-piece in cm.^{2}. Chemical composition, permeability, and other physical properties are shown in Tables I and II.

TABLE II. AIR PERMEABILITY AND OTHER PHYSICAL PROPERTIES.

Brick.	Firing Temperatures (cone).	P.C.E.	Sp. Gr.	Porosity.	Permeability at			
					50° C.	200° C.	500° C.	800° C.
(*a*)	17	32	2·36	24·70	0·3016	0·1272	0·0839	0·0641
(*b*)	10	32	2·62	30·08	0·0256	0·0160	0·0082	0·0048
(*c*)	26	37	3·75	28·38	0·2125	0·1247	0·0654	0·0359
(*d*)	14	36	3·54	24·42	0·0694	0·0375	0·0196	0·0108
(*e*)	10	34	2·64	28·43	0·0603	0·0379	0·0196	0·0112

It is concluded that the gas permeability decreases with rise of temperature in logarithmic power though the bricks expand directly as the temperature rises. The fact is contrary to the common idea that the pores open as the bricks expand.—S. G.

Magnesite Refractories. P. P. Budnikov and Z. Ya. Tabakov (*Domez*, **1932**, (9), 24–31).—[In Russian.] A review.—S. G.

Thorium Oxide, a High-Temperature Refractory. Oscar H. Fritsche, H. B. Wahlin, and Joseph F. Oesterle (*Electrochem. Soc. Preprint*, **1933**, Sept. 281–291).—An account is given of the methods used in making a thoria crucible of special design for a study of the positive ion emission of metals at high temperatures in *vacuo*. The thoria is prepared by repeated precipitation of the hydroxide from commercial thorium nitrate, followed by precipitation and ignition of the oxalate. The resulting oxide is fused in a simple smothered carbon arc furnace to produce a hard, glassy mass which is free from carbide provided that the arc is kept well covered with thoria; this mass is ground to pass 100 mesh and, after moistening with thorium chloride solution, tamped into moulds of suitable shape made of electrode graphite. The shapes are burnt in the mould at 1600° C. in an induction furnace, heated at 1000° C. in air to oxidize carbide formed on the outer surface, again burnt at 1600° C., and again heated at 1000° C. in air. Magnesia crucibles can be made in a similar way.—A. R. P.

New Super Refractory. Discussion of Tests and Operating Results [Siemensit]. Anon. (*Found. Trade J.*, 1933, **49**, 17–18, 38).—See *J.*, this volume, pp. 210, 328. The results of tests of Siemensit, a new refractory, consisting of Cr_2O_3 20–40, Al_2O_3 25–45, MgO 18–30, other constituents 8–14% are described. The 3 main constituents are present as spinels, the others as silicates. The principal characteristics are: (*a*) refractoriness, above Seger cone 42, (*b*) softening under a load of 28·9 lb./in.^{2}, above 1800° C., (*c*) bulk density (including pipe) 3·2–3·4, (*d*) heat conductivity, not yet determined, but more than that of magnesite, (*e*) expansion between 0°–1200° C., 1·2–1·4%, at higher temperatures about 2%. Operating tests have been made on a large scale under works conditions.—J. H. W.

"Siemensit" in the Construction of Furnaces. Arthur Sprenger (*Tonind. Zeit.*, 1933, **57**, 14–15, 39–40).—The results obtained over several years on a large scale with the Siemensit refractory are described; it has proved particularly satisfactory for lining combustion chambers in which coal-dust firing is practised.—B. Bl.

Sintered Corundum. Otto Bär (*Feuerungstechnik*, 1932, **20**, 174–175; *Ceram. Abs.*, 1932, **12**, 226).—Sintered corundum is obtained from chemically pure alumina. During fine grinding some acid must be added because alumina powder forms a positive suspensoid in a watery suspension in contrast to clays and kaolins which form a negative. It is shaped either in gypsum moulds or by pressing. The firing takes place in electric furnaces or in gas furnaces fired to 1800° C. Owing to a crystallization process of alumina particles in a solid state, the particles grow together in the α-modification and form a dense structure similar to granite. Chemically, sintered corundum consists of 99·3–99·8% Al_2O_3. It is resistant to a 6-hr. boiling with 10 or 30% solution of caustic soda and to superheated water vapour. It is stable to fusions of Na_2O, NaOH, Na_2CO_3, metallic aluminium, manganese iron, and other metallic alloys, to evaporation to dryness, and to glass and slag melts. It resists blast-furnace slag, lead carbonate, lead, and other metal silicates, lead boron glasses, glaze frits, and all silicate glasses. Its specific gravity is 3·9, hardness 9 (Mohs'), and porosity 0. Pyrometer tubes are gas tight when heated up to 1720° C. and under an inner pressure of 776 mm. The thermal expansion between 20° and 800° C. is $80 \cdot 10^{-10}$. Sintered corundum is also highly resistant to sudden changes of temperature. It contains a resistance to pressure of 5140 kg./cm.^{2} and a tensile strength of 350 kg./cm.^{2}. The softening point lies near 1730° C. The deformation point could not be determined. Sintered corundum may be used for chemical vessels, pyrometer tubes, and as highly refractory material for small furnaces and laboratory vessels, &c.—S. G.

Sintered Corundum. René Leonhardt (*Ind. Silicati*, 1933, **11**, 10–11; *Ceram. Abs.*, 1933, **12**, 227).—The manufacture, properties, and uses of sintered corundum products are detailed.—S. G.

Manufacture of Silicon Carbide and Artificial Corundum. A. C. (*Rev. mat. trav. publ.*, No. **277**, 1932, 425–426; *Ceram. Abs.*, 1933, **12**, 110).—Silicon carbide is produced from coal (coke) and siliceous sand treated in an electric furnace. At 1400° C. an amorphous material is obtained which has no refractory qualities, being too sensitive to oxidation. To secure a refractory product, the mixture is heated up to 1800° and 2200° C. to obtain crystallization; over this temperature silicon carbide is no longer stable and decomposes into its elements. The reaction is facilitated by adding sea salt and sawdust. Corundum exists in nature and has 95–98% pure alumina, although the emery from Naxos contains only 55–60% alumina. Some bauxites are easily transformed into crystallized alumina in an electric furnace at about 2000° C. and an artificial corundum is thus obtained. Because of crystallization, corundum easily separates from impurities. There is a great difference between crystallized corundum obtained in such a way and bauxite which has simply been fused, because the latter has none of the qualities of stability produced by crystallization.—S. G.

Manufacture of Electrocorundum and Silicon Carbide. R. Schneidler (*Feuerfest*, 1932, **8**, 129–132; *Ceram. Abs.*, 1933, **12**, 62).—Aluminium oxide or alumina exists in 3 different crystallographic modifications: (1) the α-alumina (corundum) stable at high temperatures; (2) the metastable γ-alumina with a stability range up to 930° C., and (3) the β-form. The alumina of the α-form and γ-form differ in that the γ-alumina is mostly amorphous, whilst corundum (α-alumina) forms aggregates with crystals besides having different physical properties. Electrocorundum is a crystallized α-aluminium oxide free from water and is produced in an electric arc furnace. It differs from artificial corundum (cupola furnace method, Thermit method) and natural corundum of purest form (ruby and sapphire). The manufacture of artificial corundum consists morphologically in a conversion of the amorphous α-alumina into the crystalline α-form at over 930° C. The raw materials used for it are white and red bauxites, emery, and kaolin. Amorphous alumina of great purity is used for corundum of the highest alumina content. Silicon carbide is a pure artificial product and is formed from its components, silica, and coal, in an electric resistance furnace. Patent literature dealing with the manufacture of corundum and silicon carbide refractories is discussed.—S. G.

XVII.—HEAT-TREATMENT

(Continued from p. 526.)

Remarks on the Heat-Treatment of Duralumin. Jean Matter (*Aciers spéciaux*, 1933, 8, 109–112).—M. discusses the influence of the time of heating, rate of cooling in annealing, and the temperature of ageing on the characteristics of normal Duralumin. It is recommended that annealing should consist of heating for some minutes at 400° C., except in the case of large pieces which require a longer time. The rate of cooling depends largely on the thickness of the pieces, which should be cooled separately. Ageing is considerably accelerated (a few hours as opposed to weeks) by increasing the temperature from 0° to 100° C.—J. H. W.

The Heat-Treatment of Hiduminium Alloys. Anon. (*Metallurgia*, 1933, 8, 113).—Heat-treatment technique of the Hiduminium alloys varies according to the particular alloy to be treated, and it is of vital importance to use the most suitable treatment in order to obtain the most desired properties. The recommended heat-treatments for sand- and die-castings in " R.R.50 " and " R.R.53 " alloys are given, and it is stated that in the treatment of castings with widely different variations of sections, additional care must be taken to prevent cracking or distortion due to differential contraction. The treatment of forgings and stampings in " R.R.56 " and " R.R.59 " alloys are also discussed and certain alternative treatments are mentioned. Consideration is also given to the treatment of castings in Hiduminium " Y " alloy, particularly to castings of intricate design and change of section.—J. W. D.

Application of Tungsten Wire in the Electrical Industry and Principles of its Heat-Treatment. N. M. Zarubin and A. N. Koptzik (*Zvetnye Metally* (*The Non-Ferrous Metals*), 1932, 189–204; *C. Abs.*, 1933, 27, 3689).—[In Russian.] Recent progress in the manufacture and heat-treatment of tungsten wire is reviewed. An apparatus and the method for measuring the sag in tungsten wire are described. Heat-treating experiments are described for controlling the grain-size of wires with the addition of K_2O, SiO_2, and ThO_2. Photomicrographs and a *bibliography* are given.—S. G.

Some Heat-Treatment Problems in the Automobile Factory. A. MacLachlan (*Proc. Inst. Automobile Eng.*, 1932–1933, 27, 478–501; discussion, 502–505).—The heat-treatment of steel in automobile works is reviewed, the possibility of effecting economies being kept in view throughout. The treatment is essentially practical, the work embracing a discussion of the utilization of existing plant and personnel, and shop lay-out.—J. S. G. T.

XVIII.—WORKING

(Continued from pp. 526–527.)

The Manufacture of Aluminium Foil. Anon. (*Synthetic and Applied Finishes*, 1933, May; also (reprints) *Light Metals Research*, 1933, 2, (28), 8–11; and *Aluminium Broadcast*, 1933, 4, (7), 16–18).—Aluminium foil is rolled from ingots 500 × 500 × 150 mm., which are cooled slowly in electrically-heated moulds and then machined all over to a depth of 1 cm. These are rolled to sheet 2 cm. thick in a reversible mill, cut to lengths of 5 m., and annealed. Further reductions to 0·02 mm. thick are carried out in a foiling mill, after which two sheets are fed together through the rolls until the final thickness, which may be as small as 0·005 mm., is reached. A final anneal removes oil and produces the necessary softness.—J. C. C.

Lubrication for Deep-Drawing. E. E. Halls (*Machinery* (*Lond.*), 1933, 42, 453–457).—The requirements of a lubricant for deep-drawing operations are discussed under the headings of ease of application, adherence, film strength, lubricity, corrosiveness, ease of removal, and cost. The characteristics of various oils, workshop mixtures, and proprietary compounds are considered.—J. C. C.

72 : 28 Cartridge Brass. H. Dureault (*Mém. artill. franç.*, 1932, **11**, 385–408; *Chim. et Ind.*, 1932, **29**, 1088; *C. Abs.*, 1933, **27**, 3693).—Like 67 : 33 brass, 72 : 28 brass easily becomes work-hardened and loses its malleability, which can be restored only by annealing. Tests with thick brasses showed that at the temperature corresponding with complete annealing 72 : 28 brass has a greater elongation than 67 : 33 brass. It would appear advantageous, therefore, with 72 : 28 brass to endeavour to reduce the number of operations in the manufacture of cartridges and to increase the amount of work effected at each operation. Tests on thin brasses showed practically no difference between 72 : 28 and 67 : 33 brasses. It would seem, therefore, that the increase in the copper content cannot be depended on to guarantee the keeping qualities of the cartridges, and in order to prevent fissuring a complete annealing is essential.—S. G.

Methods of Working and Fabricating Magnesium Alloys. Anon. (*Machinery* (*N.Y.*), 1933, **39**, 721–723).—The operations of casting, forging, pressing, rolling, drawing, and welding magnesium alloys are described in a general way.—J. C. C.

Spontaneous Combustion of Metals. —— Freitag (*Oberflächentechnik*, 1933, **10**, 107–108).—In working magnesium alloys, especially that containing 86·2% magnesium, 0·3% silicon, and 13·5% copper, on the lathe the turnings frequently take fire. Water and sand are useless for quenching such fires, but powdered carnallite rapidly smothers them by making a film of fused salt over the hot metal.—A. R. P.

Factors that Affect Machinability. F. R. Palmer (*Metal Progress*, 1933, **23**, (4), 17–19).—Hardness, toughness, microstructure, frictional properties, and tendency to work-hardening are shown to affect the machinability, primarily of steels, but inferentially of other materials. Corrections both in machining practice and in selection of material are suggested.—P. M. C. R.

Advances in the Construction of Machinery for the Working of Sheet. —— Weil (*Maschinenkonstrukteur*, 1933, **66**, (9/10), 59–67).—Recent examples of bending and pressing machinery, punching and cutting plant are described and illustrated; diagrams of certain unusual sections are given.—P. M. C. R.

Tapping Monel Metal. Anon. (*Machinery* (*Lond.*), 1933, **42**, 347).—In tapping Monel metal, the tough chips are apt to stick in the flutes of the tap. Methods of minimizing this trouble are briefly discussed.—J. C. C.

Materials for Cold-Heading. H. B. Pulsifer (*Metal Progress*, 1933, **23**, (3), 13–17).—The bolt industry is estimated to be capable of producing annually 5000 million pieces by the cold-heading process. This would require about 300,000 tons of material in wire form, the average sizes ranging from 0·16 in. to ¾ in. in diameter. The process demands stock of high quality; properties of typical steels, brass, Everdur, Duronze, and Monel metal are tabulated. Materials must combine high strength with low cost, and in practice this limits the choice to the α-solid solutions of iron, copper, and nickel. Certain details of the process are modified according to the alloy selected. Possible sources of defects in the wire are considered, and the importance of surface finish and of proper lubrication is emphasized.—P. M. C. R.

A Molybdenum–Titanium Carbide Cutting Material. Anon. (*Metallurgia*, 1933, **8**, 62).—A description of Cutanit, a new cutting material the components of which are molybdenum and titanium carbides of high purity, carburized in powder form. Its sp. gr. is much lower than that of other carbide materials of a similar character, yet when cutting it generates less heat. Its Rockwell hardness is 83–85 on the 100 kg. scale, and it resists oxidation up to 900° C. It has given good results after extensive and exhaustive tests for a considerable time on a wide range of materials.—J. W. D.

The Tool-Metal "Widia." Anon. (*Maschinenkonstrukteur*, 1933, **66**, (11/12), 86–87).—The preparation of Widia tools is briefly described; necessary precautions are enumerated, and 6 varieties of Widia are tabulated with their respective trade markings and colours and with the types of work for which they are especially suited.—P. M. C. R.

Cemented Tungsten Carbide for Cutting Tools. L. J. St. Clair (*Trans. Amer. Soc. Mech. Eng.*, 1931, 53, M.S.P.–15, 139–146; *Ceram. Abs.*, 1933, 12, 119).—S. describes the origin of cemented tungsten carbide and the most satisfactory method for making it. Because of its hardness, it is valuable for wear-resisting tools and particularly for cutting tools. The physical properties of cemented tungsten carbide and its economic value as a cutting medium are discussed. Design and care of the tools are essential factors in successful application. Proper support of the cemented tungsten carbide tip and allowance for proper clearance angles are essentials of design. The tool set up should be as rigid as possible, as chatter or vibration is detrimental to successful life. The critical speed at which the tool should run for a particular job should be determined and the machine should be operated below this. Grinding of the tool is important and proper grinding methods are given. Use of cemented tungsten carbide for cutting tools has resulted in increased machine speed, longer life per grind, reduced tool maintenance, less waste of material in setting up, and greater accuracy throughout a long run.—S. G.

New Metal-Cutting Alloy (548). W. P. Sykes (*Metal Progress*, 1933, 23, (2), 32).—A paper read before the Cleveland meeting of the American Society for Steel Treating. The iron–tungsten and iron–cobalt alloy systems are considered; tungsten and cobalt exert opposite effects on the γ-region, the former restricting, and the latter extending, it. The hardening properties of both series are discussed. The introduction of cobalt into the iron–tungsten system greatly increases the hardness of both quenched and aged alloys. The alloy of composition 20% tungsten, 30% cobalt, and 50% iron is found to be capable of great refinement of structure on suitable treatment, with a hardness ranging between Rockwell C–40 and C–64. A full description with photomicrographs illustrating the structures associated with varying degrees of hardness is appended.—P. M. C. R.

Non-Ferrous Super High-Speed Cutting Alloys. Anon. (*Machinery (Lond.)*, 1933, 41, 715–724).—A comprehensive review of the characteristics and applications of 4 British-made cutting alloys—the Wimet metals (originally introduced as Widia metals), the Ardaloy metals, Cutanit, and Stellite. The design, maintenance, and grinding of cutting tools, milling cutters, and drills tipped with these materials are described, and reference is made to chip-breaking methods which have been developed.—J. C. C.

Campbell "Hydrokut." Anon. (*Automotive Ind.*, 1933, 68, 357).—The "Hydrokut" machine eliminates dust and produces a clean, smooth cut by means of a thin wheel or disc which rotates at high speed, and operates on pieces immersed in a bath. The cutting stroke is automatic, the completion of the process being indicated by a light. It is claimed that time is saved both in cutting and by removing the necessity of further machining of the cut face, since the finish is of high quality. The process is applicable to a wide range of metallic and other materials.—P. M. C. R.

XIX.—CLEANING AND FINISHING

(Continued from p. [illegible].)

Metal Cleaning. Methods and Materials. Joseph Geschelin (*Automotive Ind.*, 1933, 68, 466–470, 521–526, 702–703).—(I.—) Factors influencing the choice of cleaning methods are classified. The available methods are: alkaline cleaning, pickling, degreasing by organic solvents, electrolytic methods, bright-dipping, the Bullard-Dunn process, cleaning and rinsing tanks, and metal washing machines. The advantages and special applications of each are considered. (II., III.—) Some proprietary cleaning processes are described.—P. M. C. R.

The Heating of Wooden Pickling-Vats by Gas. Anon. (*Maschinenkonstrukteur*, 1933, 66, 98–99).—An enclosed submersible gas-heating apparatus is described for use in vats where steam-heating is not convenient. A combustion chamber of cast brass, into which are led supplies of gas and of compressed air, is almost entirely submerged in the pickling fluid; the products of combustion are led out through a copper heating coil. Directions for use and certain possible modifications are given.—P. M. C. R.

Amalgamating Copper Plates. Anon. (*Eng. and Min. J.*, 1933, 134, 321).—Describes a method of amalgamating copper plates with a soft mush of ammonium chloride 80%, moistened with 20% of water, with sufficient mercury dispersed through it.—R. Gr.

Electronic Interferences on Emeried and Polished Surfaces. H. Raether (*Naturwiss.*, 1933, 21, 547).—The changes undergone by the surfaces of metals (copper, silver, and nickel) and the cleavage planes of certain salts during polishing and burnishing have been studied by the electronic interference method. Metal surfaces polished on emery give relatively slight broadening of the interference lines, but, after finer polishing, broad interference lines appear which are almost the same for all metals, and do not correspond with the atomic distances in the lattice; this is possibly due to a transition from the crystalline to the amorphous state.—J. W.

Grinding, Polishing, and Buffing of Monel Metal and Pure Nickel. Anon. (*Machinist (Eur. Edn.)*, 1933, 77, 341–342).—The applications, methods, and effects of the various operations of grinding, polishing, and buffing Monel metal and pure nickel are described and summarized in tabular form.
—J. H. W.

XX.—JOINING

(*Continued from pp.* [illegible].)

New Countersunk Riveting Process for Sheet Metal. A. Eyles (*Met. Ind.* (*Lond.*), 1933, 42, 99).—Describes a method of riveting very thin sheets of aluminium and other alloys used in the aeronautical industry. A specially shaped tool forces the flat rivet head into the two sheets which sink together into a cup shape without distorting the sheets, which remain dead flat, and at the same time form a new cup head on the rivet shank.—J. H. W.

Soldered Porcelain and Glass in the Electrical Industry. E. H. Fritz (*Ceram. Ind.*, 1932, 19, 279–283; *Ceram. Abs.*, 1933, 12, 55).—The process consists of producing a metallized area on glass or glazed porcelain surfaces which can be tinned and soldered to metal parts with a commercial solder. The metallized area is produced by coating the glass or glazed porcelain surface with a special metallic glaze of comparatively high metallic content of which the essential constituents are platinum and gold in the form of chlorides. This glaze is fired in an oxidizing atmosphere. The commercial solder consists of approximately half tin and half lead. A satisfactory union takes place between the solder and metallic glaze at 225° C. and this temperature must be closely controlled. To overcome strains due to different coefficients of expansion of metal and non-metal parts the former are made as light as possible and the latter with the maximum sturdiness. Examples of parts made by this process are illustrated photographically and explained.—S. G.

New Low Temperature Brazing Alloy [Sil-Fos]. Anon. (*Canad. Mach.*, 1933, 44, (5), 32).—See this *J.*, 1931, 47, [illegible]; 1932, 50, [illegible].—P. M. C. R.

Fabricating Products by Electric Furnace Brazing. H. M. Webber (*Machinery* (*N.Y.*), 1932, 38, 520–524; and *Machinery* (*Lond.*), 1932, 42, 461–464).—Cf. *J.*, this volume, p. 217. Electric furnace brazing is carried out by passing assembled steel parts through an electric furnace in which a reducing atmosphere is maintained. Copper is applied to the joints as wire, chips, or a paste of copper dust mixed with pyroxylin and a thinner. Details of the construction of some typical brazed products are given.—J. C. C.

New Developments Lower Cost of Continuous-Furnace Brazing. C. L. West (*Iron Age*, 1933, **132**, 15–16, 66).—Data are given on different brazing materials and on the fitting and the preparation of the parts to be joined, as well as on the operation and scope of continuous-furnace brazing.—J. H. W.

Copper Brazing. C. L. West (*Metal Progress*, 1933, **24**, (1), 44–47).—Brazing in a controlled atmosphere increases both economy and efficiency by making it possible to join rigidly and strongly many simple units in one operation. The brazing material is placed in convenient form on or near the joint to be made and on melting enters and fills the joint. A list of typical assemblies is given. Brazing materials include silver solders, certain brass alloys, and copper. The preparation of joints is described, and suitable types of furnace are considered. Brazed joints are stated to be stronger than those made by the rather cheaper projection welding process. Examples of brazed assemblies are described.—P. M. C. R.

Soldering, Brazing, and Welding of Stainless Steels. A. Eyles (*Mech. World*, 1933, **93**, 306–308).—The technique essential to good results in soldering, brazing, and welding stainless steels, is discussed. The necessity for brazing solders to be free from impurities, particularly tin and lead, is pointed out. For use with silver solders the flux recommended consists of equal parts of calcined borax, and boracic acid made into a paste with concentrated zinc chloride solution.—F. J.

Cadmium Solders. Anon. (*Machinery* (*Lond.*), 1933, **42**, 162–163; *correspondence*, 369).—Details are given of the composition and uses of a number of alloys containing cadmium. These are grouped as fusible alloys, soft solders, silver solders, brazing solders, and aluminium solders.—J. C. C.

Some Economic Aspects of Welding Aluminium. D. E. Roberts (*Met. Ind.* (*N.Y.*), 1933, **31**, 61–62; and (short abstract) *Met. Ind.* (*Lond.*), 1933, **42**, 380).—Paper read before the International Acetylene Association at Philadelphia, Nov. 16–18, 1932. Comparison of the costs of oxy-acetylene and oxy-hydrogen flames for large-scale welding of aluminium shows an advantage of 47% in favour of the former.—A. R. P.

On the Welding of Aluminium and of Its Alloys. H. Bohner (*Alluminio*, 1933, **7**, 100–102).—Cf. *J.*, this volume, p. 331. Buchholz's paper (see this *J.*, 1932, **50**, 257) is discussed. The structure and mechanical properties of welded joints of light alloys, and particularly those of heat-treated alloys, are materially affected by the welding operation, but may be restored by further heat-treatment. In cold-worked alloys, the mechanical properties are permanently affected. Contrary to the statement of Buchholz, the welding method has no influence on the properties of the joint: if the welding is correctly done, oxy-hydrogen and oxy-acetylene welds will have the same mechanical properties. Cold-riveting of aluminium alloys is always possible, and gives good results, provided that certain elementary precautions are observed.—G. G.

A Canoe of Welded Aluminium. Anon. (*Fiamma Ossiacetilenica*, 1933, **8**, (2), 60–62; and *Soudeur-Coupeur*, 1933, **12**, (4), 10–12).—A detailed description of the construction from sheet aluminium, welded by oxy-acetylene, is given. The canoe will carry two persons, is about 17 ft. long, weighs 60 lb., and has 2 air tanks for safety.—H. W. G. H.

Fluxing is Indispensable [for Welding Aluminium]. Anon. (*Fiamma Ossiacetilenica*, 1933, **8**, (4), 51–54).—The formation of vitreous alumina in the welding of aluminium is shown in photomicrographs, and Odam's attempts to find a suitable flux for the autogenous welding of aluminium are mentioned.—G. G.

Welded Aluminium Articles. Anon. (*Fiamma Ossiacetilenica*, 1933, **8**, (4), 55–57).—The use of welded aluminium in the manufacture of reservoirs, mixers, radiators, cars, moving pent-houses, &c., is illustrated.—G. G.

Welding of Light Alloy Castings. Anon. (*Fiamma Ossiacetilenica*, 1933, **8**, (4), 58–59).—Deals with the repair of gear boxes, &c.—G. G.

Welding Aluminium with the Metallic Arc. John J. Bowman (*Machinery* (*N.Y.*), 1933, **39**, 403–406).—Arc welding of aluminium is possible provided a flux is used. Electrodes made from a 5% silicon alloy, coated with a rather heavy layer of flux, are recommended. Arc welds are always slightly porous. Complete removal of flux by washing in 10% acid solution is essential.—J. C. C.

Resistance Welding of Aluminium and Its Alloys. D. I. Bohn and G. O. Hoglund (*Amer. Soc. Mech. Eng. Preprint*, 1933).—Spot and seam welding of aluminium and its alloys require a high thermal gradient from the weld point to the sheet surface, and the weld is made with metal in the molten state. Pressure between electrodes is important. Existing methods used for steel welding are not applicable without modification.—W. P. R.

Repair Methods on Damaged All-Metal Coaches. A. J. T. Eyles (*Locomotive*, 1933, **39**, 184–185).—Discusses the advantages of fusion welding of aluminium over soldering and describes appropriate technique.—P. M. C. R.

The Welding of Brass and Bronze Sheets. Herbert Herrmann (*Met. Ind.* (*Lond.*), 1933, **43**, 145–148).—Owing to the oxidation and vaporization of the alloying constituents, brass and bronze require a somewhat different technique from that of copper, (1) in the introduction of small quantities of some metal or metalloid. such as aluminium or phosphorus, exhibiting a larger deoxidizing effect than the zinc or tin, so protecting these metals from the oxidizing effect of the cuprous oxide, and (2) in the use of a flux having a protective effect and a solvent action on the zinc and tin oxides produced. The use of the deoxidizers, the composition of fluxes and welding rods, failures in brass welding, the technique of welding sheet, and the avoidance of buckling, flame control, and the differences between brass and bronze welding are discussed.—J. H. W.

Repairing Foundry Castings by Autogenous Welding. H. Gerbeaux (*Bull. Assoc. Tech. Fonderie*, 1933, **7**, 1–15).—A discussion of this essential part of present-day foundry practice. The methods employed are illustrated by typical examples, and full details are given of the technique which is necessary in order to produce a good weld. Thermit, ordinary acetylene, and arc welding are the principal processes described. Photomicrographs of good welds are included to show that true penetration and union have occurred in the examples cited. A short section is devoted to brazing.—W. A. C. N.

The Welding of High Nickel Alloys. J. G. Schoener and F. G. Flocke (*J. Amer. Weld. Soc.*, 1932, **11**, (11), 18–22).—Metallic arc welding of Monel metal, nickel, Inco chrome nickel, and nickel-clad steel is discussed. Covered electrodes are used with reversed polarity and the nature of the flux coating is extremely important. A heavy coating containing ferro–titanium is recommended.—H. W. G. H.

Welding of Nickel and Nickel Alloys. Herbert Herrmann (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 30–32).—The welding of nickel is unfavourably affected by the " hot-short " range which exists at 800°–1050° C., and the capacity of the metal for absorbing gases, which leads to embrittlement. Oxygen is less injurious than sulphur, which separates at the crystal boundaries. Oxy-hydrogen is not practicable and oxy-acetylene is the only suitable autogenous process, the acetylene being necessarily pure. Adjustment of the character of the flame is important. Welding rods may be of nickel or alloy containing a deoxidizer. The effects of various deoxidizers and fluxes are discussed. The special fluxes for the purpose are based on borax–boric acid deoxidant mixtures and are applied as an alcohol paste. Methods of jigging are discussed as well as various points of manipulation. Hammer welding of nickel is possible, although requiring much skill and attention to temperature and type of support for the welding. Careful cleaning before welding is essential. Nickel alloys behave similarly to nickel in welding, except nickel silvers, which more nearly resemble brass.—R. G.

The Principles of Bronze-Welding. A. R. Lytle (*J. Amer. Weld. Soc.*, 1932, **11**, (12), 14–17).—The characteristics of bronze-welding rods and correct methods of use are described. Joints in ferrous metals are mainly considered. —H. W. G. H.

Fundamental Research Problems in Welding. Anon. (*J. Amer. Weld. Soc.*, 1932, **11**, (12), 18–26).—A review, compiled by the Fundamental Research Committee of the American Bureau of Welding, of the more important problems requiring investigation and a list of researches already in progress. The Bureau is a joint research Board affiliated to the American Welding Society and the National Research Council. —H. W. G. H.

Advances in Welding Technique. Wolf von Bleichert (*Anz. Berg-, Hütten- u. Masch.*, 1933, **55**, (34), 4–5).—A description of recent improvements in welding technique.—B. Bl.

Welding Ferrous and Non-Ferrous Metals. W. C. Freeman (*Found. Trade J.*, 1933, **48**, 342).—Abstract of a paper (and discussion) read before the Midland Section of the Institute of Welding Engineers. Briefly describes the manufacture of acetylene for oxy-acetylene welding and the use of this process for the welding of copper, aluminium, and cast iron and for cutting metals.—J. H. W.

Copper–Hydrogen Welding a Quantity–Production Process. W. W. Anderson (*Iron Age*, 1933, **131**, 538–539).—Copper–hydrogen welding is said to produce a joint stronger than the steel. The nature and applications of the process are outlined.—J. H. W.

Welding Difficulties. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1933, **9**, (11/12), 118–120).—A consideration of the oxy-acetylene welding of iron sheet, galvanized sheet, and special steels is followed by a review of the special difficulties presented by copper, lead, zinc, nickel, and Monel metal. Suitable fluxes, and adjustments of flame, are suggested, and the injurious nature of certain impurities is indicated. Some safety precautions are given. —P. M. C. R.

Welding as a Maintenance Tool. E. L. Quinn (*Blast Fur. and Steel Plant*, 1933, **21**, (3), 161–164).—A general review of the application of the process, reference being made to non-ferrous metal technique. Stress is laid on the need for care in selecting the proper rod for the different materials. —R. Gr.

Notes on Autogenous Welding. Anon. (*Locomotive*, 1933, **39**, 57–58).—A description of economical welding practice as carried out in the workshops of the New Zealand Government Railways.—P. M. C. R.

Simple Tests for Identifying Metals. Anon. (*Iron Age*, 1933, **132**, facing p. 26).—A table showing methods of identifying ferrous alloys, copper, brass and bronze, aluminium and its alloys, Monel metal, nickel and lead by appearance and chip, spark and blowpipe tests. This table has been drawn up by the Linde Air Products Co., New York, to facilitate the identification of metals that are to be oxy-acetylene welded, particularly in maintenance work.—J. H. W.

Recent Advances and Future Expectations of the Oxyacetylene Process. James H. Critchett (*J. Amer. Weld. Soc.*, 1932, **11**, (12), 8–9).—A review of modern developments and some prophecies for the future—blowpipes of greater thermal efficiency, applications to new alloys and to non-metallic materials, uses other than welding, such as localized heat-treatment. —H. W. G. H.

Electric Welding or Autogenous Gas Welding? Karl Tewes (*Anz. Berg-, Hütten- u. Masch.*, 1933, **55**, (17), 20–22).—The advantages and disadvantages of these methods of welding are compared.—B. Bl.

Acetylene from Cylinders or from Gas-Generators? Anon. (*Anz. Berg-, Hütten- u. Masch.*, 1933, **55**, (25), 4–5).—A comparison of the advantages and disadvantages of taking acetylene supplies from these sources with comparative cost data.—B. Bl.

Determination of the Capacity of Acetylene Generators. Michel Rochette de Lempdes (*Bull. Soc. Ing. Soudeurs*, 1932, **3**, 739–750).—An exhaustive report presented by de L. on behalf of a Committee appointed by the Société des Ingénieurs Soudeurs. The particulars usually given by the makers—*viz.* maximum thickness of metal which can be welded and/or cut, number of blowpipes which can be operated for a given time, and charge of carbide, are not sufficient to define the size and capacity of a generator. The Committee has accordingly examined the important factors and recommends a standard specification for generators; a standard name-plate giving the essential characteristics and bearing the official stamp of an authority independent of the manufacturers, and revision of the regulations for testing generators.
—H. W. G. H.

Electric Welding—Arc and Resistance Welding. International Congress of Electricity. Anon. (*Science et Industrie*, 1933, **17**, 146).—An abstract of Report No. 10 (Section 12). Recent developments include the protected-arc method and the atomic hydrogen process. Automatic arc-welding machines are described and their extended applications in industry are reviewed.—P. M. C. R.

Electric Double Spot Welding. Anon. (*Maschinenkonstrukteur*, 1933, **66**, 6–8).—The "double spot" welding machine described and illustrated is said to obviate certain disadvantages and limitations of the ordinary spot, arc, and autogenous welding processes. The side-by-side setting of the electrodes renders the machine especially suitable for the attachment of thin sheet to heavier structural members, as in aero work and some types of building construction. Overheating is avoided, and the adaptability of the installation enables it to be applied to large pieces and to the making of joints in parts which are difficult of access.—P. M. C. R.

A New Welding Process. John C. Arrowsmith (*Aircraft Eng., Workshop Prodn. Section*, 1933, **5**, (48), 9–10).—The Budd "Shot-weld" process is described, and advantages are claimed in uniformity of properties of the individual welds, automatic indication of the use of incorrect conditions of welding, and a permanent record of the electrical conditions employed in every weld. Results of shear tests on welds in a corrosion-resisting steel are given.—H. S.

New Electrode for Welding Aluminium. Anon. (*Power*, 1932, **75**, 673).—See *J.*, this volume, p. 100.—F. J.

Electric Welding. R. Brennecke and A. Franke (*Anz. Berg-, Hütten- u. Masch.*, 1933, **55**, (52), 3–4).—A short description of modern welding machines and apparatus as shown at the Electric Heat Exhibition in Essen.—B. Bl.

Electrical Plant Auxiliaries: Electric Welding. Anon. (*Fuel Economist*, 1933, **8**, 613–615).—Types of welding sets are described and illustrated and economies that can be effected by electric welding as against replacement are briefly discussed. The selection of electrodes for special work is referred to.
—J. S. G. T.

Sources of Supply for Electric Welding, Particularly D.C. Generators. J. Berger (*Bull. Soc. Franç. Élect.*, 1931, **1**, 856–878; *Sci. Abs.*, 1932, [B], **35**, 23).—Graphical methods are used to determine the best characteristics for such machines, and the machines dealt with include the compound generator and the separately-excited machine, with lesser reference to the shunt-wound machine with and without separate excitation. Special generators are then considered in which the polar faces are split and a local short-circuited flux-path results, which modifies the normal armature reaction to produce a constant current independently of the load circuit. Other machines with modified poles and short-circuiting brushes, including the Alsthom, are described, and oscillograms show some of the characteristics. Finally, a brief reference is made to the generation of 1-phase current for welding.—S. G.

XXI.—INDUSTRIAL USES AND APPLICATIONS

(Continued from pp. 529–533.)

Aluminium at the XIVth Exhibition, Milan. Anon. (*Alluminio*, 1933, 2, 159–165).—An illustrated description of the exhibit.—G. G.

Aluminium in the Cotton and Wool Industries. John R. Whitelegg (*Textile Manufacturer*, 1933, 59, 241–241A, 282–283).—An illustrated article describing the uses and advantages of the aluminium alloys "2L5," "3L11," "Y," and Silumin in the manufactures of various pulleys, rollers, reels, and other parts of textile machinery where lightness combined with strength is required.
—A. R. P.

Aluminium in the Equipment of Varnish Manufacturers. C. Bianchi (*Alluminio*, 1933, 2, 90–97).—An illustrated article, in which all the possible uses of aluminium in the manufacture of varnishes and paints, boiling, cold solution, mixing, distillation, filtration, and transportation are discussed and demonstrated.—G. G.

Demountable Walls for Power Plant Construction. R. B. Horner (*Power Plant Eng.*, 1933, 37, 172).—The use of aluminium-clad sections in building construction is claimed to be economical in erection and replacement, and to give simple, durable, and weather-tight structures. A section illustrated consists of two 18-gauge aluminium sheets, between which is fixed rock-wool insulating material. Supports and attachments are made of aluminium.
—P. M. C. R.

Use of Aluminium in Collieries. T. R. Barnard (*Colliery Eng.*, 1933, 10, 233).—B. considers that aluminium and Duralumin should find more extended application in colliery work. He suggests the lightening of cages, conveyor pans, props, and bank-bars by the substitution of Duralumin for steel. Aluminium paint combines with high protective quality considerable reflecting power, involving a useful gain in underground illumination. Other uses are suggested.—P. M. C. R.

A Tower 500 Metres High [in Aluminium Alloy]. M. Dornig (*Alluminio*, 1933, 2, 154–158).—An illustrated description.—G. G.

The Use of Aluminium in Conductors of High-Voltage Electrical Lines. Anon. (*Alluminio*, 1933, 2, 35–39).—Statistical. Germany has 27,034 km. of high-voltage lines, 10,185·1 km. of which are aluminium, Aldrey, or aluminium–steel and 130 km. bronze. In France there are 32,624 km. of conductors carrying more than 30 kv.; 22,723 km. of these are copper, 7388 km. pure aluminium, 2306 km. aluminium–steel, and 188 km. of Almelec–Aldrey. In Switzerland, of 7309·1 km. of electrical lines carrying over 30 kv. 4651·8 are copper, 32·5 bronze, and 2624·8 in aluminium, aluminium–steel, and Aldrey. In England (not including the Grid System), 7727 km. of the 9114 km. of old lines are aluminium–steel. In the United States (1929) there are 877 lines with 66,000 v. or more (38,000 km.), of which 350 are in aluminium–steel (22,500 km.). The use of aluminium conductors in the rural electrification of various districts (1931–1932) is very considerable. In Italy, of the 83,960 km. of high-voltage lines (31,266 with over 30 kv.) only 1091 km. are aluminium, Aldrey, or aluminium–steel, the remainder being copper.
—G. G.

A Metal Tender for "Britannia." Anon. (*Motor Boat*, 1933, 59, 17).—A description of a launch built for the Royal yacht "Britannia" which has been constructed almost entirely of MG7 alloy. The main structure is of angles and plates of this material, and castings of the same alloy are used for the rudder, deck fittings, stern tube, and propeller. As a result of using this light alloy, the weight of the complete craft with its 10–20 h.p. engine has been kept down to 9 cwt.—J. W. D.

Light Alloys Cut Weight. Anon. (*Automotive Ind.*, 1933, **69**, (3), 69–70).—A recent type of Diesel engine intended for commercial vehicles weighs 15·4 lb. per h.p., largely through the extensive use of light alloys. Magnesium alloy castings are used for sump and crank-case; the crank and piston pins bear directly on aluminium alloy rods. Pistons are of "Y" alloy.—P. M. C. R.

More Aluminium Utilized to Increase Car Efficiency. Anon. (*Daily Metal Reporter*, 1933, **33**, (40), 5–6).—The use of aluminium cylinder heads in automobile work is steadily increasing. Reference is made to an address delivered by F. F. Kishline before the Society of Automotive Engineers in which the superiority of the aluminium over the cast-iron head is emphasized.
—P. M. C. R.

Light Alloy Body Construction. Anon. (*Tram. and Rail. World*, 1933, **73**, 143).—An account is given of the Burlingham system of body construction. Its principle is the adoption of unit sections, all parts being standardized and easily removable for repair or replacement. A standard aluminium-silicon alloy (Admiralty specification) is employed for cast parts; fillets, plating and edgings are of aluminium sheet, and for girders and other heavily strained members a strong forged light alloy is used. At no point do 2 metal surfaces touch, and no riveted structures are used: welded parts and welding instructions are greatly simplified.—P. M. C. R.

Silumin Castings in the Motor Industry. Anon. (*Automobiltech. Z.*, 1933, **36**, 67–68).—The properties of Silumin are reviewed. Recently developed alloys of this class, Silumin-β and Silumin-γ, are described, and the properties of ordinary Silumin, copper–Silumin, Silumin-β, and Silumin-γ, the latter with and without special heat-treatment, are tabulated for both sand- and chill-castings.—P. M. C. R.

An Aluminium Alloy Piston of Controlled Expansion. Anon. (*Nickel Bulletin*, 1933, **6**, 51–52).—To overcome the large thermal expansion of aluminium alloys for use as piston heads, the alloy is poured into a die in which has been inserted a bridge of low-expansion alloy containing nickel. The bridge is thus securely keyed into position, and serves as a gudgeon pin bearing and prevents undue radial expansion of the piston-head when the metal becomes hot.—J. H. W.

First Power-Driven Railway Coach with All-Aluminium Body. Anon. (*Machinery* (*N.Y.*), 1933, **39**, 673–674).—A brief illustrated account is given of the construction of the "Autotram" railway coach.—J. C. C.

Light Alloys Help Make Possible the Autotram, Latest Development in Railway Cars. Anon. (*Met. Ind.* (*N.Y.*), 1933, **31**, 135).—A petrol-driven railway car with seats for 42 persons and capable of 70 m.p.h. has just been built in America; all the superstructure and the wheels are made of aluminium alloys, and the whole is mounted on steel bogies. The car is stated to be 18,000 lb. lighter than a similar steel car would be.—A. R. P.

On Duralumin in Means of Communication (Automobiles, Aeroplanes, and Airships). —— Arnzten (*Aluminium*, 1933, **15**, (3), 1–4).—A review of the uses of aluminium alloys in vehicles driven by internal-combustion engines.
—A. R. P.

Calculations for Duralumin Constructions. M. Pubellier (*Arts et Métiers*, 1933, **86**, 213–230).—A large number of data and formulæ commonly used in structural work have been collected and adapted for the use of Duralumin constructions.—J. H. W.

Aluminium–Magnesium Mirrors. Hiram W. Edwards (*Phys. Rev.*, 1933, [ii], **43**, 205).—A note. Mirrors were prepared by evaporating a mixture of aluminium and magnesium in a vacuum, and were deposited on glass. They reflected from 93 to 94% of red, green, and blue light incident at 10°, whilst a silver mirror gave values of 95% and 85% for red and blue light, respectively, so that the aluminium–magnesium mirror has a great advantage when used with short wave-lengths.—W. H.-R.

Evaporation Technique for Aluminium [Preparation of Aluminium Mirrors]. John Strong (*Phys. Rev.*, 1933, [ii], **43**, 498).—A note. Mirrors made by evaporating aluminium are superior to those of silver as regards permanency, inertness to corrosive agents, adherence to glass, and reflectivity in the ultra-violet. Methods are described for volatilizing aluminium by means of a tungsten helix.—W. H.-R.

Tests for Aluminium Foil from the Viewpoint of its Suitability as a Wrapping Material for Cut Bread. K. Seidel (*Z. Unters. Lebensm.*, 1933, **65**, 104–106; *Brit. Chem. Abs.*, 1933, [B], 310).—Solubilities in 100 c.c. of 0·25N- and 0·5N-acetic acid, 0·25N- and 0·5N-lactic acid, 0·25N-phosphoric acid, and an aqueous extract of pumpernickel are recorded after 3 days at 20° C. A satisfactory specimen (100 mg.) lost 0, 10, 2·8, 4·5, 135·3, and 0 mg./100 cm.^{2}, respectively.—S. G.

Thermal Insulation with Aluminium Foil. Ralph B. Mason (*Indust. and Eng. Chem.*, 1933, **25**, 245–255).—One method of using aluminium foil for insulation is to provide a framework which supports the foil and forms a series of air-cells between the foil surfaces; the other is first to crumple the foil and then partly stretch it so that the resulting wrinkles separate the sheets when laid against each other and provide the necessary air cells. The results of an extensive investigation of the efficiency of different types of insulation are described. Distances of ¼ in. between foils of the plain air-cell type gave the highest resistance to heat-flow. Insulations with corrugated separators were slightly inferior to the plain air-cell type. Crumpled foil insulations were slightly inferior to the corrugated structures. By using the minimum amount of separator material of high thermal resistance the foil insulation of the air-cell type can be made to approximate the thermal resistance of quiet air, *i.e.* to eliminate practically all the heat ordinarily transmitted by radiation. The secret lies in the low thermal emissivity of the bright aluminium surface.—F. J.

Paints Wet Surfaces. Anon. (*Eng. and Min. J.*, 1933, **134**, 125).—A note on the aluminium paint known as Triple-A No. 44 Aluminium Vehicle, consisting of aluminium powder in a black vehicle made from coal tar. The naphtha vehicle displaces any water on the metal surface and penetrates rust, giving a good protective coating.—R. Gr.

Heat-Resisting Coatings on Metallic Surfaces. Anon. (*Maschinenkonstrukteur*, 1933, **66**, (9/10), 72).—Aluminium powder affords efficient protection to metallic surfaces when applied in suspension in a suitable vehicle; the choice of the latter is limited by service conditions, shellac, copal, and nitrocellulose proving unsatisfactory. Certain synthetic products, *e.g.* the condensation product of glycerin and phthalic acid, afford a sufficiently resistant medium. On heating, the organic portion is eliminated without blackening or gumming, leaving an evenly-distributed coating of metallic powder. Although aluminium powder finds the widest application, other metals can be used in the same way.—P. M. C. R.

Aluminium Primer. [I.—] Durability of Paint on Longleaf and Shortleaf Pine. F. L. Browne; **[II.—] Why Mill Prime?** R. I. Wray; **[III.—] Mill Priming and Trade Promotion.** J. F. Carter (*Southern Lumberman*, 1933, Feb. 1, and (abstract) *Aluminium Broadcast*, 1933, 4, (7), 25–28).—References are made to the use and advantages of aluminium paint as a priming coat.
—J. C. C.

1932 Aluminium Output Off from 1931 Level. Anon. (*Daily Metal Reporter*, 1933, 33, (47), 1, 6).—The 1932 production of new aluminium in the U.S.A. amounted to 104,885,000 lb., as against 177,544,000 lb. in 1931. Certain branches of the industry, however, show an increase, notably in constructional work and in aircraft.—P. M. C. R.

Welded Alloy Bucket Lips Cut Trenching Costs [Stelliting]. George Sykes (*Eng. News Record*, 1933, **110**, 215).—In a ladder-type trench excavator, digging teeth hard-surfaced with a cobalt–chromium–tungsten alloy (Stellite) were capable of further work after digging 28,000 ft. of trench. Steel teeth needed replacing after digging 2000 ft.—J. C. C.

Report of Committee B-5 [of A.S.T.M.] on Copper and Copper Alloys, Cast and Wrought. C. H. Mathewson and D. K. Crampton (*Amer. Soc. Test. Mat. Preprint*, 1933, 1–6).—Numerous modifications in certain existing standards—especially for composition brass or ounce metal sand-castings, and for yellow brass sand-castings—are given. In general, they indicate a tightening up of the specification limits. Certain other alterations in tentative standards for copper tubing, condenser tubes in general, copper bars and plates for locomotive fireboxes, and brass piping are recommended.—W. N.

What to Look For in Selecting [Telephone] Cords. J. D. Williams (*Telephone Eng.*, 1933, **37**, (2), 13, 22).—Solid copper wires were the first type used for telephone cords, but they rapidly became brittle. The fine tinsel type followed, but the resistance increased rapidly with wear and the life was short. Thin copper ribbon was next tried, but crystallization caused brittleness and increased resistance. Steel-cored cords were found to be somewhat too inflexible. Finally, a bronze alloy of which the resistance remained constant despite repeated flexure was developed. Two layers of 0·001 in. thick ribbon are spiralled over a cotton thread, and six of the resulting strands are formed into a rope; the outer insulation is then added.—H. F. G.

The Manufacture of Cocks and Taps—The Use of Cupriferous Metals in this Industry. A. Chaplet (*Cuivre et Laiton*, 1933, **6**, 57–68, 111–118).—An exceedingly clear and fully illustrated description of the main types of taps and valves used for domestic and industrial purposes. The article is divided into 3 sections dealing respectively with: (1) barrel taps and those of the ordinary domestic variety; (2) plug valves, and (3) sluice valves. Single and multiple way taps are included in the three classes. Details of construction are given in the majority of the examples quoted.—W. A. C. N.

El Paso Replaces Rustable Service Pipes with Copper. Anon. (*Daily Metal Reporter*, 1933, **33**, (29), 3).—The low price of copper has enabled the Waterworks Department of El Paso, Texas, U.S.A., to replace worn iron service pipes by copper piping. So far about one third have been thus replaced. It is stated that the iron pipes last from 2 to 15 years, according to the type of soil, but that in the Department's opinion the copper piping should need no replacements for about 100 years.—P. M. C. R.

Merimet Copper-Fabric Material Developed for Automobile Roofs. Anon. (*Automotive Ind.*, 1933, **38**, 192).—Merimet, a new material for automobile roofing, consists of thin copper sheet, a special adhesive of great flexibility being used to attach it to strong waterproofed cotton fabric. Decorative finishes are easily applied, and the material is said to have high wearing qualities and to be free from warping with variations of temperature.—P. R.

Use of Lead and Copper Service Pipes. Anon. (*Public Works*, 1931, **62**, (10), 20; *Public Health Eng. Abs.*, 1932, **12**, W, 1).—Gives a summary of the replies received to questions: "How many lead services have you in use?" "How many copper?", which were included in a questionnaire sent to water works engineers. Of the 663 cities which replied, 310 use lead and 251 use copper service pipes. Of those using copper, all but 64 have lead service pipes in use also.—S. G.

Absorption of Lead by Tooth-Pastes from Tinned-Lead Tubes. V. Frobœse (*Z. Unters. Lebensm.*, 1933, **65**, 176–181; *Brit. Chem. Abs.*, 1933, [B], 334).—The quantities found in the paste ranged from 0·5 to 37 mg. of tin per 100 grm. and 0–1·8 of lead at the time of purchase, and increased to 139 and 3·1, respectively, after up to 12 weeks' storage. Storage for periods up to 4 years produced increases (up to 357 and 2·8, respectively), decreases, and no change in the tin and lead contents, and the amounts found appear to bear no definite relation to the reaction or A of the paste. A suitable lead content for the tubes is $\not>$ 1%, and the tin coating usually corresponds to 0·12 grm. per 100 cm.^{2}.—S. G.

General Electric Receives Large Mercury Shipment for Generating Power. Anon. (*Blast Fur. and Steel Plant*, 1933, **21**, 27).—A note. 540,000 lb. of mercury will be used in the new 20,000-kw. mercury turbine at the Kearney power station, New Jersey. The total order represented 89% of the mercury consumed in the U.S.A. in an average year.—R. Gr.

Nickel–Chromium Alloy [Cronite] Furnace Bars. Anon. (*Nickel Bull.*, 1933, **6**, 1).—Furnace bars made of modified Cronite, after being subjected to a year's more or less continuous exposure to washed producer gas containing sulphur at a working temperature of 1000° C., were almost indistinguishable from new.—J. H. W.

Heat-Resisting Metals in the Pottery Industry. J. Ferdinand Kayser (*Pottery Gaz.*, 1932, **57**, 1493–1494; *Ceram. Abs.*, 1933, **12**, 69).—To meet the variable needs in the pottery industry a number of different heat-resisting alloys have been developed, each having its own special characteristics. The most essential characteristic was surface stability at high temperatures, which was comparatively easy to attain. Various uses of heat-resisting alloys in the vitreous enamelling industry, the pottery industry, the glass industry, and in metal recuperators are listed.—S. G.

The New "Zinkan" Sheet in Automobile, Motor, and Aero Construction. J. F. Kesper (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1933, **9**, 129–131).—Zinc sheet containing a small admixture of aluminium is rolled together with aluminium sheet, and subsequently aluminium-plated. The product is said to resist corrosion by water, dry and moist air, carbon dioxide, hydrogen sulphide, smoke, soot, and many organic acids. It is further claimed that Zinkan retains its bright appearance for a long time. Mechanical properties are given for 3 qualities of the material; an elongation of 40–65% is claimed for the "normal" or softest quality. The material can therefore be easily drawn and shaped. Heat-treatment at 150°–300° C. causes migration of aluminium into the zinc, with marked hardening and strengthening effects. Zinkan is very light, and may be expected to replace copper, aluminium, nickel, and brass sheet for many purposes. Many possible applications are suggested.—P. M. C. R.

Zinc-Base Alloy Die-Castings Find Steadily Widening Field of Automotive Application. Joseph Geschelin (*Automotive Ind.*, 1933, **69**, 72–75).—The adoption of die-castings in automobile construction has led to economy, due to lessening or elimination of finishing and machining, the replacement of expensive fabrication by inexpensive dies, the possibility of producing intricate forms, and to the possibility of obtaining simple design, uniform structure, and thin sections. Some uses of zinc-base die-castings are tabulated, as are the effects of normal ageing on certain important physical properties of Zamak alloys. The impact strength, tensile strength, and elongation of these alloys are compared in a table with those of sand-cast malleable iron, sand-cast brass, and die-cast aluminium alloys (type not stated). Lines of further investigation are indicated.—P. M. C. R.

Zinc–Nickel Accumulator. Anon. (*Automobiltech. Z.*, 1933, **35**, 519).—The accumulator described has an e.m.f. of 1·9 v., as against the 1·3 v.

developed by the nickel-iron cell. The negative plates consist of a specially-treated grid of nickel or Monel metal, while the positive plates have nickel oxide and silver oxide as active materials.—P. M. C. R.

Zinc in Dry Batteries. R. Gould (*Met. Ind.* (*Lond.*), 1933, **43**, 104).—A short letter commenting on an abstract (*ibid.*, 1933, **42**, 659) of an article in *Z. Metallkunde*, 1931, **23**, 301. See this *J.*, 1932, **50**, 435.—J. H. W.

Non-Ferrous Metals in the Limelight. Anon. (*Iron Age*, 1933, **131**, 45–46).—The properties and applications of new alloys and new methods of heat-treating non-ferrous metals adopted during the past year are briefly described.
—J. H. W.

Sintering. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 2–3).—The characteristic features of sintered metals are discussed. Although the process has disadvantages, its development may in the future enable the metallurgist to meet demands difficult to satisfy by melted products.—R. G.

Contact Metals and Contact Care. P. Mabb (*Met. Ind.* (*Lond.*), 1933, **43**, 3–5).—For the high qualities required of contact metals, only rare metal alloys and tungsten alloys have been successfully used. Platinum is hardened and its corrosion-resistance is increased by the addition of iridium or, where economy is required, palladium. The composition, specific properties and applications of the principal contact alloys of platinum, iridium, palladium, copper, silver, gold, tungsten, and nickel and cobalt are given.—J. H. W.

Metallic Contamination of Beverages. Anon. (*Bottler and Packer*, 1933, **7**, (3), 30–32).—Where cost permits, it is thought that stainless steel should be used for syrup and carbonating equipment. Tinned copper and gun-metal are the most popular materials in use, and give satisfactory service until the tin is worn or corroded away. Electrolytic tinning is unsatisfactory. Nickel is useful for making filter gauzes which may be subject to the action of hot tartaric acid. Good quality glass enamel is considered satisfactory, but requires care in use. Earthenware often contains pits which are difficult to clean. Care must be exercised in the use of cleansers for metal equipment; chlorine solutions, for example, being very corrosive to most metals. Bisulphite of soda cannot be used to clean and sterilize metal vessels, "as, being a fairly strong acid, it attacks practically all metal, particularly copper and its alloys."—H. W. G. H.

Effect of Metal in Mixing Bread Doughs. E. N. Frank (*Cereal Chem.*, 1932, **9**, 636–637; *Brit. Chem. Abs.*, **1933**, [B], 168).—Doughs prepared in a bronze mechanical mixer gave loaf volumes up to 40 c.c. lower than those obtained by hand-mixing, the actual decrease increasing with the period of contact between metal and dough.—S. G.

Suitability of Metals, Alloys, &c., for Varnish-Kettle Manufacture. J. Sommer (*Farben-Zeit.*, 1933, **38**, 420–427; *Brit. Chem. Abs.*, **1933**, [B], 198).—The properties of a range of materials are tabulated under the headings: price, durability, influence on colour of varnish, ease of cleaning, heat-transference. Separate data relating to suitability for kettle bottoms and bodies are collectively evaluated; it is shown that a Monel metal body and tin-plated steel bottom is the best combination, whilst a copper body and aluminium bottom is the worst.—S. G.

What the School of Experience Has Taught a Dye Plant Operator About Construction Materials. Anon. (*Chem. and Met. Eng.*, 1933, **40**, 62).—Numerous corrosion problems are encountered in dye plants and the equipment is subject to a range of conditions so wide that almost every known material of construction finds application. The more outstanding applications are reviewed. "Aluminium-bronzes" and manganese-brasses are next to cast iron in general utility value. The former give excellent service in both sulphuric and hydrochloric acid processes. An instance is given of experimentation leading to the adoption of an alloy consisting of copper 88, aluminium 10, iron 2%, which saved $3800 per annum in the department in which cast iron had formerly been used. Copper–nickel, nickel–chromium, and nickel–molybdenum alloys have special merits but their high cost precludes their general application.—F. J.

Service Pipes of Various Materials. R. W. Reynolds (*J. Amer. Water Works Assoc.*, 1931, 23, 658–663; discussion, 663–672).—Measurements were made at four or more velocities, of the friction losses in pipes of cement-lined and unlined galvanized pipes, copper tubing, and unlined iron pipes for bores varying from ¾ to 2 in. Test lengths of 19 ft. were used. Taking into account that the copper tubing was usually under nominal bore and the iron pipe oversize, copper tubing is considered to show lowest friction losses. Losses increase considerably in iron pipes after service. In the discussion, it is emphasized that character of water and soil must influence the choice of pipe material for any given locality.—J. C. C.

Service Pipe Material and Practice in the United States and Canada. James E. Gibson (*J. Amer. Water Works Assoc.*, 1931, 23, 1435–1454; *discussion*, 1454–1460).—A questionnaire concerning service pipe material and practice, drafted by Subcommittee 7–F of the Water Works Practice Committee was answered by 255 out of 463 water departments in the United States and Canada. For service pipe material, 49% reported good experience with copper tubing, 40% with lead, 25% with galvanized wrought iron, and 15% with galvanized steel. In the case of copper tubing no users reported unsatisfactory results, lead pipe was found fair by 5% and poor by 3%, and galvanized steel was found fair by 11% and poor by 7%. Troubles from tuberculation and incrustation were overcome by substituting lead or copper pipe (presumably for iron) in 44% of the cases. Only one reply reported known lead poisoning and 93% answered positively that no lead poisoning was encountered. As the ideal material for service pipes, 49% favoured copper, 23% lead, and 13% galvanized iron.—J. C. C.

Use of Non-Ferrous Service Pipes at Present Prices. George W. Pracy. J. E. Gibson. S. B. Morris. H. F. Blomquist. T. H. Wiggin. —— Hibbs (*J. Amer. Water Works Assoc.*, 1932, 24, 1819–1828; *corrigenda*, 1933, 25, 444).—A report of a Superintendents' Round Table Discussion at the Memphis Convention, 1932. In San Francisco, copper service tubes are used in heavy soils, which are most corrosive. Galvanized steel is used in lighter soils which permit the pipe to be driven through. It is emphasized that no one material can be universally adopted. Electrolytic action between iron and copper tubing, imperfect annealing of copper tubes, and corrosion embrittlement of brass, are briefly discussed.—J. C. C.

Dissertation on Non-Ferrous Metals Used for Power Plant Piping. Henry C. Moffett (*Power Plant Eng.*, 1933, 37, 208–210).—The properties and special applications of tubing made of copper, lead, tin, zinc, aluminium, nickel, various brasses and bronzes, copper–nickel alloys and "packing" alloys are enumerated.—P. M. C. R.

Sludge Pumps. G. Sire (*Science et Industrie*, 1933, 17, 227–230).—The materials, construction, and maintenance of centrifugal pumps intended for the handling of sludges and pastes are reviewed. Appropriate modifications are described for special service conditions, *e.g.* the pumping of highly acid or markedly abrasive materials.—P. M. C. R.

The Present Position of Airship-Construction, Especially of Framework Construction. Hans Ebner (*Z. Flug. u. Motor.*, 1933, 24, 331–341).—A fully illustrated survey of the framework of recently constructed airships is followed by a discussion of constructional elements. Materials are reviewed, and the mechanical properties of some Duralumins used in recent assemblies are tabulated, and compared with those of "DM31," a new alloy of the Duralumin class with exceptional resistance to corrosion. The questions of loading and of the relative weights of various portions are considered in the concluding sections.—P. M. C. R.

All-Metal Planes. R. E. Johnson (*Metal Progress*, 1933, 24, (1), 41–43).—Aluminium sheet, bronze, Duralumin, and cadmium-plated alloy steel are used in the production of a standard all-metal plane. All main parts are interchangeable with the corresponding portions of another plane; bolted joints are adopted where interchangeable units are used. Sheet-metal work becomes of the first importance. Increased cheapness and extreme rapidity of output and in repair are claimed.—P. M. C. R.

The Metallurgists' Contribution to Automotive Development. P. M. Heldt (*Automotive Ind.*, 1933, 69, 64–68).—A review of developments in ferrous materials is followed by sections which review the manufacture and properties of zinc die-casting alloys, light alloy pistons, and aluminium and magnesium body-work and casings.—P. M. C. R.

Process Industries as Purveyors to the Motor Car. T. A. Boyd (*Chem. and Met. Eng.*, 1933, 40, 15–17).—The U.S. motor-car industry has been the largest consumer of nickel, and of lead. It has also been a very large user of aluminium, copper, tin, and zinc. The basic chemical and metallurgical products used in the industry are tabulated, but the list, although large, is not complete. The quantities of metals and other materials used in making, repairing, and operating motor-cars during the years 1927 to 1931 inclusive and the percentages of the total production of each, which the motor-car industry has absorbed, are also tabulated. The demand for cheaper light metals and better rustproofing methods is stressed.—F. J.

Recent Developments in the Design of Tank Wagons. Roderick Hedley (*Locomotive*, 1933, 39, 45–46).—Recent types of container are described, with details as to dimensions, capacity, tare weight, and paying load. For such liquids as formaldehyde, aluminium containers must be used: the sheet, of chemical purity not less than 99·5%, being rolled to $\frac{7}{16}$ in. thick, pickled and subsequently welded. Corrosion due to contact with iron parts is eliminated by protective paint and by the insertion of webbing.—P. M. C. R.

XXII.—MISCELLANEOUS

(Continued from pp. 533–538.)

British N.F. Metals Research Association. Researches in Hand. —— (*Met. Ind.* (*Lond.*), 1933, 43, 9–11).—Details of individual researches in progress, taken from the Annual Report of the British Non-Ferrous Metals Research Association.—J. H. W.

Engineering Research at Michigan. A. E. White (*Metal Progress*, 1933, 23, (3), 33–36).—The development and present activities of the Department of Engineering Research of the University of Michigan are described and illustrated.—P. M. C. R.

Recent Progress in the Technique of Copper Production. M. Altmayer (*Cuivre et Laiton*, 1933, 5, 227–230, 255–258).—A summary of modern practice exemplified by references to plants in different countries of the world. The introduction of flotation methods has caused the development of more efficient and more economical reverberatory smelting. The fine material is charged into the reverberatory while still containing up to 15% of moisture. Full details of the process employed at Anaconda are given. Finely-pulverized coal is now used for firing purposes, and the results obtained are compared with those previously recorded for coal, gas, and oil. A description is next given of the basic converter practice at Messina.—W. A. C. N.

Field for Non-Ferrous Metals is Broadened by Research. Anon. (*Machinery* (*N.Y.*), 1933, 39, 388–390).—A review of some recently developed alloys.—J. C.

New Inventions [in the Non-Ferrous Metal Industry]. E. S. Gurevich and S. S. Gurevich (*Zvetnye Metally* (*The Non-Ferrous Metals*), 1932, 99–100; *C. Abs.*, 1933, 27, 3688).—[In Russian.] Lists some abstracts of pending patents of Russian inventions.—S. G.

Electric Power Consumption in the [U.S.S.R.] Metal Industry. N. P. Aseev (*Zvetnye Metally* (*The Non-Ferrous Metals*), 1932, 377–386; *C. Abs.*, 1933, 27, 3902).—[In Russian.] In connection with the second 5-year plan a study was made of the requirements in electrical energy for the production of non-ferrous metals. Interesting figures are given for the consumption of electrical energy for several common metals, in terms of kw.-hrs. per ton of metal produced, and also total energy consumption for the entire world output of the common metals in 1929.—S. G.

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XXIV.—BOOK REVIEWS

(Continued from pp. 540–544.)

An Engineer's Outlook. By Sir Alfred Ewing. Cr. 8vo. Pp. xxiv + 333, with portrait and 5 illustrations. 1933. London: Methuen & Co., Ltd. (8*s.* 6*d.*)

This is a book that positively cannot be reviewed at a glance: it is too fascinating. It has held my interest from its first to its last page; it is one of the few books of general interest that have come my way which have been well worth writing and well worth reading.

Sir Alfred Ewing in an autobiographical preface states that his friend E. V. Lucas, when undertaking to publish the volume, remarked: "It will be your monument." One can desire no better. The contents of the book consist principally of addresses delivered by Sir Alfred on a variety of occasions. What a privilege and pleasure it must have been to have been present on the occasions of their delivery! The next best thing is to have the addresses easily available, and here they are. I recommend them whole-heartedly to the attention of metallurgists, engineers, physicists, and the intelligent public generally, not excluding politicians, who, too frequently, appear to be completely ignorant of the contribution of scientific workers to the advance of civilization. Here they will find set out a short review of the long pageant of discovery and invention, an account of the work of Lord Kelvin in telegraphy and navigation, the work of Parsons in the invention and development of the steam turbine. Here, too, will be found reminiscences of Lord Balfour, of Fleeming Jenkin, and, last but not least, of Robert Louis Stevenson. The whole is written in a beautiful style which is not generally anticipated from a scientific author. Our author, however, has "something the others haven't got"—he was a friend of the Stevensons, and that, I think, will explain the fascination which I have found in the book. It is crammed with epigrams. Let this one suffice by way of example: "All the visual signals that have been used from the day when Eve first smiled to Adam are examples of magnetic wave telegraphy, though I cannot claim them as fruits of magnetic research." There is an amusing reminiscence of the author and Sir Frederick Bramwell travelling in a "growler," the bottom of which fell out, depositing the two distinguished engineers in the road! I have said enough, I hope, to whet your appetites for more.

I would like, in conclusion, to refer to Sir Alfred's opinion, which runs as a *leit-motif* through the book, that the gifts of the engineer to mankind are good gifts only if they are used with wisdom. How often is this forgotten? The work is certain to have a wide circulation; it deserves to be a best-seller.—J. S. G. Thomas.

Der Einfluss der Korrosion auf die Drehschwingungsfestigkeit von Stählen und Nichteisenmetallen. Von Theodor Dusold (Mitteilungen des Wöhler-Instituts, Braunschweig, Heft 14). Demy 8vo. Pp. iv + 89, with 36 illustrations. 1933. Berlin: N.E.M. Verlag G.m.b.H.

Dr. Dusold's little book contains an instructive account of experiments recently carried out at the Wöhler-Institut at Braunschweig on the resistance towards alternating torsion of ten materials, including nickel, aluminium, Pantol, and various steels. The alternating-stress strength was tested both in air and in Braunschweig water. With one exception ("Nitrierstahl") the strength was lower under the wet conditions, but a process of surface pressure is described which was found to increase the strength shown under wet conditions to a figure similar to that obtained from air-tested specimens not subjected to the surface treatment; the beneficial effect of the pressure is attributed to the removal of surface defects which constitute the starting places of corrosion. The strength of the materials when tested in air was, with one exception, considerably increased by the same type of treatment. The detrimental effect of corrosion could also be overcome to some extent by electrochemical protection, using a zinc anode and current from an external source; the protection (which the author seems to regard as due to a film of metallic zinc) takes time to develop. Sulphur derived from rubber connections used in the water-jacketing was found to accelerate the attack. The latter part of the book is devoted to mechanical matters, such as the damping of oscillations.

The experiments are described in an interesting manner, and the tables of results deserve careful study from all engaged in research on corrosion-fatigue. The description is illustrated by numerous photographs showing the various types of fracture, the nature of typical corroded surfaces, and the curious four-rayed rust-stars noted by McAdam in one of his earlier papers; this paper by McAdam is the only representative of non-German work in the list of 13 references given at the end of the book.—U. R. Evans.

Gmelins Handbuch der anorganischen Chemie. Herausgegeben von der Deutschen Chemischen Gesellschaft. Achte völlig neu bearbeitete Auflage. System-Nummer 35. **Aluminium.** Teil B.—Lieferung 1. Sup. Roy. 8vo. Pp. 308, with 10 illustrations. 1933. Berlin: Verlag Chemie G.m.b.H. (R.M. 48; subscription price R.M. 42.)

The present section of Gmelins' *Handbuch* deals with the preparation, properties, and general relationships of the compounds of aluminium. The treatment follows the lines adopted, with such happy results, in the volumes which have already appeared. Among the features which call for special notice we may direct attention to the following. The various commercial methods for the production of pure alumina from natural material are fully described and discussed. Under the heading of aluminium chloride, a large number of compounds of this substance with organic compounds is included. The commercial preparation of aluminium sulphate is fully described. An unusual, but none the less welcome, fact is the inclusion of a number of aluminium salts of organic acids.

The section is in every respect an excellent one, the work of compilation has been carried out with care and discretion, the book is not over-weighted in any particular part, and it contains much valuable and useful material of the kind which ought to be included in works like this, but which is not generally included. The book is thoroughly up to date and accurate. It is a volume which must find a place in every chemical library.—JAMES F. SPENCER.

Iron and Steel (A Pocket Encyclopædia), Including Allied Industries and Sciences. By Hugh P. Tiemann. With an Introduction by Henry Marion Howe. Third edition. Pp. xviii + 590, with 67 illustrations. 1933. New York: McGraw-Hill Book Co., Inc. ($4.00); London: McGraw-Hill Publishing Co., Ltd. (24*s.* net).

This pocket encyclopædia of iron and steel, which includes allied industries and sciences, is now issued in its third edition. In the thirteen years which have elapsed since the appearance of the second edition there have been many improvements in processes, largely due to better equipment and technique and marked advances in metallurgical science. Advances which might be instanced are the developments in the manufacture and uses of stainless and heat-resisting steels, nitriding, advances in metallography, the application of the X-rays to metallurgy, and the protection of metals against corrosion. To keep in touch with these advances and with the various investigations and researches, which are increasing yearly, is a task which is becoming more difficult to all metallurgists and users of both ferrous and non-ferrous materials.

The present edition should, therefore, be of considerable value, for not only is it a metallurgical encyclopædia as formerly, but it has also been brought up to date by the addition of special articles dealing with the advances referred to.

The non-ferrous metallurgist will find particular interest in the articles on corrosion, where the various theories are discussed at considerable length; on crystallography, in which are discussed the various crystal systems, the space lattice theory, cleavage, twinning, and crystalline structure; on electric melting, to which 12 pages are given and which deals with various types of electric furnaces; on heat-treatment; on metallography; on the protection of metals, where reference is made to protection by metal coatings, spraying, and electroplating; on refractories (5 pages); on the various methods of testing (20 pages); on welding; and on the use of the X-rays in studying the crystal structure of metals.

The volume also contains interesting articles on heat, including pyrometry, and on the physical properties of metals, as well as various definitions and phrases which are of considerable interest to the non-ferrous as well as to the ferrous metallurgist.

The book is well cross-indexed, which is important in an encyclopædia which is to be of value, and it can be recommended as being extremely useful and up to date.

—J. W. DONALDSON.

The Metals, Their Alloys, Amalgams and Compounds. By A. Frederick Collins. Cr. 8vo. Pp. ix + 310, with 54 figures in the text. 1932. New York and London: D. Appleton and Co. (7*s.* 6*d.* net.)

This is intended to be a "popular handbook on the metals for the layman and student," according to the publisher's claim on the dust-cover: it is "written simply and lucidly, . . . gives the complete story of the World's metals, . . . is a great reference book in itself. . . . is of truly encyclopædic character, . . . entertaining to read, instructive to study and of great value to anyone engaged in metal work." A careful perusal of the book leads one to conclude that the only claim which is really substantiated is that relating to its entertainment value. It is certainly written in simple language, but many of the statements made are the reverse of lucid; as a work of reference for students and those engaged in metal work its value is practically nil, since the large number of erroneous and misleading statements it contains serve simply to confuse the reader. In many places the author seems to have allowed his imagination to run away with his discretion; this is especially true of the historical and ore metallurgy sections, which contain many absurd statements. The articles on the extraction of copper, lead, nickel, antimony, gold, silver, arsenic, and most of the rarer metals from their ores display an abysmal ignorance of the reactions involved and of modern methods of metallurgy. In the chapters on alloys and amalgams brief notes of the composition and uses of some of the more important alloys are given, but even these are not always correct, despite the numerous text-books on the subject which the author could have consulted to check his information. Thus aluminium bronze is said to have a beautiful golden colour, and "when powdered and mixed with oil makes a very fine silvery-white paint;" tungsten bronze is said to consist of 90 per cent. copper and 10 per cent. tungsten; gold amalgam is stated to be made by melting powdered gold and stirring in mercury with an iron rod; steel is defined as "iron that has various higher percentages of carbon in it than cast iron," and aluminium-silver alloy is stated to consist of 84·29 per cent. of aluminium, 10·20 per cent. of tin, 5·50 per cent. of copper, and 0·01 per cent. of phosphorus, the copper and tin being added "to give it enough weight so that it approximates that of silver." There is a chapter on the hypothetical metals; these are divided into three classes, *viz.* true hypothetical metals, pseudo-hypothetical metals, and mythical hypothetical metals.

There are numerous errors in the formulæ given throughout the book and many names of minerals, &c., are incorrectly spelt. Some of the numerical data are entirely wrong, especially in the section on cobalt; thus skutterudite is formulated as $CoAs_3$ and its cobalt content is given as 88·2 per cent., the density of cobalt is given as 85·89 and its atomic weight as 38·94. The illustrations are on the whole very crude, and in some cases ludicrous; thus, that representing the discovery of copper shows two Ancient Britons apparently sharing their lunch (!), and that of a pyrophoric gas lighter shows sparks arising from friction between hard steel and pyrophoric acid (*sic*).

To sum up, this book is of little technical value, but its perusal has afforded us several hours of quiet amusement.—A. R. POWELL.

Enquiry into the Manufacture of Gold-Filled Spectacles. 4to. Pp. 31, with 26 illustrations. 1932. London: The Joint Council of Qualified Opticians, Clifford's Inn Hall, Fleet St., E.C.4.

This report is the result of attempts made by the J.C.Q.O. to standardize qualities of rolled gold spectacle frames for the purposes of supplying contributors under the Insurance Acts with uniform grades of spectacles at minimum cost. The enquiry on which the report is based led to the disclosure that the quality, grade and description of rolled-gold frames differed markedly according to the manufacturer, and the J.C.Q.O. therefore has put forward a series of suggestions for standard qualities and for testing the quality of the finished frames. The report contains a brief account of the manufacture of rolled gold wire and of the methods used in making this up into the various parts of spectacle frames; hints on soldering are also given. Much emphasis is laid on the necessity for assuring an adequate gold covering on all parts of the frames especially at joints and cut edges; numerous excellent photomicrographs illustrate the many points that arise in this connection.

The J.C.Q.O. are to be congratulated on producing a report which is excellent in all respects and should, if its recommendations are put into practice, result in the production of standardized frames and thus safeguard the public from being supplied with an article which sooner or later is bound to develop serious faults.—A. R. POWELL.

Kristallchemie der anorganischen Verbindungen. Von M. C. Neuburger. (Sammlung chemischer und chemisch-technischer Vorträge. Herausgegeben von H. Grossmann. Neue Folge, Heft 17.) Roy 8vo. Pp. 115, with 21 figure sand 15 tables. 1933. Stuttgart: Ferdinand Enke. (R.M. 9.70.)

The application of X-ray methods to the study of matter in the solid state has resulted in a large extension of our knowledge of the fine structure of matter, and the numerical data obtained have provided material for the foundations of a new branch of physical chemistry concerned with matter in the crystalline state. Recent researches have shown that the crystalline state is more widespread than was commonly supposed, and, in fact, is the rule rather than the exception, among solids. Even vegetable and animal fibres, such as cotton and wool, display crystalline properties. Professor Neuburger's book is confined to a description of the advances which have been made in the crystal chemistry of inorganic compounds, and readers of this *Journal* will no doubt share his regret that the space at his disposal has made it impossible for him to discuss the large body of material now available concerning metals and alloys.

Although the structure of intermetallic phases is not dealt with in the book, the subject-matter is of such importance that it will, in spite of this omission, be of interest to all physical metallurgists. The "valency laws" formulated by chemists, which have long been known to have no validity in the study of intermetallic phases, find no place in crystal chemistry.

The new science is founded on the work of V. M. Goldschmidt and his collaborators on the relationships between atomic (or ionic) diameters and crystal structure. The first half of the book consists of sections dealing with this aspect of the subject, together with the effect of the ratio of the diameters and electrical charges of the atoms of which crystals are built. A discussion of the influence of the number and type of neighbouring atoms on the atomic radii includes a brief reference to solid solutions of metals. The remainder of the book includes sections on isomorphy, polymorphy, and morphotropy, hardness of crystals, and finally brief reference to the structure of silicates.

The book concludes with a bibliography divided into two parts; the first being a list of original papers for further study of the subject; the second a list of literature referred to in the text.—G. D. Preston.

Atlas Metallographicus. Von [H.] Hanemann und [A.] Schrader. Lieferung 10: Tafel 73–80; Lieferung 11: Tafel 81–88. 1932. Berlin: Gebrüder Borntraeger, Schöneberger Ufer 12a. (Lieferung 10: R.M. 15; subscription price R.M. 7.50; Lieferung 11: R.M. 13.50; subscription price, R.M. 6.75.)

Continuing the "Atlas" (cf. this *J.*, 1927, **38**, 712; 1929, **42**, 730, and 1930, **44**, 762), the subject matter of Part 10 deals with the separation of fine constituents in unworked α-iron, the structure of rolled iron and steel, the effect of the rate of cooling on the formation of pearlite, pearlite in hypereutectic, eutectic, and hypoeutectic steel, and veining in ferrite. In the introduction to Part II are discussed the formation of iron nitride (Fe_4N), slip phenomena in ferrite, the structural appearance of ferrite after striking, cold-rolled ingot iron, and the alteration in structure caused therein by tests to destruction. As before, the subject-matter is profusely illustrated by the excellent photomicrographs which comprise the actual "Atlas."

—J. H. Watson.

Applied X-Rays. By George L. Clark. Second Edition. Med. 8vo. Pp. xiv + 470, with 239 illustrations. 1932. New York: McGraw-Hill Book Co., Inc. ($5.00); London: McGraw-Hill Publishing Co., Ltd. (30*s.* net).

The first edition of this work appeared in 1927, and was reviewed in this *J.*, 1927, **37**, 770. Our statement in that review, that "we know of no better work than the present to recommend to metallurgists anxious to know something of the development and technique of X-ray analysis," is abundantly justified by the early appearance of this second edition, and applies with added force thereto. Developments which have occurred in the technical application of X-rays since 1926 have converted the task of revision of the original edition into one of a completely new creation. The growth of the subject during the intervening years is well illustrated by a comparison of the two editions, the first with its 255 pages and 99 illustrations, published at 20*s.*, and the second with almost twice as many pages and more than twice as many illustrations, published at 30*s.* Let it be said, right away, that the increase of price is justified. It is interesting to contrast the author's enthusiasm for the application of X-rays to industrial problems, contained in the first edition—"before long an X-ray apparatus will be an essential part of the research and testing equipment of progressive manufacturers"—with the achievement suggested by, "and yet all would agree that only the barest beginning has been made" of this edition. It can very definitely be asserted that X-rays have not hitherto been applied in technology to anything like the extent they might be. Part I of the present edition is devoted to the discussion of the general physics and applications of X-radiation; Part II, devoted to the X-ray analysis of the ultimate structures of materials, contains much of interest to metallurgists. Here are discussed, amongst other subjects, such matters as the structures of alloys, the interpretation of diffraction patterns in terms of grain size, orientation, internal strain, and mechanical deformation, and applications in metallurgical practice. Here surely is much to interest the practical metallurgist. The book as a whole should make a very ready appeal to metallurgists, physicists, chemists, and medical practitioners. It is well printed on good paper and is well illustrated; an adequate index is provided, and the book is sturdily bound.—J. S. G. Thomas.

Der Verchromungsbetrieb. Bewährte Badzusammensetzungen und Arbeitswesen bei der Verchromung. Von K. Altmannsberger. 5¾ × 8¼ in. Pp. 39. 1932. Coburg: Muller und Schmidt. (Geh., R.M. 1.50.)

The principal contents of this volume consist of detailed methods of analysis for the estimation of the more important constituents of chromium, nickel, and copper (acid and cyanide) plating solutions. The methods are well selected, with due attention to the order of accuracy required in each case, and should be easily carried out with a minimum of equipment and training. The application of the analytical results to the rectification of the plating solutions is then described. The composition and operating conditions of eight different nickel depositing solutions are given, special attention being devoted to plating on aluminium and zinc. Sodium citrate is a constituent of each solution to increase the throwing power and to decrease the hydrogen absorbed by the deposit. Although it must be admitted that the addition of this salt has many advantages, it should be pointed out that the presence of organic salts is undesirable, since the anodic oxidation or cathodic reduction of such substances, facilitated by the presence of freshly precipitated nickel, may lead to the formation of deleterious organic compounds in the bath and consequent pitting or embrittlement of the deposit.

Recommended compositions and operating conditions for acid and cyanide copper plating solutions and for a brass depositing solution are given, also for a combined degreasing and coppering bath. A short section describes methods for the removal of defective nickel or chromium deposits.

The book is well produced and can be recommended; selected references to the original literature would be an improvement.—S. WERNICK.

Traité de Galvanoplastie. Par Alfred Soulier. 8e. édition, revue et augmentée d'une annexe sur le Chromage. Cr. 8vo. Pp. viii + 203, with 32 illustrations. [1932.] Paris: Garnier frères, 6 rue des Saints-Pères. (9 francs.)

The expressed object of this volume (which is a revised edition of a previous work) is to provide amateurs and artisans with precise instructions in the electrodeposition of metals. The scope of the book is wider than the title might suggest, since practical information on both electrotyping and decorative electroplating of metals is included. Considerable space is devoted to a description of sources of current, chiefly primary cells, and there is a short section on electro-refining of copper.

No attempt is made to explain the mechanism of the processes described, and many processes are made to appear more simple than, unfortunately, they are in reality. Almost all the information is much out of date, and even the section on chromium plating, newly added in this edition, is not in accordance with modern practice. The chapter on nickel plating fails to mention three of the essentials of modern nickel deposition, *viz.* warm solutions, accurate control of acidity by determination and adjustment of the p_H value of the solution, and the presence of chloride in the electrolyte to facilitate anode corrosion. The recommended preparatory methods prior to electroplating would scarcely be adequate for the thickness of deposit now normally required.

The printing and illustrations are clear, but the paper and binding are poor: this, however, is excusable in view of the low price of the book.—S. WERNICK.

Handbuch der technischen Elektrochemie. Herausgegeben von Victor Engelhardt. Zweiter Band. 1 Teil. **Die technische Elektrolyse wässeriger Lösungen. B. Anwendungen in der Chemischen Industrie.** 1. Anorganischer Teil: **Elektrolyse des Wassers getrennte Darstellung von Chlor und Alkali.** Bearbeitet von J. Billiter, F. Fuchs, u. G. Pfleiderer. Med. 8vo. Pp. ix + 451, with 147 illustrations. 1933. Leipzig: Akademische Verlagsgesellschaft m.b.H. (Brosch., M. 42; geb., M. 44.)

Notices of the two volumes forming Part I of this "Handbuch" appeared in this *Journal*, 1931, **47**, 506, and this volume, p. 176. The present volume deals only with the electrolysis of water, and of aqueous solutions of alkali chlorides. Both sections have been prepared with the thoroughness which characterized the earlier volumes of this series, and deal in detail not only with the theoretical aspects of the problems, but also with the various types of cell and other plant involved in their technical application. This particular section of the work is entirely confined to problems in the chemical industry, the only section likely to be of interest to metallurgists being that dealing with the use of alkali amalgams in the electrolytic processes.

C. J. SMITHELLS.

Practical Cable Jointing. Second impression. Cr. 8vo. Pp. 215, with 332 illustrations. 1932. London: W. T. Henley's Telegraph Works Co., Ltd., Engineering Department, Holborn Viaduct, E.C.1. (5*s.* net.)

With the exception of a short introduction which lists the kit of tools considered necessary for a cable jointer and briefly but authoritatively lays down the precautions to be observed in handling lead-covered cables, this book consists of a collection of excellent photographs illustrating clearly every step in jointing impregnated paper-insulated power cables in a variety of circumstances. The operations which are illustrated include wiping a joint by the "stick" and "pot" methods, jointing copper conductors in different ways, trimming, fitting, and plumbing lead sleeves, and installing proprietary types of jointing, distribution, and terminal boxes. Within the limits of a detailed instruction manual, it achieves its purpose to perfection, and should prove invaluable to jointers, their apprentices, and cable engineers generally. Such competence, indeed, is shown in describing every detail of jointing practice that it is all the more disappointing that no attempt is made to discuss at all fully that most interesting metallurgical operation, the "wiping" of lead joints, to examine the causes of "porous wipes," to describe that mysterious "grittiness" that all plumbers seem able to find in some samples of solder, or to discuss the effects of impurities. The conventional attitude is taken that practice alone will teach the art; and its full analysis still remains unrecorded.—J. C. CHASTON.

Anleitung zum Gas-Schmelzschweissung. Unter Mitarbeit zahlreicher Fachleute, massgebender Körperschaften. Bearbeitet und herausgegeben vom Deutschen Auschuss für Technisches Schulwesen E.V. Demy 8vo. Zweite, verbesserte Auflage. Pp. 44, with numerous illustrations. 1932. Berlin: Deutscher Ausschuss für Technisches Schulwesen, Potsdamerstr. 119*b*. W.35. (R.M. 1.)

This little booklet consists of a series of instruction charts illustrating the apparatus and technique of oxy-acetylene welding. Exercises for practice are clearly demonstrated by excellent sketches. These are so self-explanatory that, with no knowledge of German at all, one could understand quite three-quarters of the book. Correct flame adjustment is explained and the technique of right-hand and left-hand welding, horizontally, vertically and overhead, is described. As a manual for the instruction of technical classes, this provides a very sound, well-arranged course. It may possibly be thought, however, that its methods tend to "spoon-feeding."—H. W. G. HIGNETT.

Annual Reports on the Progress of Applied Chemistry. Volume XVII, 1932. Demy 8vo. Pp. 721. 1932. London: Society of Chemical Industry (Members 7*s.* 6*d.*; non-members, 12*s.* 6*d.*).

The new volume of the annual reports of the Society of Chemical Industry deals, as in previous years, with the progress in a number of important branches of industrial chemistry during the year 1932. One or two minor changes in the titles of the sectional reports may be noted. The sectional report which has previously been entitled "Colouring Matters and Dyes" has become "Intermediates and Colouring Matters," in the present volume. The consideration of the progress in paper manufacture has been omitted from the report which previously dealt with "Fibres, Textiles, Cellulose, and Paper," and a new report has been added on "Paper and Pulp." Otherwise the sectional reports are as in previous years, except that the report on "Rubber" has now become one on "India-Rubber." The report on "Explosives" deals with the progress during 1931–1932. The volume contains, amongst others, very good reports on "Refractories, Ceramics, and Cements" (p. 15) by A. H. B. Cross and W. J. Rees; "Non-Ferrous Metals" (p. 23) by A. R. Powell, and "Electrochemical and Electrometallurgical Industries" (p. 12) by J. H. West.

The high standard of the reports is maintained, and a volume has been presented to the chemical world which will be exceedingly useful to all chemists, whether they are engaged in the industries or in purely academic chemistry.—JAMES F. SPENCER.

Jahresbericht 1932 der Stoff-Abteilung der D.V.L. Von Paul Brenner. (Sonderdruck aus dem Jahrbuch 1932 der Deutschen Versuchsanstalt für Luftfahrt, E.V.) Demy 4to. Pp. 22 + 72, illustrated. 1932. München und Berlin: R. Oldenbourg. (Geh., R.M. 5.50.)

Summaries of reports on completed investigations dealing with light metals, steel, non-metallic materials, surface protection against corrosion, failures, fuels, &c., are given in the first part of the volume. Several of these summaries deal with experiments on the influence of heat-treatment on corrosion properties of Duralumin, experiments on blistered Duralumin, stress-cracking in wrought light alloys, and spot-welds in Duralumin. Each of these items is of importance in relation to the use of light alloys in aircraft construction and of interest to users of light metals and alloys generally. Items placed under the heading "Surface-Protection" include tests of paints and varnishes, oxide films, and oxide films supplemented by organic protectives on light aluminium alloy sheets, and tests of paints on pickled Elektron sheets. The investigations of failure include work on broken crank-shafts, crank-cases, pistons, &c. The second and larger portion of the volume consists of reprints of papers on materials of construction, protection against corrosion, stress-corrosion cracks in light metals, &c.
—H. SUTTON.

The Advancement of Science: 1932. Addresses Delivered at the Annual Meeting of the British Association for the Advancement of Science (102nd Year), York, August 31–September 7, 1932. Demy 8vo. Pp. 256, illustrated. 1932. London: British Association, Burlington House, W.1. (3*s.* 6*d.*)

Whilst these 13 addresses are of outstanding interest from the point of view of the sciences with which they deal, there is little in any of them to appeal directly to the worker in metals, except possibly in Professor M. Walker's "Call to the Engineer and Scientist," in which the lecturer discusses in a very able manner the causes of the present world depression, and puts forward a series of suggestions for removing these causes and setting the world once more on the way to prosperity.—A. R. POWELL.

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

1933 NOVEMBER Part 11

I.—PROPERTIES OF METALS

(Continued from pp. 545–548.)

Beryllium. J. Laissus and P. Tyvaert (*Bull. Assoc. Tech. Fond.*, 1933, 7, 209–219).—A general discussion on the metal beryllium from the points of view of: historical development; occurrence in natural state; metallurgical extraction; principal properties; effect as an addition agent in foundry practice; and economical considerations.—W. A. C. N.

The Absolute [Magnetic] Saturation of Cubic Cobalt. Robert J. Allen and F. W. Constant (*Phys. Rev.*, 1933, [ii], 44, 228–233).—The method of Weiss and Forrer (this *J.*, 1930, 43, 439) for extracting an ellipsoid from the field of a powerful electromagnet has been used to determine the absolute saturation intensity of magnetization of cubic cobalt between 93° and 273° abs. The magnetization for infinite field (J_{ST}) was calculated by means of Weiss' formula, which agreed with the upper half of the experimental curve within 0·03%. A straight line was obtained by plotting the values of J_{ST} at different temperatures against the square of the absolute temperature; from this the saturation intensity at the absolute zero, J_{SO}, was determined as 1418. When the reduced saturation intensities (J_{ST}/J_{SO}) were plotted against $(T/\theta)^2$, where θ is the Curie point, a straight line was obtained which coincided with that for iron and nickel, but differed from the curves for hexagonal cobalt, and for the orthorhombic crystals magnetite, cementite, and Fe_2B, indicating that the crystal structure is an important factor. The cobalt used was 98% pure with nickel, iron, carbon, and aluminium as the chief impurities.—W. H.-R.

Thermal Expansion of Columbium [Niobium]. Peter Hidnert and H. S. Krider (*U.S. Bur. Stand. J. Research*, 1933, 11, 279–284; *Research Paper* No. 590).—The results are given of an investigation on the linear thermal expansion of a rod of niobium containing 0·93% tin and 0·26% iron. Data were obtained at various temperatures between − 135° and + 305° C. The following is given as the most probable second-degree equation for the expansion of this rod of niobium:

$$L_t = L_0[1 + (7\cdot06t + 0\cdot00144t^2)10^{-6}].$$

The coeff. of expansion increases regularly with temperature. From 0° to 100° C. the average coeff. of expansion is $7\cdot2 \times 10^{-6}$ per ° C. A table gives the coeff. of expansion for various temperature ranges.—S. G.

An Examination of Roman Copper from Wigtownshire and North Wales. G. Clement Whittick and J. A. Smythe (*Proc. Univ. Durham Phil. Soc.*, 1933, 9, 99–104).—Analysis of four circular cakes of copper found in North Wales and ascribed to the Romans gave the following results: (A) copper 98·90, arsenic 0·03, iron 0·11, nickel 0·02, insoluble 0·35, total 99·41%; (B) copper 99·08, iron 0·04, nickel 0·01, sulphur 0·04, insoluble 0·07, calcium carbonate 0·39, total 99·63%; (C) copper 99·00, silver 0·03, arsenic 0·06, iron 0·09, nickel 0·02, insoluble 0·18, calcium carbonate 0·73, total 100·11%; (D) copper 99·08, silver 0·03, iron 0·10, nickel 0·02, insoluble 0·13, calcium carbonate 0·41, total 99·77%. The density of the samples was respectively 8·56, 8·65, 8·73, and 8·52. The average composition of the samples calculated on a scale- and dirt-free basis is copper 99·91, silver 0·01, arsenic 0·02, nickel 0·02, sulphur 0·04%. A cake of " copper " from Carleton, Wigtownshire, was found to be a leaded bronze of the composition copper 93·04, silver 0·14, lead 4·87, tin 1·85, iron 0·13, nickel 0·10, sulphur 0·02%, apparently made by addition of lead and tin to a copper having about the average composition recorded above. —A. R. P.

Influence of the Degree of Cold-Working and Temperature on Mechanical Properties of Soft Steel, Copper, and Nickel.—I.-II. André Ancelle (*Rev. Mét.*, 1933, **30**, 266–274, 309–318).—(I.—) The influence of progressive drawing through dies is studied by tensile tests. Wires which have been subjected to various degrees of cold-working by drawing are reheated to various temperatures, cooled in air, and then subjected to tensile tests. The effects of the re-heating on the microstructure of the mild steel wire are studied. (II.—) Copper wires drawn to give various degrees of cold-working, reheated to various temperatures, and afterwards tested show maximum elongation values after reheating to the temperature which gives complete annealing, whatever the degree of previous cold-working. The maximum stress and elastic limit of drawn copper remain practically constant after reheating to low temperatures, but commence to fall as the reheating temperature approaches that of annealing. In the case of nickel wires, the maximum stress and elastic limit values show an initial increase corresponding with reheating temperatures in the range 20°–350° C., and afterwards decrease rapidly. The results of measurements of the small contractions in length observed immediately after removal of the load from wires overstrained in tension are given. The contraction is rapid at first, but slows down to zero.—H. S.

Hafnium. Paul M. Tyler (*U.S. Bur. Mines Information Circ.* No. **6457**, 1931, 1–11).—An account of the occurrence, distribution, properties, known compounds, and analytical separation of hafnium from zirconium. Future industrial applications are predicted owing to the high melting point and electronic emissivity of the metal.—P. M. C. R.

Notes on Some Romano-British Pigs of Lead. G. Clement Whittick (*J. Roman Studies*, 1931, **21**, (2), 256–264).—A description is given, without analyses, of some Roman pigs of lead found in the Mendip Hills and in Shropshire. Dimensions, weight, and inscription are discussed in detail.—A. R. P.

The Shropshire Pigs of Roman Lead. G. Clement Whittick (*Trans. Shropshire Archæol. Soc.*, 1932, **46**, 129–135).—The history and authenticity of some pigs of Roman lead found in Shropshire are discussed.—A. R. P.

The Clean-Up of Hydrogen by Magnesium. A. L. Reimann (*Phil. Mag.*, 1933, [vii], **16**, 673–686).—The mechanism of the clean-up of hydrogen by magnesium in vacuum tubes is investigated.—J. S. G. T.

The Relation of Hydrogen to Nickel with Special Reference to the Catalytic Power of the Latter. Harry N. Huntzicker and Louis Kahlenberg (*Electrochem. Soc. Preprint*, **1933**, May, 333–353).—The alleged passivity of nickel in solutions of nickel, copper, silver, and mercury salts has been studied by measuring the cathode potential of the metal in the various solutions. The results indicate that nickel exists in a passive state under ordinary conditions, and that this state is in no way dependent on a surface phenomenon, since scratching or bending the metal or the various chemical ways of depassifying passive metals do not alter the potential. Immersion of nickel in copper sulphate solution renders it more noble, but subsequent exposure to air or nickel sulphate solution slowly restores the ordinary "air potential." Silver and mercury salts do not produce this ennobling effect. In dilute sulphuric acid solutions nickel cathodes slowly become covered with a film of nickel sulphide, but in dilute phosphoric acid solutions the metal is activated by adsorption of hydrogen. This active nickel will immediately deposit silver and copper from their solutions, and becomes coated with a thin deposit of black cobalt or nickel in the corresponding sulphate solutions; it decolorizes bromine, iodine, permanganate, and ferric chloride solutions and reduces *N*-potassium nitrate to nitrite. Nickel may also be activated by heating it in hydrogen. On subsequently expelling the hydrogen it is liberated in a highly active form, some reactions of which are described.—A. R. P.

Spectro-Analytical and Electrical Investigations with Very Pure Platinum. Walther Gerlach and Else Riedl (*Physikal. Z.*, 1933, 34, 516–522).—A spectrographic method and apparatus for the detection of minute quantities of impurities in metals are described. The method is applied to the analysis of three commercial varieties of platinum. Physically pure platinum, containing less than 0·001% of impurities, is shown to contain, in addition to calcium and strontium, copper, silver, palladium, and lead. The residual resistance of the very purest sample of platinum is found to be independent of temperature between 4° abs. and 1·35° abs. and to amount to 0·3 part per 1000 of its resistance at 0° C.—J. S. G. T.

The Catalytic Properties and Structure of Metal Films. I.—Sputtered Platinum. G. I. Finch, C. A. Murison, N. Stuart, and G. P. Thomson (*Proc. Roy. Soc.*, 1933, [A], 141, 414–434).—The effect of sputtering conditions on the catalytic and structural properties of platinum films is investigated.—J. T.

[Contribution] to the Knowledge of Fundamental Atomic Weights. XII.—Revision of the Atomic Weight of Potassium; Analysis of Potassium Chloride and Potassium Bromide. O. Hönigschmid and R. Sachtleben (*Z. anorg. Chem.*, 1933, 213, 365–376).—A redetermination of the atomic weight of potassium gave 39·096.—M. H.

Conditions Affecting the Freezing Temperature of Silver. Wm. F. Roeser and A. I. Dahl (*U.S. Bur. Stand. J. Research,* 1933, 10, 661–668; *Research Paper* No. 557; and (abstract) *Met. Ind.* (*Lond.*), 1933, 43, 197–200).—The International Temperature Scale is defined in the range 660°–1063° C. in terms of the indications of a platinum to platinum–10% rhodium couple calibrated at the freezing points of gold, silver, and antimony, which metals, of course, should be of high purity when used. The requirements have been met in the case of gold and antimony, according to results from the chief research stations in England, Germany, and America, but differences, up to 0·5° C., were found in the freezing temperature of silver when using the same couple in the respective bulk samples of silver from the three institutions. In Germany and America the silver was contained in covered graphite crucibles, with presumably an atmosphere consisting of nitrogen, carbon dioxide, and carbon monoxide above the surface. At the National Physical Laboratory the silver was melted and cooled *in vacuo*. The three gases named are not appreciably soluble in the metal, but molten silver absorbs oxygen, and but 0·007% of this gas is sufficient to lower the freezing point of silver by 0·5° C. This amount of oxygen would be absorbed by molten silver in equilibrium with oxygen at a pressure of 0·4 mm. mercury. This investigation sought to find the source of the discrepancies. It was found that they are due primarily, if not wholly, to metallic impurities. It has been calculated, incidentally, that the freezing point of silver is only 0·005° C. lower *in vacuo* than at a pressure of 1 atm., which is well within the limit of experimental error, and the effect of changing pressure may be neglected. It is stated that any of the methods now in use for protecting silver from oxygen is adequate, but in order to obtain an accuracy of 0·1° C. it is necessary to limit the amount of impurities to 0·01%. A sample of silver containing 0·068% copper had a freezing point 0·5° C. lower than one containing only 0·008% of impurities. The freezing point of silver saturated with air at 760 mm. mercury pressure is 11·2° C. lower than that of the same silver protected from access of oxygen. Silver saturated with oxygen at 760 mm. mercury pressure melts at a temperature 22·6° C. lower than that of the same sample out of contact with oxygen.—W. N.

Some Physical Properties of Commercial Thorium. J. G. Thompson (*Metals and Alloys*, 1933, 4, 114).—The physical properties of (A) electrolytic thorium and of (B) 10 mm. rods of calcium-reduced thorium (carbon 0·055,

silicon 0·02, iron 0·058, calcium 0·078%, aluminium trace) have been determined. Extraordinary difficulties were met with in determining the melting point, since the metal reacts with carbon, oxygen, nitrogen, and all refractories except beryllia, and all the available supplies of commercial metal evolve much fume at about the melting point. The best results obtained indicate a melting point of 1680° C. for (B) and 1730° C. for (A), *i.e.* well below the accepted value of 1845° C. The latter is probably high, since molten thorium readily dissolves thoria and the melting point is thereby raised. Micrographs of the commercial metal showing inclusions of oxide, carbide, and metal-carbide eutectic are shown. The lattice parameter of (B) is 5·091 ± 0·004 A., whence $d_{\text{calc.}} = 11{\cdot}61$; actual determinations of d gave 11·1–11·49. The scleroscope hardness of (B) is 28–25, the Brinell hardness 78–74, and the Rockwell B hardness 43–29, the high values being those obtained on 10 mm. wire and the low values those obtained after annealing for 15 minutes at 700°–800° C. The electrical resistivity (A) at 20° C. is 18·6 × 10^{-6} ohm/cm., temperature coeff. 0·0038, coeff. of thermal expansion (B) 11·1 × 10^{-6} (20°–60° C.) and 12·1 × 10^{-6} (20°–300° C.) and the thermal e.m.f. against platinum − 0·13 (100° C.), − 0·53 (500° C.), + 0·87 (900° C.), and + 5·42 (1300° C.) mv.
—A. R. P.

The Emission of Electrons from Tungsten and Molybdenum Under the Action of Soft X-Rays from Copper. J. Bell (*Proc. Roy. Soc.*, 1933, [A], **141**, 641–651).—The photo-electric emission from molybdenum and tungsten under the action of soft X-rays from copper in the voltage range 1–20 kv. is investigated. The effect of heat-treatment is to cause either an increase or a decrease of the emission, depending on the previous treatment of the metal. The emission from molybdenum is about 70% of that from tungsten.—J. T.

The Effect of Temperature on the Emission of Electron Field Currents from Tungsten and Molybdenum. A. J. Ahearn (*Phys. Rev.*, 1933, [ii], **44**, 277–286).—The electron field currents from clean filaments of tungsten and molybdenum have been investigated between 300° and 2000° K. at field strengths from about 5 × 10^5 to 1 × 10^6 v./cm. Above about 1600° K. the thermionic emission completely masks the field currents. At low temperatures the thermionic emission was estimated by extrapolating Richardson emission curves, and the field current was determined by subtracting the thermionic emission from the total emission. The field currents thus obtained are independent of temperature to within 5% from 300° K. to 1400° K. Above 1400° K. the data are consistent with the assumption that the measured current consists of a thermionic current plus a field current which is independent of temperature, but the rapid increase in the thermionic emission with temperature makes it impossible to detect a small temperature effect on the field current above 1400° K. The theoretical bearing of the results is discussed.—W. H.-R.

The Effect on the Density of Zinc of Deformation by Cold- and Hot-Rolling. O. Bauer and P. Zunker (*Z. Metallkunde*, 1933, **25**, 149–153; and (abstract) *Met. Ind.* (*Lond.*), 1933, **43**, 246).—Cast ingots of (A) electrolytic zinc (99·98%) and (B) zinc (lead 1·12, cadmium 0·11%) had densities of 7·134 and 7·160, respectively. After hot-rolling at 175° C. to reductions of 22, 32, 42, 72, and 98% the density of A was 7·115, 7·087, 7·127, 7·134, and 7·116, respectively; the corresponding values for B were 7·159, 7·162, 7·163, 7·165, and 7·149. The large decrease in the density of electrolytic zinc on hot-rolling up to about 32% is due to cracking of the coarse-grained casting structure and to the absence of lead inclusions which can fill these cracks. With reductions of about 40% the casting structure disappears in both cases, and the density once more increases until cracking again occurs with more than 72% reduction. Cold-rolling is possible only after an initial hot-rolling to 50% reduction. With cold-reductions of more than 76% a decrease in density takes place which is considerably larger in the case of electrolytic zinc. The change in the density of electrolytic zinc sheet on annealing at 150°, 220°, and 300° C. and after subsequent cold-rolling has also been investigated.—M. H.

"Zinkan" as the Latest Material for Mining Machinery and Apparatus. J. F. Kesper (*Schlägel u. Eisen*, 1933, **31**, 78–79; *Chem. Zentr.*, 1933, **104**, II, 120).—"Zinkan" is zinc (containing a small amount of aluminium) plated on both sides with pure aluminium in a similar way to "Alclad." Sheets of the material have a density of 6–7, according to the thickness of the aluminium layers, and a tensile strength of 20–25 kg./mm.^{2} with an elongation of 40–65% in the annealed state, 25–32 kg./mm.^{2} with an elongation of 10–20% in the semi-hard state, and 32–42 kg./mm.^{2} with an elongation of 5–10% in the hardest-worked state. At 150°–300° C. some of the aluminium diffuses into the zinc and increases the hardness and strength, so that articles made from soft sheet can be hardened by subsequent annealing within this range. The metal melts at 450° C.—A. R. P.

The Preparation of Some Rare Metals by Thermal Dissociation [of Their Compounds]. A. E. von Arkel (*Rev. Univ. Mines*, 1932, [viii], **8**, 37–41; and (abstract) *Met. Ind.* (*Lond.*), 1932, **41**, 462).—The preparation of ductile zirconium, titanium, and thorium by thermal dissociation of their iodides *in vacuo* on an electrically-heated tungsten filament is briefly described. A similar method may be used to prepare ductile vanadium using the diiodide heated in an evacuated quartz tube at 1000° C. Boron has been prepared in the form of extremely hard and brittle rods by reduction of the bromide with mercury vapour. The thermal dissociation method may also be used for preparing pure platinum from platinum carbonyl dichloride. The theory of the method is briefly discussed.—A. R. P.

Theory of Metals. P. Peierls (*Z. Physik*, 1933, **81**, 697–699).—P. replies to N. H. Wilson's criticism (*J.*, this volume, p. 7) of P.'s theory of the metallic state (*Ann. Physik*, 1932, **12**, 154).—J. S. G. T.

The Nature of Metals. R. Seligman (*J. Inst. Brewing*, 1933, **39**, 445–448; and (abstract) *Brewers' J.*, 1933, **69**, 456–457).—The way in which the chemical, physical, and mechanical properties of metals depend on their structure is explained with particular reference to materials used in the brewing industry. —H. W. G. H.

The Physical Properties of Metals Used in Brewing. T. S. Pritchard (*J. Inst. Brewing*, 1933, **39**, 449–450).—Materials used for fermenting vessels are discussed with particular reference to the effect of surface on fermentation and to metallic contamination of the yeast. A discussion of the papers by Seligman (preceding abstract) and Pritchard follows, *ibid.*, 451–453.—H. H.

The Origin of the Plasticity of Single Crystals. (i) H. Schlechtweg. (ii) W. C. Burgers. (iii) H. Schlechtweg (*Physikal. Z.*, 1933, **34**, (i) 404–407; (ii) 623–624; (iii) 624).—(i) S. shows that the plasticity of single crystals can be explained in terms of a combination of Polanyi's theory of stresses in the crystals (this *J.*, 1928, **40**, 481) with Prandtl's model embodying his kinetic theory of solids (see this *J.*, 1928, **40**, 481). The postulation of a mosaic structure within the crystal is unnecessary. (ii) B. contends that the existence of microscopic heterogeneities within the crystal is necessary to explain the phenomenon of plasticity. (iii) S. replies.—J. S. G. T.

A Method for Obtaining Single Crystals With a Given Axis Orientation. P. A. Polibin and A. I. Froyman (*Zhurnal eksperimentalnoy i teoreticheskoy Fiziki* (*Journal of Experimental and Theoretical Physics*), 1933, **3**, (2), 162–164).—[In Russian.] The method, which depends on a special arrangement of the capillary in the lower portion of the tube, has been used with pure zinc, cadmium, and tin.—N. A.

Plastic Deformation. N. Seljakov (*Zhurnal Tehnicheskoi Fiziki* (*Journal of Technical Physics*), 1933, **3**, (1), 14–25).—[In Russian.] A review of the present position of the problem.—N. A.

The Mechanism of Plastic Deformation. A. W. Stepanow (*Z. Physik*, 1933, **81**, 560–564).—Plastic deformation, it is suggested, is accompanied by a transformation of the energy of deformation into heat in a narrow zone in the neighbourhood of the slip bands, whereby a temporary dissociation of the crystal lattice in this region is produced. Experimental results supporting this hypothesis are referred to.—J. S. G. T.

The Path Followed by the Fatigue Fracture in Metal Parts. A. Thum and H. Oschatz (*Usine*, 1932, **41**, (11), 33).—A summary of a paper published in *Z.V.d.I.*, 1932, **76**, 132–134. See this *J.*, 1932, **50**, 342, 725.—R. B. D.

The Tenacity of Polycrystalline Materials. W. Kuntze (*Z. Physik*, 1933, **81**, 564).—A diagram in K.'s paper (*J.*, this volume, p. 229) is corrected.
—J. S. G. T.

Lattice Distortion in Nitrided Steels and Theory of Hardness. W. A. Wood (*Phil. Mag.*, 1933, [vii], **16**, 719–727).—An X-ray investigation of the changes produced in the case-hardening of steels by the nitriding process indicates that the method produces a surface layer of nitrides and a case of steel having an abnormally diffused and weakened X-ray spectrum. Extreme hardness values are associated with this type of spectrum. The results necessitate the postulation of the existence of a distorted atomic lattice and a disturbance of the electron distribution affecting the hardness. The disturbed distribution tends to obliterate the electronic arrangement facilitating "slip."—J. T.

Gases in Solid Substances. S. W. Ptitzyn (*Zhurnal Tekhnicheskoi Fiziki* (*Journal of Technical Physics*), 1932, **2**, (9–10), 953–971).—[In Russian.] The distribution of gases in metals and other solids and their diffusion in a high vacuum is reviewed.—N. A.

Crystallization of Metals is Not Caused by Vibration. Joseph A. Kendrick (*Power Plant Eng.*, 1933, **37**, 402).—K. attacks the popular misconception that fatigue failures are due to the production by vibratory strains of a crystalline structure in the metals concerned.—P. M. C. R.

The Surface Tension of Molten Metals and Alloys. IV.—The Change of Surface Tension with Time and the Drop Method of Measurement at Elevated Temperature. F. Sauerwald and B. Schmidt (*Z. anorg. Chem.*, 1933, **213**, 310–318).—Apparatus for the determination of the surface tension by the drop method is described. The surface tension of mercury in the highest vacuum lies between the initial and final values in air. Under a pressure of 5×10^{-5} mm. the surface tension of tin shows no change with time, whereas that of thallium increases. Hence it is concluded that when the surface tension of a metal changes with time the final value is the resultant of the influence of the atomic arrangement at the surface and the effect of the gas atoms adsorbed thereon. Experiments on the influence of concussions and irradiations on the surface tension are in accordance with this conception.
—M. H.

The Action of Metals at a Distance on Microorganisms. G. A. Nadson and E. A. Stern (*Doklady Akademii Nauk U.S.S.R.* (*Comptes rendus de l'Académie des Sciences de U.R.S.S.*), 1932, [A], (14), 352–367).—[In Russian.] The action of magnesium, aluminium, nickel, copper, silver, tin, and lead on yeast and bacteria has been investigated. The distance of the metals from the culture was 1 mm. The action at a distance is apparently due to the radioactivity of the surrounding medium, secondary radiation being emitted from the metal surface. Just as in the case of secondary X-rays, so with metals, the principal effect is caused by streams of electrons which bombard the bacteria, either killing them or weakening and altering their activity.
—N. A.

Theory of Thermal Conduction at Low Temperatures. Wolfgang Kroll (*Z. Physik*, 1933, **81**, 425–427).—An expression for the thermal conductivity at low temperatures is deduced from Bloch's theory, and satisfactory agreement is found between theoretical and experimental results relating to lithium.—J. S. G. T.

The Contribution of Protons to Electrical Conduction in Metals. III.—The Photographic Plate as Indicator. Alfred Coehn and Kurt Sperling (*Z. Physik*, 1933, 83, 291–312).—The motion of hydrogen in palladium conducting a current can be recorded on a photographic plate. A method for achieving this is described and discussed.—J. S. G. T.

On the Meaning of the Origin of Superconductivity. U. Dehlinger (*Naturwiss.*, 1933, 21, 607).—The transition from superconductivity to finite resistance is considered to be a transition from the oriented to the unoriented state in the electronic configuration, and to be comparable to the transition from regular to irregular atomic distribution which occurs in certain transformations in alloys.—J. W.

Some Remarks on the Frequency Dependence of Superconductivity and Ferromagnetism. Raymund Sänger (*Phys. Rev.*, 1933, [ii], 44, 302–307).—Theoretical. Superconductivity and ferromagnetic properties are affected by high frequencies. S. investigates the extent to which this frequency dependence can be accounted for by assuming that a conducting wire consists of a normal metallic core surrounded by a surface layer or skin which shows neither superconductivity nor ferromagnetism. The treatment is preliminary only, but suggests that such an explanation is possible although the surface layer required is rather thick, being of the order 10^{-4} and 10^{-5} cm. as indicated by the calculations for the superconducting and ferromagnetic properties, respectively.—W. H.-R.

A Possible Explanation of Superconductivity. J. I. Frenkel (*Zhurnal eksperimentalnoy i teoreticheskoy Fiziki* (*Journal of Experimental and Theoretical Physics*), 1933, 3, (2), 101–108).—[In Russian.] See abstract from another source, *J.*, this volume, p. 489.—N. A.

Remarks on the Theory of Superconductivity. J. Dorfman (*Physikal. Z. Sowjetunion*, 1933, 3, (4), 366–380).—[In German.] It is shown that the various factors, such as temperature, magnetic fields, and high frequency, which prevent superconductivity can be considered as purely energy factors which supply sufficient energy to the superconductors to transform them into the non-superconducting state. The observed relations admit of the drawing of certain conclusions as to the nature of superconductivity.—N. A.

On the Influence of a Transverse Magnetic Field on the Resistance of Liquid Metals. Ibrahim Fakidow and J. Kikoin (*Physikal. Z. Sowjetunion*, 1933, 3, (4), 381–392; also (in Russian), *Zhurnal eksperimentalnoy i teoreticheskoy Fiziki* (*Journal of Experimental and Theoretical Physics*), 1933, 3, (1), 36–43).—[In English.] The influence of a magnetic field on liquid sodium–potassium alloy is to produce a change in the resistance $\Delta R/R$ which for fields of more than 1000 Gauss is linearly proportional to the intensity.—N. A.

Superconductivity and the Hall Effect. J. Kikoin and B. Lasarew (*Physikal. Z. Sowjetunion*, 1933, 3, 351–365; and (in Russian) *Zhurnal eksperimentalnoy i teoreticheskoy Fiziki* (*Journal of Experimental and Theoretical Physics*), 1933, 3, 44–52).—[In German.] The value of the Hall constant R and of the product of this constant and the sp. electrical conductivity σ have been compared for a series of metals. R is relatively small and $R \cdot \sigma$ exceptionally small for superconducting metals at room temperature compared with the corresponding values for ordinary conductors. The same remarks apply to superconducting alloys of lead–bismuth, bismuth–thallium, and antimony–thallium, as well as to superconducting compounds containing a non-metallic component, *e.g.* sulphides.—N. A.

The Influence of the Elastic Elongation of Ferromagnetic Material on the Magnetic Transformation Point. M. N. Michejew (*Physikal. Z. Sowjetunion*, 1933, 3, (4), 393–398; also (in Russian) *Zhurnal eksperimentalnoy i teoreti-*

cheskoy Fiziki (*Journal of Experimental and Theoretical Physics*), 1933, 3, (1), 72–75).—[In German.] Determinations of the magnetic transformation point of a loaded copper–nickel alloy wire have shown that this point is independent of the tensional stress within the limits of experimental error. —N. A.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 548–553.)

X-Ray Study of the Equilibrium Diagram of the Iron–Aluminium System. Atomi Osawa (*Kinzoku no Kenkyu*, 1933, 10, (7), 277–289).—[In Japanese.] The equilibrium diagram of the iron–aluminium system has been studied by X-ray and microscopic examination, and from the results a new diagram is proposed. Four compounds exist; namely, $(FeAl)_n$, $FeAl_2$, Fe_2Al_5, and $FeAl_3$. The first three are formed by peritectic reactions :—

$$\begin{aligned} &\text{melt} + \delta \text{ solid solution} &&\rightleftharpoons (FeAl)_n \\ &\text{melt} + (FeAl)_n &&\rightleftharpoons FeAl_2 \\ \text{and}\quad &\text{melt} + FeAl_2 &&\rightleftharpoons Fe_2Al_5 \end{aligned}$$

$FeAl_3$ solidifies directly from the melt, having a maximum melting point on the liquidus line, and forms eutectics with pure aluminium on one side and with Fe_2Al_5 on the other.—S. G.

Solubility of the Chemical Compound $MgZn_2$ in Aluminium in the Solid State at Different Temperatures. P. Saldau and M. Zamotorin (*Z. anorg. Chem.*, 1933, 213, 377–382).—The solubility of $MgZn_2$ in aluminium in the quasi-binary system Al–$MgZn_2$ (determined by micrographical analysis) is about 30·0, 24·7, 14, 3·6, and 1·6% $MgZn_2$ at 475° (eutectic temperature), 460°, 400°, 300° C., and room temperature, respectively.—M. H.

The Sodium Content of Silumin. E. Scheuer (*Z. Metallkunde*, 1933, 25, 139–141, 157–160; and (abstract) *Met. Ind.* (*Lond.*), 1933, 43, 354).—The sodium content of Silumin can be determined by melting the alloy in air, cooling, washing with distilled water, and titrating the alkaline solution with standard acid. Grain-refinement takes place independently of the modifier used (metallic sodium or sodium salts) but is not produced by less than 0·003% sodium; normally modified Silumin contains about 0·010% sodium. The amount of sodium taken up by molten Silumin depends, under otherwise equal conditions, on the temperature at which the sodium is added; it is considerably smaller at the melting point of Silumin and at 1000° C. than at 700° and 900° C., and largest at about 800° C. The decrease in the sodium content of Silumin melts has been determined at temperatures between 600° and 1000° C. Between 15 seconds and 1 minute after the addition of the sodium the loss was 20–40%, the rate of oxidation being smallest at 600° C. and greatest at 800° C.—M. H.

Hydronalium, a New Light Metal Alloy with a High Resistance to Corrosion. Werner Schultze (*Forschungen u. Fortschritte*, 1933, 9, 386–387).—A short account of the properties and uses of Hydronalium.—J. W.

Notes on the Light Alloys of Aluminium, Especially Those which Require no Heat-Treatment. E. Herrmann (*Bull. tech. Suisse Romande*, 1933, 59, 193–195).—A survey of the development of light alloys leads to a discussion of the ageing alloys Duralumin, Avional, and Anticorodal. Uniformity of structure, high strength, and good elongation are secured by working in the soft condition, with subsequent heat-treatment, but the selection of suitable materials may obviate the expense and skilled labour entailed by these methods. Recently developed alloys of aluminium with magnesium and manganese are described, notably Peraluman (special Anticorodal), of the composition : manganese 1·5, magnesium 2·0–2·5%, and remainder aluminium. The mechanical properties of pressed sections and of sheet in the annealed, half-hard and fully hardened conditions are tabulated. Other alloys considered are Aluman (aluminium with 1·5% manganese) the American "4 S" alloy (magnesium 1; manganese 1%), Birmabright (magnesium 3·5; manganese 0·5%), Hydronalium, Duranalium, and "MG 7" (low manganese, magnesium 5–15%). —P. M. C. R.

The Influence of Small Quantities of Silicon on the Strength and Elasticity of Duralumin. J. G. Muzalevsky (*Tehnika Vosdushnogo Flota* (*Technology of the Aerial Navy*), **1933**, (1), 70–80).—[In Russian.] The influence of 0·04% to 0·66% of silicon on Duralumin containing copper 4·5, magnesium 0·80, manganese 0·40, and iron 0·20% has been investigated in tensile and bending tests on rolled and heat-treated specimens after ageing for 2, 24, and 144 hours. The strength of Duralumin during natural ageing is independent of the silicon content within the above limits. In bending sheet Duralumin the toughness falls sharply when the silicon exceeds about 0·5%, the fall being especially marked with annealed metal with a high silicon content. It is concluded that additional silicon should not be introduced into Duralumin.—N. A.

The Influence of Silicon on the Mechanical Properties of Duralumin. V. O. Krenig (*Tehnika Vosdushnogo Flota* (*Technology of the Aerial Navy*), **1933**, (1), 81–83).—[In Russian.] Criticisms of a paper by J. G. Muzalevsky. Krenig's researches demonstrate the beneficial influence of silicon on the properties of Duralumin. The decrease in strength in the annealed condition is without significance, since Duralumin sheets in practice are usually bent immediately after the quenching.—N. A.

Methods of Strengthening Duralumin by Means of Thermal Treatment. S. M. Voronov (*Tehnika Vosdushnogo Flota* (*Technology of the Aerial Navy*), **1929**, (8), 500–513; (9), 568–576).—[In Russian.] From a study of the mechanical properties during the process of ageing, it is concluded that the degree of strengthening is a function of the chemical composition of the alloy, degree of the preceding plastic deformation, temperature of quenching, and temperature of the quenching medium. The greater the prior mechanical deformation and the better the condition of the subsequent quenching, the more vigorous is the ageing process and the more intense the final strengthening effect. The existing theories of the ageing process are examined in the light of numerical data prepared by V. which confirm the important part played by the separation of Mg_2Si during the ageing process.—N. A.

An Investigation of the Influence of Air Quenching on the Mechanical Properties of Duralumin. I. G. Schoulgin (*Tehnika Vosdushnogo Flota* (*Technology of the Aerial Navy*), **1932**, (10), 933–949).—[In Russian.] The mechanical properties and hardness of air-quenched (normalized) Duralumin during the first 8 hrs. of ageing at room temperature are higher than those of the water-quenched alloy. During the next 7 days of ageing this relationship changes, until after 15 days the difference practically vanishes. The mechanical properties during the ageing process alter as shown below.

	Water-quenched, %.	Air-quenched, %.
Increase in tensile strength	31–41	16–29
,, limit of proportionality	105–119	39–81
,, Rockwell hardness	46–159	34–91
Decrease in elongation	0–16	0–15

Air quenching of tubes and complete structures is possible if the furnace is operated correctly and the heating period is sufficiently prolonged. The mechanical properties of air-quenched Duralumin fall more rapidly than those of water-quenched during corrosion. No difference between the two can be detected by metallographic methods.—N. A.

An Investigation of the Materials of Connecting Rod Forgings of Duralumin for Aircraft Motors. I. G. Schoulgin (*Tehnika Vosdushnogo Flota* (*Technology of the Aerial Navy*), **1933**, (2), 50–58).—[In Russian.] The condition of connecting rod forgings of Duralumin has been investigated at different points, to determine the effect of the thermal and mechanical treatment. The alloy tested contained copper 4·45, silicon 0·17, manganese 0·50, magnesium 0·75, and iron 0·46% and in the initial state had an average tensile strength of 25 kg./mm.^{2}, an elastic limit of 15·8 kg./mm.^{2}, a relative elongation 13·3%, and an impact strength of 3·55 kg./cm.^{2}; the corresponding values for the quenched alloy were 41·2, 31·5, 24, and 3·27. Results of a metallographical examination are given.—N. A.

Measurements of the [Thermal] Expansion of Aluminium Casting Alloys for Motor Cylinders. F. Bollenrath (*Metallwirtschaft*, 1933, **12**, 85–89).—Different heat-treatments considerably affect the shape of the thermal expansion curve of cast aluminium alloys. The conditions under which the best curve for practical use of the alloys is obtained have been investigated.
—v. G.

Aviol (Aviation Aluminium). J. G. Muzalevsky (*Tehnika Vosdushnogo Flota* (*Technology of the Aerial Navy*), **1930**, (1), 47–58).—[In Russian.] Aviol is a medium strength alloy to replace aluminium in aircraft construction; it contains 0·7% silicon and 0·6% magnesium, and has a coeff. of linear expansion 2·3 × 10^{-5}. The yield point (kg./mm.^{2}) is 12–15 in the annealed, 17–23 in the quenched, and 25–36 in the aged (at 150° C.) state; the corresponding values for the elastic limit are 5–7, 8–10, and 17–24 kg./mm.^{2}, for the elongation 27–20, 28–25, and 18–8%, and for the Brinell hardness 40–50, 60–75, and 80–110. The thermal treatment of Aviol and its influence on the mechanical properties have been investigated in detail: the mechanical properties are improved by quenching from above 400° C., the optimum temperature being 530°–550° C. With natural ageing a progressive rise in mechanical properties occurs during 4 days. Ageing at 150°–170° C. improves the mechanical properties during 3 hrs. The resistance of Aviol to the action of the atmosphere, and to fresh and sea-water does not differ from that of the purest aluminium. Acids, especially hydrochloric, in any concentration dissolve Aviol. The production of semi-manufactured parts for the aircraft industry and the methods of working Aviol are described.—N. A.

Strength of [" 4 S "] Aluminium [Alloy] Corrugated Sheet. Anon. (*Eng. News-Record*, 1933, **110**, 705).—Safe uniformly-distributed loads are computed for standard sizes of corrugated sheet made from the aluminium alloy " 4 S." Load-deflection tests made on samples with ends freely supported on wooden horses 6 ft. apart and loaded with dry sand over an area 24 × 72 in. showed close agreement with calculated values. Crushing tests indicated a wide margin of safety against the end reactions likely to be encountered in practice.
—J. C. C.

Vacuum-Melted Beryllium Alloys. W. Hessenbruch (*Heraeus Vacuumschmelze* [*10th Anniv. Volume*], **1933**, 199–232).—In preparing hardenable alloys of beryllium with copper, nickel, and cobalt with or without other metals, vacuum-melting produces alloys with more reproducible properties than does melting under a salt layer, since the loss of beryllium in the first case is almost negligible. Alloys of copper with 2·5% beryllium develop a maximum hardness after quenching from 750° C. and tempering at 250° C. for 10 hrs., or, after 30% reduction by cold-rolling, for 1½ hrs. An alloy of nickel with 1·7% beryllium develops the maximum hardness after quenching from 1000° C. and tempering at 450° C. for 15 hrs. or, after 30% reduction by cold-rolling, tempering at 400° C. for 16 hrs. The cold-worked and hardened copper alloy has a yield-point of 107 kg./mm.^{2}, tensile strength of 123·3 kg./mm.^{2}, elongation of 5·7%, Brinell hardness of 350, and notched bar impact value of 0·81 m.-kg./cm.^{2}; the corresponding values for the nickel alloy after similar heat and mechanical treatments are 150, 182·5, 8·3, 460, and 4·47. The high tensile strength and toughness are characteristic of vacuum-melted alloys. Beryllium confers similar remarkable properties on cobalt, but the alloy with 2% beryllium can be worked hot only; after addition of 8% iron to convert the cobalt from the hexagonal to the face-centred cubic form, the alloys can readily be cold-worked. For the 2 : 8 : 90 beryllium–iron–cobalt alloy maximum hardness is induced by quenching from 1000° C. and tempering at 400°–450° C. for 4–8 hrs.; in this way Brinell hardness numbers of over 600 can be obtained. The solubility of beryllium in copper, nickel, cobalt, and iron is reduced by addition of other elements such as molybdenum, tungsten, chromium, and manganese, and hence smaller quantities of beryllium are sufficient to produce temper-hardening alloys. Thus addition of 0·6–1% beryllium to Contracid (nickel 61, chromium 15, iron 15, manganese 2, molybdenum 7%) produces the following changes in the properties after heat-treatment; (values in same order throughout) (*a*) quenched from 1050° C.: yield-point 41·7 kg./mm.^{2}, tensile strength 88 kg./mm.^{2}, elongation 29·15%, Brinell hardness 195, notched bar impact value 13·9 m.-kg./cm.^{2}, (*b*) subsequently annealed at 500° C. for 4 hrs.: 49·6, 93·2, 22·75, 320, 8·14, (*c*) quenched from 1050° C. and reduced 30% by cold-rolling: 105, 110·5, 1·35, 390, 3·34, (*d*) as (*c*) but tempered for 6 hrs. at 450° C.: 118, 129, 7·9, 430, 2·83. Ordinary 80 : 20 Nichrome and 65 : 15 : 20 nickel–chromium–iron alloys become hardenable after addition of 1–1·5% beryllium, hardness values of over 420 being obtainable by cold-working the quenched alloys and tempering at 400°–500° C. Addition of 8% molybdenum or of 8% chromium and 4% molybdenum to nickel containing 1–1·5% beryllium confers marked temper-hardening properties and a relatively great stability of the hardened state at temperatures up to 450° C. Addition of chromium or of tungsten to beryllium–cobalt alloys reduces the amount of beryllium required to produce temper-hardening, but makes the alloys much too hard for cold-working in the quenched state. The alloy with cobalt 34, iron 50, chromium 15, and beryllium 1%, which has a hardness of 225 (Brinell) in the quenched state, can be reduced by 30–50% by cold-rolling, whereby the hardness is raised to 470; subsequent tempering at 450° C. raises the hardness to a maximum of 680–700. Addition of 5% manganese or silver or 3% silicon with 1% beryllium to copper produces alloys which can be heat-treated to give Brinell hardness values of about 300; with 3% titanium and 1% beryllium hardnesses of about 370 can be obtained. Curves are given showing the creep limit of beryllium–Contracid and ordinary Contracid at high temperatures as well as tables showing the electrical resistance and coeff. of thermal expansion of many of the above alloys after various heat and mechanical treatments. The rates of corrosion of beryllium–nickel and beryllium–Contracid alloys in various acids are compared with those of stainless steels and some possible uses of heat-treated beryllium alloys are mentioned.—A. R. P.

The Action of Oxygen and Hydrogen Sulphide Upon Iron–Chromium Alloys at High Temperatures. R. L. Rickett and W. P. Wood (*Amer. Soc. Steel Treat. Preprint*, **1933**, Oct., 1–32).—Alloys containing up to 28% chromium were studied within the range 760°–1095° C. and for periods of exposure up to 150 hrs. Examination comprised the determination of gain of weight, and the chemical composition, microstructure, and general crystal structure of the scale produced under the varying conditions. Other factors being constant, hydrogen sulphide produced a greater amount of scale than oxygen. Resistance to oxidation was increased by increasing the amount of chromium, but resistance to sulphurization only slightly thereby. The greater resistance to oxidation of the higher chromium alloys was accompanied by a large increase in the amount of chromium found in the scale. The rate of scaling decreased with increase in time of exposure, and increased rapidly as the temperature increased. It is surmised that in these operations there is diffusion of the reacting gas, or of higher products of reaction, inward, and of the metal, or of lower products of reaction, outwards, through the scale. —W. A. C. N.

Ordinary and Special Bronzes. The Alloys of Aluminium and Copper. II.–III.—" Aluminium–Bronzes." L. Guillet (*Cuivre et Laiton*, 1933, **6**, 237–238, 395–396).—(II.—) A general discussion of the properties and uses of " aluminium–bronze." (III.—) Deals with the alloy containing copper 90, and aluminium 10%—the so-called St. Claire–Deville alloy. G. gives details of the thermal diagram, the physical properties of the alloy, and the precautions which must be taken during casting.—W. A. C. N.

On the System Beryllium–Copper. H. Tanimura and G. Wassermann (*Z. Metallkunde*, 1933, **25**, 179–181).—The solid solubility of beryllium in copper as determined by X-ray analysis of well-annealed and quenched alloys decreases from 2·1% (extrapolated) at the peritectic temperature (864° C.) to 1·8% at 700° C., 0·4% at 400° C., and about 0·16% at 250° C. The decomposition of the quenched, supersaturated solid solution during ageing at 150°–350° C. can be followed by X-ray analysis.—M. H.

Tin-Free Leaded Bearing Bronze. H. K. Herschmann and J. L. Basil (*U.S. Bur. Stand. J. Research*, 1933, **10**, 591–608; *Research Paper* No. **551**; and (summary) *Met. Ind.* (*Lond.*), 1933, **43**, 219–222, 243–246, 325–326).—Bronzes containing 25–28% lead have to a great extent replaced tin-base alloys in connecting-rod bearings of aeroplane engines. They usually contain tin, which is added to prevent agglomeration of lead particles and to give strength to the alloy matrix. The aim of the work here described was to produce such bronzes without tin, and the paper is divided into two parts: (1) the effect of small amounts of various elements on the distribution of lead in leaded-bronzes containing more than 30% lead; and (2) the characteristic mechanical properties of leaded bronzes containing 30·5–40% lead together with small amounts of sulphur, silicon, and zirconium. Steel-backed bearings lined with one of the best alloys studied were subjected to service tests. Individual additions of barium, calcium, zirconium, and sulphur showed promise in preventing lead segregation. An alloy containing sulphur, silicon, and zirconium is suggested as showing but little segregation. The one used in the steel bearings above mentioned contained lead 35, sulphur 0·4, silicon–zirconium alloy 1·5%. The wear-resistance of this alloy was superior to that of many commercial alloys containing appreciable quantities of tin. Its compressive strength was equal to that of an alloy containing tin but only 10% less lead. Between 100° and 250° C. there was little change in the resistance to pounding. Under service conditions in an aeroplane this alloy gave very promising results.—W A. C. N.

Investigations Relating to Heusler Alloys. S. Valentiner and G. Becker (*Z. Physik*, 1933, **83**, 371–403).—The magnetic properties of Heusler alloys are attributable to the presence of crystals of composition Mn–Al–Cu$_2$. The Curie points of the alloys are all in the neighbourhood of 330° C., which is that characterizing the very strongly magnetizable alloy of atomic composition manganese 25, aluminium 25, copper 50%. This alloy, whether quenched from 800° C. or higher temperatures or aged at temperatures below 350° C., possesses a body-centred lattice with super-structure, the side of the crystal unit being of length 5·950 A. At temperatures between 350° C. and 700° C.

the alloys consist of Al–Cu_3 and Mn–Al–Cu_2 with embedded Mn atoms. Alloys quenched from, or aged within, this range of temperatures are less strongly magnetizable than the alloys previously referred to. The magnetic saturation value of alloys of other compositions is dependent on the percentage of manganese present which goes to form crystals of Mn–Al–Cu_2. On ageing these alloys the coercive force at first increases and then decreases. Excess manganese can, in part, enter the lattice of the Mn–Al–Cu_2 crystals without altering the length of the lattice edge or appreciably affecting the magnetic properties. Excess aluminium disturbs the formation of crystals of Mn–Al–Cu_2, and easily combines with the copper of such crystals to form Al–Cu_3. If the aluminium content is only slightly greater than 25%, the crystal lattice, during ageing of the alloy, changes from one having a length of edge 5·833–5·950 A. to one of length 8·7 A. These latter alloys are only feebly magnetic. Alloys of composition not very different from that represented by Mn–Al–Cu_2 are characterized by a very high coercivity for weak saturation values.—J. T.

Herculoy—A Copper–Silicon–Tin–Zinc Alloy. R. A. Wilkins (*Metals and Alloys*, 1933, 4, 123–126).—Herculoy is a copper alloy containing silicon 3·25, zinc 1·5, and tin 0·5%. The zinc increases the tensile strength and improves the casting and working properties, whilst the tin improves the resistance to corrosion and permits a low-temperature anneal to be carried out to remove internal stresses without affecting the mechanical properties produced by cold-work. The cast alloy has a tensile strength of 55,000 lb./in.^{2} with an elongation of 70%; by cold-working a strength of 100,000 lb./in.^{2} can be obtained, and the internal stress induced by the work can be relieved by annealing at 285°–315° C., during which operation the hardness and strength are increased by a precipitation-hardening effect. Cold-drawn rod after annealing at 290° C. for 30 minutes has a yield-point of 105,000 lb./in.^{2}, an ultimate strength of 135,000 lb./in.^{2}, and an elongation of 11%; in this state an outside fibre stress of 30,000 lb./in.^{2} does not cause failure after 6×10^7 reversals of load. The alloy has a density of 8·54, modulus of resiliency of 17·5 (soft) and 375 (hard) in.-lb./in.^{3}, coeff. of thermal expansion of 0·0000170 (0°–100° C.), resistivity (soft wire) of 21·75 microhms./c.c. at 22·5° C., max. induction 470 Maxwells/cm.^{2}, magnetizing force 200 Gilberts/cm.^{2}, normal coercive force 1·5 Gilberts/cm.^{2}, permeability 2·5, temperature coeff. of resistance 0·00046 at 20° C., and melting point 1023·5° C. The alloy resists corrosion by most neutral and alkaline solutions and by hydrochloric and sulphuric acids.—A. R. P.

On the Equilibrium Diagram of the Copper–Tin–Phosphorus Alloys. J. Verö (*Z. anorg. Chem.*, 1933, 213, 257–272).—The solidification and transformation of copper–tin–phosphorus alloys with 0–25% tin and 0–8% phosphorus have been studied by thermal analysis and micrographical examination of alloys with a constant tin content of 5·0, 10·0, 15·0, and 20·0% and of alloys with a constant phosphorus content of 1·0, 2·0, and 3·0%. The eutectic reaction in the copper–phosphorus system (melt $\rightleftharpoons \alpha + Cu_3P$ at 707° C.), which also takes place in ternary alloys poor in tin, and the peritectic reaction in the copper–tin system (α + melt $\rightleftharpoons \beta$ at 798° C.) merge into the 4-phase reaction α + melt $\rightleftharpoons Cu_3P + \beta$ at 637° C. The transformations in the solid state are similar to those in the copper–tin system. The solid solubility of phosphorus in the α- and β-tin–copper solid solutions has been determined in detail and the phase equilibria are shown in diagrams and photomicrographs. —M. H.

Ageing and Elastic Hysteresis in Instrument Springs. Paul MacGahan and Robert W. Carson (*Instruments*, 1932, 5, 89–90).—An extended abstract of a paper read before the American Institute of Electrical Engineers. Spiral instrument springs are made by winding hard-rolled phosphor-bronze tape tightly on a mandrel, holding the tape with a close-fitting barrel, and heating for several minutes to about 300° C. to fix the shape. In the course of time, such springs uncoil 5°–10° and increase in torque by 2–5%, depending on forming and ageing temperatures. This is due to the relief of residual stresses. By heating at 100°–150° C., however, relaxation is very rapid, and no further ageing then occurs at lower temperatures. Measurements were made of the elastic hysteresis of spring materials under low stresses, making use of a grid glow relay tube to indicate contact between the ribbon and the micrometer used to measure deflections.—J. C. C.

Relative Temperatures of Brass when Subjected to Reversed Direct Stresses in Vacuo and in Air. H. J. Gough and D. G. Sopwith (*Aeronaut. Res. Cttee. R. and M.* No. 1482, 1932, 1–4).—Cf. this *J.*, 1932, 49, 93. In continuation of earlier work three alternating direct stress tests have been made on 70 : 30 annealed brass: (*a*) in air at ± 7·1 tons/in.^{2} (*i.e.*, just below the air fatigue limit); (*b*) *in vacuo* at ± 9 tons/in.^{2} (*i.e.*, just below the *vacuo* fatigue limit), and (*c*) in air at ± 9 hrs./in.^{2}; the temperature difference between the holders and the specimens during the tests are shown graphically. Specimens (*a*) and (*b*) survived respectively, 26 and $35{\cdot}2 \times 10^6$ reversals without fracture, whereas specimen (*c*) broke after $0{\cdot}36 \times 10^6$ reversals. The actual temperatures of the specimens were identical over the same period, the maximum temperature after primary hysteresis reaching about 30° C. Hence the difference in the fatigue limits in air and *vacuo* is not due to temperature effects.—A. R. P.

Alloys of Copper Combining High Mechanical Strength with Good Electrical Conductivity. Anon. (*Cuivre et Laiton*, 1933, 6, 401–403).—Data are given concerning the physical and electrical properties of a large number of copper alloys, for which good qualities in both directions are required. Special attention is devoted to silicon–, cadmium–, and beryllium–" bronzes."

—W. A. C. N.

[Basaloy] Pasco Copper Co. Alloys. Anon. (*Automotive Ind.*, 1932, 67, 497).—Basaloy, an alloy of unstated composition, has a sp. gr. of about 10, melts at about 257° F. (125° C.), is somewhat malleable and ductile, is harder than lead, takes a clean impression, and retains a constant composition in re-melting. It is recommended for proving forging dies and as a liquid seal for annealing furnaces of certain types.—P. M. C. R.

The Tensimetric Analysis of the Systems Gold–Phosphorus, Silver–Phosphorus, and Copper–Phosphorus. Haakon Haraldsen (*Skr. Norske Vidensk.-Akad. Oslo. Mat.-Naturv. Kl.*, 1932, (9), 1–63).—[In German.] Tensimetric analysis of these systems in a specially designed apparatus has shown that the following stable compounds exist: Au_2P_3, AgP_3, AgP_2, CuP_2, and Cu_3P; this has been confirmed by X-ray analysis. The densities of these compounds are respectively 8·123, 3·881. 4·653, 4·201, and 7·147, and their heats of formation 41·7 (630° C.), 35·5 (456° C.), 32·7 (478° C.), and 52·0 (697° C.), respectively, from phosphorus vapour and metal or lower phosphide. Cu_3P is the most stable phosphide and Au_2P_3 is more stable than either of the silver phosphides.

—A. R. P.

X-Ray Investigations on Antimony–Lead and Tin–Lead Alloys. I. Obinata and E. Schmid (*Metallwirtschaft*, 1933, 12, 101–103).—The lattice parameter of pure lead ($a = 4{\cdot}9389$ A.) is reduced by $0{\cdot}1\,^{\circ}/_{oo}$ by the presence in solid solution of 1 atomic-% antimony and by $0{\cdot}34\,^{\circ}/_{oo}$ by 1 atomic-% tin. The solubility of antimony in lead at 250°, 200°, and 100° C. is 2·9, 1·5, and 0·4 weight-% respectively, and that of tin in lead at room temperature is 3·4 atomic-%.—v. G.

New Bearing Alloy [Satco] Designed to Withstand High Temperature. Anon. (*Automotive Ind.*, 1933, 69, 122).—The following are claimed for Satco: solidification point 295° C.; temperature of complete liquefaction 420° C.;

transverse strength 10 tons/in.^{2} with a bend of 11°, that of railway Babbitt metal tested under identical conditions being about 9·5 tons/in.^{2} with a bend of 7°; low shrinkage and retention of hardness at elevated temperatures. The alloy is said to be suitable for die-casting.—P. M. C. R.

Shape and Structure of Lead Shot. G. Tammann and K. L. Dreyer (*Met. Ind.* (*Lond.*), 1933, **42**, 618).—Short abstract of a paper published in *Z. Metallkunde*, 1933, **25**, 64. See *J.*, this volume, p. 299.—J. H. W.

Study of Magnesium–Aluminium–Copper Alloys Rich in Magnesium. Paul Bastien (*Publ. sci. et tech. Ministère de l'Air*, No. **20**, 1933, 1–9).—The equilibria in the system magnesium–aluminium–copper have been determined by thermal analysis of alloys containing more than 45% magnesium. The section Mg_2Cu–Mg_4Al_3 does not form a quasi-binary system, since complex changes take place within a certain composition range and the compound $Mg_2Cu_3Al_2$, which has *d* 6·5, separates in crystals at the bottom of the melt. The liquidus of the ternary system in this region consists of four surfaces sloping down to two eutectic valleys corresponding with the solidification of two ternary eutectics (A) containing magnesium 56·5, aluminium 26·5, copper 17%, melting point 412° C., and (B) containing magnesium 67·5, aluminium 0·5, copper 32%, melting point 484° C. Two ranges of solid solution occur, one extending from magnesium to the alloy with aluminium 8·8 and copper 6·2%, and the other from Mg_4Al_3 to the alloy with magnesium 58, aluminium 41·4, and copper 0·6%. The existence of the above phases has been confirmed by micrographic examination, 30 photographs of characteristic structures being given. The hardness of magnesium is increased more rapidly by addition of copper than by addition of aluminium, and chill-cast alloys are always harder than sand-cast. Forging and drawing reduce the hardness, particularly of alloys with a high copper content. The coeff. of thermal expansion (α) of aluminium–magnesium alloys increases slightly up to the limit of homogeneous solid solution, then decreases linearly with increasing proportion of eutectic; similar effects occur in the copper–magnesium system. In the ternary solid solution aluminium increases α, whilst copper tends to decrease it slightly. The density, and the electrical and thermal conductivities of numerous alloys containing up to 15% aluminium + copper have been determined, and the results are given in tables and graphs. Alloys with up to 12% copper or 6% aluminium (total not exceeding 15%) can be readily forged into pistons of good hardness and thermal conductivity for use in internal-combustion engines. Static bending tests are more satisfactory than the ordinary tensile tests for appraising the value of cast ternary alloys. Certain alloys in the drawn state have a fatigue limit which compares favourably with that of Duralumin, *e.g.* the 9 : 3, 9 : 6, and 6 : 9 aluminium–copper–magnesium alloys have fatigue limits of 12–13 kg./mm.^{2} with tensile strengths of 26–28 kg./mm.^{2}. The presence of copper increases the corrosion of these alloys slightly in acid media and considerably in saline media. Addition of aluminium to copper–magnesium alloys rapidly decreases their rate of corrosion.—A. R. P.

Selection of Alloys of the Elektron Type for the Casting of Aeroplane Parts. A. S. Ball (*Tehnika Vosdushnogo Flota* (*Technology of the Aerial Navy*), **1932**, (11–12), 1062–1068).—[In Russian.] The methods of manufacture, mechanical, casting, and corrosion properties were investigated of magnesium alloys containing (*a*) aluminium 4, zinc 3, manganese 0·2–0·5%; (*b*) aluminium 2, cadmium 2, copper 4, manganese 0·2%; (*c*) aluminium 6, zinc 3, manganese 0·2–0·5%; (*d*) aluminium 6·5, zinc 0·3, manganese 1%; (*e*) aluminium 8%; (*f*) aluminium 6, manganese 0·3%. Alloys (*a*) and (*b*) are recommended for fittings cast in chill moulds, alloy (*a*) is best for casting small structural details in sand moulds, and alloy (*c*) for large castings in sand.—N. A.

Alloys of Iron Research. XI.—The Constitution of the Alloys of Iron and Manganese. Marie L. V. Gayler. **Appendix I.—X-Ray Analysis of Manganese-Rich Alloys Heat-Treated and Quenched from Different Temperatures.** C. Wainwright (*Iron Steel Inst. Advance Copy*, **1933**, 1–48).—The constitution of the iron–manganese alloys has been determined by means of thermal, microscopical, and X-ray examinations of alloys made from very pure materials. Compared with previous determinations, the position of the liquidus and solidus has been appreciably raised and the existence of a peritectic between γ-iron and liquid to form γ-manganese has been confirmed. The δ–γ iron transformation takes place at 1504° C. from 1 to 8% manganese; γ-iron then separates directly from the liquid state, until at 1270° C. it reacts with the manganese-rich liquid to form a phase containing approximately 68% γ-manganese. This peritectic reaction extends from 65 to 74% manganese, after which the γ-manganese phase separates directly from the liquid on cooling. The constitution in the solid state of iron-rich alloys has not yet been solved. The changes in the solid state of manganese-rich alloys have been similarly determined. In the solid state of the manganese-rich alloys, the γ-manganese phase is shown to decompose into γ-iron and β-manganese at 1028° C. from 64 to 72% manganese, and similarly the β-manganese phase is shown to decompose into γ-iron and α-manganese at 600° C. from about 59 to 63% manganese. In Appendix I, the conclusions reached from X-ray analysis of manganese-rich alloys quenched from various temperatures and values of the parameters are given.—J. H. W.

Alloys of Iron and Manganese. Transformations and Heterogeneity in the Binary Alloys of Iron and Manganese. Francis M. Walters, Jr. (*Amer. Soc. Steel Treat. Preprint*, **1933**, Oct., 1–12).—These alloys may be made to exhibit striking differences in composition in the solid state by holding them within the α to γ transformation range. The heterogeneity may be demonstrated dilatometrically owing to the pronounced volume changes which occur. Homogeneity may be restored by heating to 100° C.—W. A. C. N.

A Correlation of Some Thermoelectric and Thermomagnetic Data. L. F. Bates (*Phil. Mag.*, 1933, [vii], **16**, 657–672).—Rods of manganese arsenide which have not been heated since their preparation are ferromagnetic up to about 45° C. They exhibit changes of magnetic properties following each transition from the ferromagnetic to the paramagnetic state until a steady condition is reached. These changes comprise a progressive increase in the intrinsic magnetization and a progressive lowering of the ferromagnetic Curie point. They are intimately connected with corresponding changes in the thermoelectric power of the substance.—J. S. G. T.

Solid Cadmium Amalgams; An X-Ray Proof of the Compound Cd_3Hg. Nelson W. Taylor (*J. Amer. Chem. Soc.*, 1932, **54**, 2713–2720).—Previous work on the cadmium–mercury system is summarized. Microscopic and thermal analysis gave no evidence of the formation of cadmium–mercury compounds, such as would have been expected from vapour-pressure and e.m.f. phenomena. The X-ray examination of a series of solid cadmium amalgams, annealed *in vacuo* at 147° C. for 72 hrs., revealed the existence of a solid phase (Cd_3Hg). Approximate lattice-constants are given; the body-centred tetragonal structure is apparently derived from the ω type of solid solution characterizing alloys containing 12 atomic-% or more, cadmium.—P. M. C. R.

Structure Viscosity of Dilute Amalgams. R. Köhler (*Kolloid-Z.*, 1933, **64**, 200–205).—Measurements of viscosity indicate that amalgams containing, respectively, 0·37% of copper and 0·5 or 1% of silver consist of colloid systems in which mercury is the dispersion medium.—E. S. H.

High-Grade Chromium–Nickel Alloys and Life Tests Thereon. W. Hessenbruch and W. Rohn (*Heraeus Vacuumschmelze* [10*th Anniv. Volume*], **1933**, 247–289).—The various methods which have been proposed for determining the useful life of wires of the Nichrome type as electric resistance heaters are critically discussed and shown to give variable results according to the heating and cooling rates employed in the test. Much more consistent results are obtained by measuring the rate of increase in resistance with time of heating at constant temperature, *e.g.* 1050° C., under constant voltage. The life of Nichrome wires is increased by additions of silicon and molybdenum and reduced by addition of carbon; plating with chromium or copper has no effect on the life, whilst coating with aluminium or silicon by cementation definitely reduces the life. Prolonged heating of the wires in carbon monoxide or dioxide at above 1100° C. results in absorption of carbon and subsequent precipitation of carbides along the grain boundaries on cooling. The life of the wires is independent of the diameter when this exceeds 0·6 mm., and for all wires at 900° C. it is 15 times as great as at 1050° C.; it is less with intermittent, than with continuous, heating, and with coarsely crystalline wire than with fine-grained. The melting and casting conditions have considerable influence on the life of Nichrome alloys; melting in hydrogen is more satisfactory than melting in air, but melting *in vacuo* gives the best alloys. Casting into copper moulds produces a finer structure than furnace cooling. Vacuum-melted alloys are softer and more easily worked by forging and drawing than alloys melted in air or hydrogen, and test-pieces bend without fracture in the notched-bar impact test. The average life of a good air-melted Nichrome is about 80 hrs. at 1050° C., but the same alloy vacuum-melted has a life of about 250 hrs. Prolonged heating of Nichrome containing chromium 33, nickel 50, iron 13, manganese 2, and molybdenum 2% results in the slow precipitation of a new phase along the crystal boundaries. This behaviour is exhibited by all the usual Nichrome alloys, and is accelerated by the presence of foreign elements; hence it appears that the generally accepted equilibrium diagram of the nickel–chromium–iron system does not represent the stable equilibria.—A. R. P.

On Sulphur-Resistant Alloys. H. Ipavic (*Heraeus Vacuumschmelze* [10*th Anniv. Volume*], 1933, 290–302).—In wet and dry atmospheres containing hydrogen sulphide, nickel–chromium alloys containing more than 50% nickel are rapidly attacked at high temperatures, the readily-fusible nickel sulphide formed spreading quickly along the grain boundaries until the wire is completely destroyed. Under similar conditions a protective sulphide film having no tendency to pass along the grain boundaries is formed on chromium–iron alloys with more than 30% chromium; cementation with aluminium or silicon is of no advantage. The behaviour of both types of alloys in atmospheres containing sulphur dioxide, *e.g.* furnace gases produced from the burning of oil or coal with a high sulphur content, is similar to that in hydrogen sulphide except that the rate of attack is slower.—A. R. P.

New Screen Metal Resists Corrosion and Staining [Inconel]. Anon. (*Daily Metal Reporter,* 1933, 33, (82), 4).—Inconel, containing approximately nickel 80, chromium 12–14, and iron 6%, is stated to possess exceptional resistance to corrosion by air, brine, and lactic acid. The alloy was originally applied to dairy equipment, but its tensile strength in the form of wire has been found sufficient to warrant its use in the manufacture of wire cloth. Screens made of this material are said not to corrode or stain in use, and to require no painting.—P. M. C. R.

On Alloys for [Watch and Clock] Springs with a Small Temperature Coefficient of the Elastic Modulus. R. Straumann (*Heraeus Vacuumschmelze* [10*th Anniv. Volume*], 1933, 408–423).—An alloy for the hair-springs of watches and clocks made by adding to 100 parts of a 33 : 67 nickel–iron alloy tungsten 8 (or molybdenum 6), beryllium 1, manganese 0·8, and silicon 0·1 parts has a very small linear temperature coeff., a high elasticity, and a high resistance to rusting, and is insensitive to magnetic fields. In combination with an anisotropic balance-wheel (*e.g.*, nickel silver) the system provides accurate timing over a wide temperature range. A non-rusting driving spring for clocks and watches with a high elasticity can be made of an alloy of nickel 60, chromium 15, molybdenum 65, iron 15, beryllium 0·65, and manganese 2%; such springs can be hardened by heat-treatment without becoming brittle and give more satisfactory service than the usual steel springs.—A. R. P.

Magnetic Properties and Chemical Compounds in Alloys. J. Dorfman (*Physikal. Z. Sowjetunion*, 1933, **3**, 399–417).—[In German.] Forrer, Sadron, and Neel's empirical data on the saturation moments of nickel alloys, have been recalculated on new assumptions. The results obtained indicate that (1) the atomic moments are a multiple of the Bohr magneton and (2) the absolute values of the atomic moments bear a definite relation to the number of valency electrons. From this it is inferred that the conducting electrons play no part in producing ferromagnetism, that ferromagnetism is due to the "missing" electrons in the unenclosed levels of the atom, and that in alloys the "excess" valency electrons can fill up these "gaps" in the atoms of the ferromagnetic metal and thus reduce the number of elementary magnets. The number of electrons of iron and cobalt filling these gaps in nickel atoms has been determined. The data so obtained have been checked with pure materials, and identical values for the relationship between the number of ionized atoms and the number of neutral atoms have been obtained by saturation magnetization and by susceptibility measurements. The methods have been applied to certain alloys, and the results afford a new insight into the origin of martensite and an explanation of the ferromagnetism of Heusler alloys.—N. A.

Non-Corrosive Silver Alloy Perfected in Japan. Anon. (*Daily Metal Reporter*, 1933, **33**, (169), 5); **Stainless Silver Alloy.** Anon. (*Met. Ind.* (*Lond.*), 1933, **43**, 310).—A "stainless" silver alloy for ornamental work, patented by Tadashi Tanabe, is stated to possess a tensile strength of 20 kg./mm.², an elongation of 11%, and a Brinell hardness of 60, as against 14 kg./mm.², 40%, 23, respectively, for pure silver. Its composition varies within wide limits, those quoted being zinc 0·5–20, tin 10–40, and silver 50–89·5%.—P. M. C. R.

Bearing Metals and Seatings for Aero-Engines. Jaroslav Malkovský (*Stroj. Obzor*, 1932, **12**, 273–278).—The best compositions, structure, casting temperature, and rate of cooling for high-grade bearing metals for aero-engines are discussed. Photomicrographs of good and faulty structures and the plan of a works are included.—R. P.

Design of Heat-Resisting Castings. Ralf S. Cochran (*Metal Progress*, 1932, **22**, (4), 45–49).—Abstract of a paper read before the Buffalo Convention, American Society for Steel Treating, Oct., 1932. The use of heat-resisting alloys, especially in beam conveyors, makes the elimination of unnecessary material important; accordingly, the questions of creep, beam design, and the chief operating stresses are considered. Compositions of suitable alloys are indicated, and some coeff. of friction at various temperatures are given.—P. R.

The Researches of A. Westgren in the Realm of Metallic Alloy Chemistry. N. Ageew (*Zhurnal Prikladnoi Khimii* (*Journal of Applied Chemistry*), 1932, **5**, (8), 1127–1129).—[In Russian.] An introduction to the paper on "The Problem of Alloy Chemistry" by A. Westgren (*Angew. Chem.*, 1932, **45**, 33–40; see this *J.*, 1932, **50**, 352). The historical development of Westgren's theories of the nature of intermetallic compounds and solid solutions, as the result of his X-ray investigations of the structure of alloys, is described. Westgren's earliest theory was the division of alloys into "ideal" compounds in which the atoms had a regular geometrical distribution in a space-lattice and "ideal" solid solutions in which the atoms had a statistical distribution. Later researches, however, showed that a regular geometrical structure was obtained if the ratio of the number of valency electrons to the number of atoms was a constant, which was usually a characteristic of a particular phase type.—M. Z

Properties of Alloys. R. S. Pratt (*Metal Progress*, 1933, 24, (2), 39–40, 50).—The structure and mechanical properties of the α-brasses are discussed. Graphs show the effect of cold-working on reduction of area, elongation, and tensile strength; the influence of cold-working and of annealing temperature on the same properties and on grain-size; and the effect of cold-working on tensile strength and Rockwell and Scleroscope hardness, the inter-relation of these properties varying considerably according to the degree of cold-working. The effects of common impurities are described. Uses are enumerated. Limitations of the material with respect to corrosion are discussed, and the selection of material for specific purposes is considered in relation to the American Society for Testing Materials, Specification B 36–27.—P. M. C. R.

Solid Solutions. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1933, 9, 53).—A brief article, referring to the results of C. H. Barrett (*Metals and Alloys*, 1933, 4, 63), which showed that the discrepancy between X-ray and density measurements of the lattice of aluminium–silver alloys, observed by other investigators, was due to imperfect data. There is thus no basis for the suggested third type of solid solution (additional to the substitution and interstitial types) in which groups of atoms are supposed to replace a number of atoms on the parent lattice.—R. G.

Studies on Precipitation-Hardening. Anomalies in the Course of Hardening During the Hardening Process. G. Masing and L. Koch (*Z. Metallkunde*, 1933, 25, 137–139, 160–163).—When a copper alloy with 2·5% beryllium is quenched and partly aged at 150° or 200° C., then aged at a higher temperature, a decrease in hardness occurs followed by a further increase. This "anomaly" has been studied in more detail by measurements of the Brinell hardness and electrical conductivity of Duralumin during ageing (*a*) first at 0°, then at 50°, 100°, or 150° C.; (*b*) first at 50°, then at 100° or 150° C.; and (*c*) first at 100° or 150°, then at 230° C. The initial decrease in hardness in the second ageing is associated with a more or less pronounced increase in the electrical conductivity and is probably due to a partial re-solution of the extremely minute nuclei which become unstable on heating at a higher temperature if their dimensions lie below a critical value. Theoretical aspects of the process of precipitation-hardening are discussed.—M. H.

Alloys Hardening at Elevated Temperatures. A. Portevin, E. Pretet, and E. Jolivet (*Revue du Nickel*, 1933, 4, 78–79).—Precipitation-hardening effects in certain iron–nickel–tungsten alloys containing high percentages of nickel and tungsten are recorded. In a particular case quoted the alloy was heated to temperatures between 650° and 1100° C. Precipitation was appreciable between 850° and 950° C.—W. A. C. N.

The Age-Hardening of Alloys as a Dispersoid-Chemical Problem. K. Trettin (*Kolloid-Z.*, 1933, 61, 125–127; *Chem. Zentr.*, 1933, 104, II, 121; cf. *J.*, this volume, p. 439).—By suitable heat-treatment of beryllium–copper alloys the hardness, tensile strength, and resistance to corrosion can be made equal to those of hardened steel. Magnesium–copper alloys can also be considerably hardened by heat-treatment. Hardenable copper alloys containing aluminium can be produced by addition of iron, cobalt, or nickel or mixtures of these in an amount exceeding the percentage of aluminium. The working properties of silicon–copper alloys are considerably improved by quenching which also produces a great increase in the resistance to corrosion. The modifications which occur in the structure of the above alloys on heat-treatment to produce these remarkable changes in properties are discussed from the point of view of the colloid chemist.—A. R. P.

Notes on the Ageing of Metals and Alloys. Albert Sauveur (*Amer. Soc. Steel Treat. Preprint*, 1933, Oct., 1–17).—A general review of the evidence in connection with the ageing of alloys, of the theoretical explanations which have been advanced, and of the predictions which may be made as to the behaviour of certain classes of alloys when quenched and subsequently modified.

The later section of the paper deals with the ageing of iron carbon alloys, but the principles involved afford instructive comparisons with those generally accepted for non-ferrous alloys. The hardening and tempering of steel are satisfactorily explained by the precipitation theory. The influence of nitrogen and oxygen on the ageing of steel is discussed. An interesting piece of technique is the use of the Brinell ball hardness test to produce cold-work deformation and the measurement of the change of hardness at the bottom of the depression by the Rockwell machine.—W. A. C. N.

The Present Status of Age-Hardening. Richards H. Harrington (*Amer Soc. Steel Treat. Preprint*, **1933**, Oct., 1–17).—The three theories of age hardening that are considered are (1) precipitation; (2) simple lattice strain; and (3) allotropic complications. Typical examples, ferrous and non-ferrous, are discussed in each instance. Other causes of age-hardening that are mentioned are: (*a*) gas reactions within a metal lattice; (*b*) a single solid solution phase in a quenched alloy which may, on reheating, be transformed into two solution phases, of which one or each is harder than the original; (*c*) recrystallization to a fine grain-size or the complete precipitation of a new phase along the lattice planes of maximum slip or deformation. Considerations affecting the choice of age-hardening alloys for specific requirements—tensile properties, spring properties—are discussed: the methods of investigation are described. The addition of cobalt to several age-hardening alloys has resulted in a marked increase in age-hardening properties, and often increases the temperature of maximum age-hardness. It acts, generally, in two ways—as a "desolvent," reducing the solubility of the precipitating constituent, part of the cobalt going into solid solution in the solvent lattice, and also by entering into a ternary constituent with the precipitating agent, thus usually decreasing the solubility of the latter.—W. A. C. N.

The Functioning of Entirely Metallic Piles in Contradiction of the Law of Electric Tension in Metals (Volta's Second Law). O. Scarpa (*Bull. Soc. franç. Elect.*, 1933, [v], **3**, 891–901).—Anomalies in the behaviour of certain metallic systems in electrical contact at constant temperature lead S. to conclude that Volta's Second Law and its corollaries hold good only when no mobile metallic ions are present, and cannot apply with any accuracy to metals in the liquid state, many metals being capable of an appreciable degree of interaction at room temperature. The systems studied are: copper–cadmium–mercury–platinum–copper; copper–zinc–mercury–platinum–copper; and the alloys of mercury with silver, platinum, gold, nickel, lead, bismuth, iron, and aluminium, respectively.—P. M. C. R.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from p. 551.)

The Mechanism of Crystal Growth. Wheeler P. Davey (*Amer. Soc. Steel Treat. Preprint*, **1933**, Oct., 1–32).—The paper deals with the evidence leading up to a picture of the mechanism of crystal growth and with the consequences of that mechanism in determining certain of the properties of crystals. It is shown that imperfection, rather than perfection, is the normal state of all crystals, no matter whether they have been grown from the vapour, liquid, or solid or from less stable crystals in contact with the growing crystal in a continuous solid. The various instances are discussed and illustrated by examples, and it is stated as a general conclusion that the ordinary properties of materials —crystal growth, tensile properties, segregation of impurities, properties of the melt, etch figures, and segregate structures of the Widmanstätten type—all follow as natural corollaries to the theoretical picture which D. develops. A *bibliography* of 31 references is included.—W. A. C. N.

Some Characteristics of the Microstructure of Cold-Drawn Brass Tubes. James Fox (*Mech. World*, 1933, **94**, 722–723).—A series of photomicrographs is given illustrating the transverse sections of 70 : 30 brass tubes in various degrees of reduction. [*Note by abstractor:* F.'s interpretation of these structures is open to criticism.]—F. J.

Photomicrography. A. MacDougall (*J. West Scotland Iron Steel Inst.*, 1931–1932, **39**, (2), 13–23; and (abstract) *Heat.-Treat. and Forging*, 1932, **18**, 351–359, 366).—A review of the technique of photomicrography, with special emphasis on diffraction effects, the importance of critical illumination, and the use of filters.—P. M. C. R.

X-Ray Investigations in the System (Zn, Cd)–Sb.—II. F. Halla, H. Nowotny, and H. Tompa (*Z. anorg. Chem.*, 1933, **241**, 196–200).—Cf. this *J.*, 1930, **43**, 525. Crystal structure of the unstable compound Cd_3Sb_2: monoclinic, a = 7·20, b = 13·51, c = 6·16 A. with 4 molecules in the elementary cell. Crystal structure of ZnSb: rhombic, a = 6·17, b = 8·27, c = 3·94 A. with 4 molecules in the elementary cell. From X-ray investigations and density measurements after different heat-treatments of an alloy corresponding in composition with the formula Zn_3Sb_2 it is concluded that the compound Zn_3Sb_2 is stable only at elevated temperatures and decomposes on cooling into Zn and ZnSb.—M. H.

X-Ray Analysis of the Systems Iron–Boron, Cobalt–Boron, and Nickel–Boron. T. Bjurström (*Ark. Kem. Min. Geol.*, 1933, **A 11**, (5), 1–12; *Chem. Zentr.*, 1933, **104**, I, 3680).—The borides Fe_2B, Co_2B, and Ni_2B crystallize in the body-centred tetragonal system with 4 molecules in the elementary cell: for Fe_2B, a = 5·099, c = 4·240 A.; for Co_2B, a = 5·006, c = 4·212 A.; for Ni_2B, a = 4·980, c = 4·236 A. The borides FeB and CoB crystallize in the rhombic system V_h^{16}; for FeB, a = 4·053, b = 5·495, c = 2·946 A.; for CoB, a = 3·948, b = 5·243, c = 3·037 A. The atomic coordinates have been determined in all cases. NiB has not been prepared.—A. R. P.

In Which Binary Intermetallic Alloys Are β-, γ-, and ε-[Brass] Lattices to be Expected? H. Perlitz (*Metallwirtschaft*, 1933, **12**, 103–104).—From Hume-Rothery's and Westgren and Phragmén's rules on the occurrence of phases with the structure of β-, γ-, and ε-brass it is deduced that such phases can occur in an alloy system when one component has at the most one, and the other component at least two valency electrons. In the light of this rule manganese, iron, cobalt, nickel, rhodium, palladium, and platinum have no metallic valency electron, and copper, silver, and gold one; beryllium, magnesium, zinc, and cadmium have two, aluminium has three, and mercury, indium, germanium, and tin have five such electrons.—V. G.

The Structure of Liquid Mercury. O. Kratky (*Physikal. Z.*, 1933, **34**, 482–487).—Debye and Menke's results relating to the X-ray investigation of the structure of liquid mercury (*ibid.*, 1930, **31**, 797, and 1932, **33**, 593) are explained by assuming the existence of a closest-packed hexagonal atomic lattice within the liquid.—J. S. G. T.

X-Ray Analysis of the Alloys of Mercury with Silver, Gold, and Tin. Sten Stenbeck (*Z. anorg. Chem.*, 1933, **214**, 16–26).—Murphy and Preston's work (cf. this *J.*, 1933, **46**, 507–527) on the silver–mercury system has been confirmed. The phase with 60% mercury has a hexagonal close-packed lattice; after tempering at 100° C. a_1 = 2·964 A., a_3 = 4·831 A., a_3/a_1 = 1·631 (saturated with silver) or a_1 = 2·987 A., a_3 = 4·830 A., a_3/a_1 = 1·617 (saturated with mercury). The homogeneous phase with about 74% mercury (Ag_5Hg_8) has a cubic body-centred lattice similar to that of γ-brass with a = 10·013 A. when saturated at 100° C. with silver and a = 10·031 A. when saturated with mercury. In the gold-mercury system X-ray analysis of alloys tempered at 90° C. for several months has shown that the limit of the cubic face-centred gold-rich solid solution lies at 16·7% mercury ($a = 4{\cdot}098$ A.) and that 5 intermediate phases exist: β (close-packed hexagonal) with 21·6 ($a_1 = 2{\cdot}900$ A., $a_3 = 4{\cdot}770$ A., $a_3/a_1 = 1{\cdot}648$)—27·7% mercury ($a_1 = 2{\cdot}915$ A., $a_3 = 4{\cdot}802$ A., $a_3/a_1 = 1{\cdot}647$), and γ, δ, ε, and μ with about 50%, 67%, 72%, and 80% mercury, respectively. The complex crystal structures of γ, δ, ε, and μ have not been elucidated. Mercury is not appreciably soluble in solid tin but between 6 and 10% mercury an intermediate phase exists with a simple hexagonal crystal lattice ($b = 3{\cdot}198$ A., $c = 2{\cdot}980$ A., $c/b = 0{\cdot}932$ at 8% mercury). A somewhat "deformed" structure of the same nature has been found in an alloy with 14% mercury; it has a rhombic lattice: $a = 5{\cdot}548$ A., $b = 3{\cdot}196$ A., $c = 2{\cdot}981$ A., $a/b = 1{\cdot}736$, $c/b = 0{\cdot}933$). The question whether these two lattices belong to the same phase or to two different phases could not be decided by X-ray analysis.—M. H.

The Crystalline Structures of Electrolytically Deposited Alloys. An X-Ray Study of Silver-Cadmium Deposits. Charles W. Stillwell and Lawrence E. Stout (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 457–459).—See *J.*, this volume, p. 361.—A. R. P.

Crystal Parameters of Four Metals When Under Reduced Pressure. E. A. Owen and E. L. Yates (*Phil. Mag.*, 1933, [vii], **16**, 606–610).—A precision X-ray camera suitable for the investigation of materials at high temperatures *in vacuo* is briefly described. The crystal parameters of four spectroscopically pure elements—*viz.* gold, platinum, palladium, and rhodium—have been determined. Each specimen was heated *in vacuo* to a high temperature and maintained thereat for a definite time. It was then allowed to cool to atmospheric temperature and exposed to X-rays *in vacuo*. The following values of the respective parameters (A.U.) were found: gold, $4{\cdot}0699_9$; platinum, $3{\cdot}9158_0$; palladium, $3{\cdot}8823_8$; rhodium, $3{\cdot}7955_9$.—J. S. G. T.

On the X-Ray Investigation of Molten Metals and Alloys.—I. F. Sauerwald and W. Teske (*Z. anorg. Chem.*, 1933, **210**, 247–256).—The question of the interpretation of the X-ray interferences of molten metals is discussed. The results of S. and T.'s work on mercury, thallium, tin, and lead and of earlier work on potassium, sodium, and gallium are not opposed to the general hypothesis that in a molten metal there are locally atomic arrangements which correspond with the structure in the solid state. Investigation of alloys (Hg_5Tl_2, KHg_2) which can very probably be regarded as intermetallic compounds showed that larger molecular complexes can be detected in them than in the structure of the components.—M. H.

Adsorption, Oriented Overgrowth and Mixed Crystal [Solid Solution] Formation. C. W. Bunn (*Proc. Roy. Soc.*, 1933, [A], **141**, 567–593).—The properties of crystals usually regarded as being built up by continual adsorption and inclusion of impurity during growth are compared with those of solid solutions, and it is concluded that the two types differ only in degree. The condition for strong adsorption is similarity of lattice structure and interatomic distances on specific planes only; the rest of the structures may be quite dissimilar. This condition is the same as that necessary for oriented overgrowth of different crystals on each other. Another consequence of the ideal is that modification of habit should be reciprocal. A simple explanation of modification of habit is suggested: on the affected faces a mixed crystal is formed and, being unstable, tends to redissolve, thereby reducing the rate of growth. Examples are given.—J. S. G. T.

A Rapid Method of Determining the Crystal Axes of Single Crystal Wires of Certain Metals. R. Roscoe and P. J. Hutchings (*Phil. Mag.*, 1933, [vii], **16**, 703–707).—Method and apparatus for the determination of the crystal axes of single-crystal wires from the elliptical slip bands which appear on the surface of the stretched wires are described. The method is applied more especially, to cadmium wires.—J. S. G. T.

On the Broadening of the Debye–Scherrer Lines in the Röntgenograms of Metals with Cold-Working and Annealing. S. Konobievsky and J. Selisskiy (*Trudi rentgengraficheskoy laboratorii Ginzvetmeta* (*Transactions of the X-Ray Laboratory of Ginzvetmet*), 1933, (2), 1–19).—[In Russian.] The broadening of the lines in röntgenograms of metals after cold-deformation has been investigated with especial reference to magnesium and Elektron (aluminium 4·2; zinc 0·8%). In contradistinction to pure metals, there is no separation of the K_a doublet in Elektron after annealing for many hours at 150° C., and the broad lines remain up to the temperature of recrystallization. Two specimens, A and B, of cold-worked Elektron were annealed for 5 minutes at 280° C. (*i.e.* above the recrystallization temperature), and B was further annealed for 8 hrs. at 150° C.; A showed a distinct separation of the K_a doublet, whereas B showed none. This result may be explained by the diffusion in the magnesium lattice at 150° C., of the dissolved aluminium and zinc. Owing to the asymmetric deformation of the lattice and the presence of unequal residual strains, this diffusion causes an irregular distribution of solute atoms. It has been shown theoretically that the recovery from elastic stress during heating of a deformed solid solution lattice through a certain temperature range must take place by means of a redistribution of the solute atoms. The connection between the observed phenomena and the change in recrystallization temperature of Elektron is shown, and the possibility of that factor influencing the course of phase changes in alloys is suggested.—N. A.

IV.—CORROSION

(Continued from pp. 555–556.)

Dissolution of Corrosion Products of Light and Ultra-Light Alloys. Paul Bastien (*Rev. Mét.*, 1933, 30, 284–286).—Attention is directed to the method which has been adopted as standard by the Aluminium Association for cleaning-off the corrosion product from corroded samples of light aluminium alloys. The samples are immersed for 30 minutes in concentrated nitric acid heated to 30° C., rinsed carefully, and dried in an oven at 120°–150° C. The method is unsuitable for observing the degree of corrosion when the latter is of the intercrystalline or other deep-seated type. B. refers to Whitby's method for removing corrosion product from magnesium-rich alloys. The formation of protective films often renders the interpretation of results of corrosion tests difficult. The influence of aluminium content in magnesium-rich magnesium–aluminium alloys on the rate of corrosion in hydrochloric acid, citric acid, and magnesium chloride solutions, and the influence of silicon content of magnesium-rich magnesium–silicon alloys on the rate of corrosion in 1% hydrochloric acid are illustrated by graphs as examples.—H. S.

A Review of the Behaviour of Aluminium and Its Alloys Towards Materials of the Chemical and Foodstuffs Industries. H. Bohner (*Korrosion u. Metallschutz*, 1933, 9, 86–92, 113–122).—An alphabetically arranged list of foodstuffs and pharmaceutical and other chemicals with recent information on their behaviour in contact with aluminium and its alloys.—A. R. P.

The Use of Aluminium Alloys for the Construction of Stills and Rectifying Apparatus for Alcohol. F. Bendix (*Z. Spiritusind.*, 1933, 56, 46–47; *Bur. Chem. Abs.*, 1933, [B], 431).—Silumin is recommended. It is much stronger than pure aluminium, forms good castings, can be repaired by welding, and is satisfactorily resistant to corrosion by spirit mashes. Strips having 133 cm.^{2} of area, fixed inside a mash column still of iron, and not insulated from the latter, lost in 170 days only 1·1 grm. in weight, equivalent to a layer of metal 0·03 mm. thick.—S. G.

Contribution to the Question of the Influence of Heat-Treatment of Age-Hardenable Aluminium Rolling Alloys on Their Resistance to Corrosion by Sea-Water. Helmut Mann (*Korrosion u. Metallschutz*, 1933, 9, 141–150, 169–178; and (abstract) *Met. Ind.* (*Lond.*), 1933, 42, 645–646).—The effect of annealing and ageing temperatures and duration of ageing on the rate of corrosion in 3% sodium chloride solution containing 0·1% hydrogen peroxide has been determined for the alloys (A) Duralumin 681 B (copper 4·07, magnesium 0·50, manganese 0·60, iron 0·31, and silicon 0·24%) and (B) Lautal VLW 14 (copper 4·27, manganese 0·45, iron 0·30, silicon 0·78%). In the first series of tests the alloys were annealed for 20 minutes in a salt bath at temperatures between 460° and 540° C., quenched in water at 10° C., and aged at room temperature for at least 150 hrs.; the best resistance to corrosion was obtained after annealing (A) at 510° C. and (B) at either 480° or 515°–520° C. In the second series of tests the annealing temperature was 505°–510° C. and the specimens were aged at 75°–180° C. for 16, 32, or 48 hrs. after ageing for 150 hrs. at room temperature; a well-defined maximum of corrosion of the intercrystalline type occurred with an ageing temperature of 125°–145° C. for (A) and 100°–145° C. for (B). The more prolonged the ageing in each case the lower was the ageing temperature which promoted corrosion. With ageing temperatures of 150°–175° C. a marked decrease occurred in corrosion. The causes of these variations in the corrodibility with the heat-treatment are discussed from the point of view of the precipitation theory of hardening. —A. R. P.

An Investigation of Structural Corrosion of Aluminium Alloys. I.—Electrode Potentials of the Structural Constituents of Aluminium Alloys. G. W. Akimov and A. S. Oleshko (*Zhurnal Fizicheskoy Khimii* (*Journal of Physical Chemistry*), 1932, 3, (4), 336–344).—[In Russian.] The following values have been obtained for the electrode potentials, E_h of single crystals of the constituents of aluminium alloys in a 3% sodium chloride solution at 17°–18° C.; aluminium — 0·55; silicon — 0·421 to — 0·508: $FeAl_3$ — 0·14 to — 0·333; $CuAl_2$ — 0·371; $MnAl_3$ — 0·26 to — 0·607; Mg_2Si — 1·275 to — 0·427: $NiAl_3$ — 0·49 to — 0·471. Duralumin single crystals had $E_h =$ — 0·44 to — 0·41. E_h is calculated from the expression $E_h = E_c + 0{\cdot}250$, where E_c is the potential against a calomel electrode.—N. A.

Intercrystalline Corrosion of Duralumin. A. J. Sidery, K. G. Lewis, and H. Sutton (*Aeronaut. Res. Cttee. R. and M.* No. 1523, 1933, 1–3).—An abstract of a paper published in this *J.*, 1932, 48, 165.—A. R. P.

Action of Acids on Iron and Copper [Corrosion of Sugar Factory Plant]. J. Zamaron (*Bull. Assoc. Chim. Sucr.*, 1933, 50, 108–113; *Bur. Chem. Abs.* 1933, [B], 709).—Abnormal corrosion of diffusion-battery steel calorisator tubes in a beet-sugar factory, involving a loss of 44% of the metal in 4 campaigns, is attributed to the acids in the raw juice. No such corrosion occurred in the tubes of the carbonated juice heater. Pieces of ordinary steel immersed for 7 hrs. in 0·04–0·16% sulphuric acid at 90° C. lost 0·4–1·4% in weight; in acetic acid of the same range of concentration under similar conditions losses of 1·2–1·5% were observed. Similar experiments with copper showed losses only about $\frac{1}{10}$ as great in sulphuric acid and much less in acetic acid.—S. G.

A Peculiar Case of Corrosion of Copper Sheet. M. von Schwarz and G. Koch (*Korrosion u. Metallschutz*, 1933, 9, 123–125).—A hot-water reservoir made of 0·7 mm. thick copper sheet and tinned internally was very severely corroded after short use with water containing a high content of calcium bicarbonate, and soon after became perforated in many places. Tests on tinned copper in the water showed that in very few specimens of the commercial product was the tin film entirely sound. The presence of cuprous oxide in the copper causes faulty adherence of the tin film.—A. R. P.

Corrosion of Iron, Chromium, and Nickel. Resistance Alloys of These and Other Metals. R. Müller, G. Hahn, and H. Krainer (*Berg. hüttenmänn. Jahrb.*, 1932, **80**, 74–78; *Chem. Zentr.*, 1932, **103**, II, 251; *Brit. Chem. Abs.*, **1933**, [B], 349).—With magnesium fluoride (melts at 950° C.), nickel was the most resistant, chromium–nickel steels moderately resistant, and heat-resistant silicon steels considerably attacked.—S. G.

Resistance to Intercrystalline Corrosion of Acid-Resistant and Hardenable Chromium–Nickel Alloys. W. Hessenbruch and E. Horst (*Heraeus Vacuumschmelze* [*10th Anniv. Volume*], **1933**, 233–246).—The rate of corrosion in 10% solutions of hydrochloric, sulphuric, and nitric acids of vacuum-melted Contracid (chromium 12·55, nickel 61·75, iron 13·37, manganese 2, silicon 0·4, cobalt 3, tungsten 3·41, molybdenum 3, carbon 0·05%) is practically unaffected by cold-work or by annealing at temperatures up to 1000° C. The ordinary 18 : 8 chromium–nickel steel shows a slightly greater rate of corrosion in sulphuric acid and a much greater rate in hydrochloric acid; in all three acids corrosion increases rapidly after annealing at 500°–800° C., due to intercrystalline penetration of the acid and to the effect of local elements formed by precipitation of constituents from solid solution. Tests have been made to determine the effect of heat-treatment on the corrosion-resistance of (*a*) nickel containing iron 0·2, manganese 1·0, and beryllium 1·8% and (*b*) Contracid containing nickel 60, chromium 15, iron 14·9, molybdenum 7, beryllium 0·61, manganese 1·8, silicon 0·6, and carbon 0·02%; neither quenching from high temperatures nor prolonged annealing produced any marked effect on the very slow rate of corrosion of these alloys in 10% mineral acids.—A. R. P.

The Influence of Corrosion on the Fatigue Limit of Chromium–Nickel Alloys. A. Thum (*Heraeus Vacuumschmelze* [*10th Anniv. Volume*], **1933**, 424–434).—The fatigue limit (8 × 10^7 alternations of stress) of Contracid B7M with 0·65% beryllium is 26–28 kg./mm.^{2} in the temper-hardened state, and is practically unaffected by corrosion in tap water. The results are compared with those obtained by other workers on non-rusting steels.—A. R. P.

Wire Rope Research. Anon. (*Colliery Guardian*, 1933, **147**, 336–338).—From an appendix to the 11th Annual Report of the Safety in Mines Research Board. An account is given of observations made on deteriorated zinc coatings on wires taken from winding ropes.—P. M. C. R.

General Observations on the Determination of Loss in Weight in Corrosion Tests. Albert Portevin (*Rev. Mét.*, 1933, **30**, 275–279).—The degree or intensity of corrosion may be studied by observation of loss in weight if the corrosion is of determined types (simple solution or superficial corrosion), and if the corrosion is sufficiently intense to render the loss in weight measurable with sufficient accuracy. There are 3 methods: (*a*) direct, by difference in weight of the metal before and after corrosion; (*b*) indirect, by determination of the products of the reaction; (*c*) mixed, by observing the general change in weight resulting from the reaction. The relative merits and limitations of these methods are discussed. Methods (*a*) and (*b*) imply ability to remove corrosion product from the metal, whilst methods (*b*) and (*c*) cannot be applied to marine exposure tests or immersion tests in rivers. Reference is made to Pomey's reagent for the removal of rust from iron, and the preparation and use of the reagent are described.—H. S.

Determination of Loss in Weight in Corrosion Tests of Metallurgical Products. Jean Cournot (*Rev. Mét.*, 1933, **30**, 280–283).—Methods for observing corrosion as employed in France are discussed, and those recommended by the Sous-Commission de Normalisation under the presidency of M. Legendre and the Commission de Corrosion under C. Grard are outlined. C. points out that brushing or scratch-brushing to remove corrosion product and to indicate loss of metal due to corrosion is objectionable and should be substituted by chemical methods of such a nature as not to result in any attack on the underlying sound metal. A method of removing corrosion product from iron and steel is described. The piece to be cleaned is immersed in a boiling 20% solution of caustic soda: 30 grm. of zinc dust are then added to each litre of solution. Most of the corrosion product falls off, the rest being left in a loose condition on the surface and easily removed by brushing with a soft hair brush. The results given indicate that the chemical method gives consistent values of loss in weight and indicates greater loss than the usual brushing method.—H. S.

Results of Corrosion Research and New Methods of Testing Metals for Resistance to Corrosion and Erosion. Walter Denecke (*Giesserei*, 1933, **20**, 89–93).—A review of recent work with illustrated descriptions of modern apparatus for testing the corrodibility of metals under standardized conditions. —A. R. P.

Preparation of Test-Pieces for Exposure Tests of Electrolytic Coatings on Steel. Anon. (*Galvano*, **1932**, (5), 27–28; (6), 17–20).—Translation of a report of a joint committee of the American Electroplaters' Society, American Society for Testing Materials, and U.S. Bureau of Standards; see this *J.*, 1932, **50**, 609.—E. S. H.

Corrosion of Metals by [Vegetable] Tan Liquors. IV.—Corrosion of Submerged Metals in Movement. M. P. Balfe and H. Phillips (*J. Soc. Leather Trades Chem.*, 1933, **17**, 448–459; *Bur. Chem. Abs.*, **1933**, [B], 791).—Cf. this *J.*, 1932, **50**, 547, and this volume, p. 22. Chromium–iron and nickel–iron–chromium alloys are not corroded and iron–silicon alloy is slightly corroded by vegetable tan liquors and bleaching extracts, respectively. Phosphor-bronze, nickel, Monel metal, and copper–aluminium–nickel alloy are equally resistant, but aluminium–brass is more resistant than are these to both vegetable tan liquors and bleaching extracts. Copper was equally resistant to chestnut extract but less resistant than these to bleaching extracts. An aluminium–magnesium–manganese alloy is corroded but the tan liquors are not contaminated. Brass is not superior to other copper alloys, nickel, or Monel metal. Metals are not markedly corroded by algarobilla liquors.—S. G.

Corrosion Effects of Lubricants on Bearing Surfaces. Christopher H. Bierbaum (*Iron Age*, 1933, **132**, 20–21, 58).—The corrosion effects of various lubricants on bronze were investigated by heating the oil, with and without additions, to 150° F. (65° C.), bubbling air through and introducing polished metallographic specimens into the oil, the resulting effects being examined microscopically. It was found from a purely chemical point of view that: (1) the oils may have no effect, an exceedingly rare condition, (2) they may have a slight selective corrosion effect on the softer formations, which may be beneficial, (3) they may have an excessive selective corrosion effect on the softer formations, causing pitting and reducing the bearing life, (4) they may have a selective effect on the harder formations, thereby destroying both the bearing value and the life of the alloy, (5) they may corrode all phases of the alloy, producing a general destructive effect.—J. H. W.

The Resistance to Oxidation of Lubricating Oils. Anon. (*Automobiltech. Z.*, 1933, **36**, 367).—The corrosive effects of lubricating oils are mainly due to their acid content. Inorganic acids occur only in oils of mineral origin; the less highly corrosive organic acids are present in almost all oils to a greater or less extent. If the content of such acids is too high there is danger not only of corrosion, but also of the formation of an obstructive slimy deposit. Improvements in acidity titrations are suggested. In use, the catalytic action of the metallic parts promotes oxidation; existing methods of estimating this effect are briefly reviewed, and an accelerated method is described, involving the use of "Perhydrol" (hydrogen peroxide).—P. M. C. R.

The Corrosion of Metals: Its Causes and Effects. G. Guzzoni (*Aerotecnica*, 1933, **13**, 714–744).—An account is given of the principles of the electrochemical theory of corrosion, the factors governing the corrosion of metals are discussed, and modern methods of protection are described.—G. G.

The Electrochemical Theory of Corrosion. Oliver P. Watts (*Electrochem. Soc. Preprint*, **1933**, Sept., 219–224).—The opinions of eleven leading exponents of the electrochemical theory of corrosion in England and the U.S.A. as to the fundamentals of the process are briefly summarized and discussed by W.
—A. R. P.

Season-Cracking Due to Corrosion (Corrosion-Fatigue as the Cause of Premature Wear on Cylinders). P. Nettmann (*Automobiltech. Z.*, 1933, **36**, 438–439).—Previous work on corrosion-fatigue is briefly reviewed, and is correlated with recent researches dealing with the influence of lubrication on cylinder wear. Faulty lubrication in itself seems to have no appreciable effect on wear, the main operative factor being the temperature of the cylinder walls. If this is sufficiently low, the condensation of water produced by combustion may set up corrosion, the necessary p_H value being given by the presence of alcohol or its combustion products.—P. M. C. R.

Dissolved Oxygen and Corrosion. F. J. Matthews (*Eng. Rev.*, 1933, **47**, 106–108).—The principle of differential aeration is discussed, and its application to local concentrations of oxygen is indicated. Certain common cases are quoted in illustration. Inhibitory methods are classified; other methods mentioned are de-aeration, agitation and spraying of water, and electrical protective devices.—P. M. C. R.

Electrolytic Corrosion of Heating Coils in Hot Plates Fitted with Unipolar Switches. W. Schmidt (*A.E.G. Mitt.*, **1933**, (4), 139–142).—Corrosion is traced to the electrolysis of moisture absorbed during periods of disuse by the porcelain insulators. The oxygen thus produced rapidly attacks the material (nickel–chromium alloy) of the coils. Tests on specimen coils in moist air with a.c. and d.c. showed that only d.c. produced any appreciable corrosive effect; this confirms observations made under ordinary service conditions.
—P. M. C. R.

9th Report of the Corrosion Committee of the Association Suisse des Électriciens and Three Associated Societies. Anon. (*Bull. Assoc. Suisse Élect.*, 1933, **24**, 409–411).—Periodic inspection of electric tramways and railways, together with careful avoidance of supercharging of conductor rails, has resulted in a marked diminution of ground corrosion due to stray currents. An extension of such control is expected. Research on subterranean corrosion (see 8th Report, *ibid.*, 1932, **23**, 275–277, and this *J.*, 1933, **53**, 3, 131) has been continued and extended to aluminium and its alloys. The action of certain corrosive agents on metallic conductors has been observed, in order to elucidate the mechanism of the process. Corrosion under a.c. has also been studied.
—P. M. C. R.

Chemical Injection Retards Corrosive Action. Anon. (*Oil Weekly*, 1933, **70**, (3), 21–22).—In certain Kansas oil wells, corrosion of metallic parts (ferrous and non-ferrous) is severe on account of the action of hydrogen sulphide in the presence of brines of low sodium chloride concentration. Caustic [soda] was found to give the best protection against further action, and methods of injection are described.—P. M. C. R.

Reducing Metal Corrosion Rate by Use of an Inhibitor. A. R. Dunham (*Gas Age-Record*, 1933, **71**, 657–658).—Tests relating to the reduction of corrosion of iron by the use of tetrahydronaphthalene are described.—J. T.

Erosion in Steam Turbines. C. R. Soderburg (*Mech. World*, 1933, **93**, 212–213).—Abstract of a paper read before the Engineers' Society of Western Pennsylvania. The most favourable solution of this problem is to apply separate shielding strips of tungsten, tantalum, Stellite, &c., to the blades by welding or soldering to render them impervious to the bombardment of the water-drops.—F. J.

V.—PROTECTION

(Other than Electrodeposition.)

(Continued from pp. 556–557.)

The Protection of Metals against Corrosion. The Principles of the Protection of Metals. J. Glaymann (*Usine*, 1932, **41**, (1), 29–30).—Consideration of the protection of metal parts against corrosion is divided into: (1) chemical composition; (2) physical constants and treatment of the part; (3) medium in which the part will work; (4) nature and intensity of the work to be undertaken; (5) immediate neighbourhood of the part; (6) duration of protection required. These factors are briefly discussed in general terms.—R. B. D.

Penetration of Non-Metallic Protective Coatings on Aluminium by Halogen Ions. L. Tronstad and B. W. Bommen (*Kong. Norske Videnskab. Selskabs Forhandl.*, **1933**, 175–178; *Chem. Zentr.*, 1933, **104**, I, 3237).—The resistance of passive films on aluminium to penetration of chloride ions has been determined under various electrical and corrosive conditions. The results indicate that the film most resistant to chloride attack is obtained by anodic oxidation of the aluminium at 50° C. with 150 v. in 0·01*N*-potassium chromate solution. —A. R. P.

Electrolytic Oxidation of Aluminium by Means of a High-Frequency Alternating Current (Preliminary Results). A. F. Valter, S. S. Gutin, T. G. Lapunzova, and D. V. Stepanov (*Zhurnal Tehnicheskoy Fiziki* (*Journal of Technical Physics*), 1932, **2**, (9–10), 1090–1093).—[In Russian.] Preliminary data on the electrolytic oxidation of aluminium by high-frequency currents (500, 13,000, and 10^6 cycles/second).—N. A.

The Eloxal Process. Hans Schmitt (*Korrosion* (Suppt. to *Chem. Apparatur*), 1933, **20**, 13–14).—Cf. *J.*, this volume, pp. 84, 195, 245. The electrolyte of the Eloxal process for the anodic oxidation of aluminium is a solution of oxalic acid containing varying quantities of strong inorganic acids other than those of the halogens. The crystalline structure of the deposit can be modified at will by varying the concentration of the bath, the temperature, and the current conditions; thus porous films suitable for impregnation with fatty substances and colouring matter and dense, hard, water-resistant films of the nature of corundum are both readily obtainable. The thickness can vary from almost invisible films to about 0·8 mm. A recent modification of the process for large castings consists in spraying the reagents with an aerograph over the casting and, after allowing a suitable period of reaction, removing the excess with a water spray.—A. R. P.

The Protection of Aluminium and Its Alloys by the New "Protal" Process. J. Bary (*Aéronautique*, 1932, **14**, 151–152).—In the "Protal" process, the aluminium is immersed in a solution of an alkaline salt of a metal the higher oxide of which is soluble and lower oxide insoluble in the alkali. The hydrogen evolved reduces the soluble oxide to the insoluble form, which is deposited as an adherent layer on the surface.—J. C. C.

Alumilite. H. Bergston and R. E. Pettit (*Quarterly Rev. Amer. Electroplaters' Soc.*, 1933, **19**, (10), 47–61).—A long general account is given of the Alumilite process of anodically oxidizing aluminium in sulphuric acid solution and of colouring the deposits; no precise details of the baths used or of the operating conditions are given, but numerous claims are made for the corrosion resistance of the products of the process.—A. R. P.

Increase of Resistance of Mild Steel to Oxidation at High Temperatures by Means of Aluminium Coatings. L. P. Istomin (*Metallurg* (*The Metallurgist*), 1932, **7**, (12), 48–52).—[In Russian.] The properties of mild steel (carbon 0·12, manganese 0·3, phosphorus 0·034, silicon 0·037, chromium 0·14%) aluminium-coated by hot-dipping under varying conditions were investigated, and the nature of the coatings was metallographically examined. The results are compared with those obtained by the cementation process using a bath containing ferro-aluminium 49, aluminium oxide 49, and ammonium chloride 2%. It is concluded that the hot-dipping process effects a cheap and simple method of protecting mild steel, the resulting resistance to oxidation being equal to that obtained by cementation with ferro-aluminium. The best results are obtained at 800° C., and maintenance in the dipping bath for 20 minutes, followed by annealing for 4 hrs. at 900° C. The latter process may be regarded as causing a diffusion of the ferro-aluminium surface alloy into the body of the steel. The amount of aluminium used is very low—about 800 grm./m.^{2}—and the presence of some iron in it (above 1%) is an advantage, since it prevents the dissolution of more iron from the steel to be coated.—M. Z.

Anodic Treatment and Dyeing of Aluminium Castings. N. D. Pullen (*Mech. World*, 1933, **94**, 668–669).—An abstract of a paper read before the Institute of British Foundrymen, see *J.*, this volume, p. 444.—F. J.

Hot-Dip Cadmium. Wallace Imhoff (*Met. Ind.* (*N.Y.*), 1932, **30**, 269; and (abstract) *Galvano*, **1932**, (4), 20).—A method for cadmium coating is suggested, involving the use of zinc to give a coherent bond with the [iron] base. The proportions recommended are cadmium 95, zinc 5%, with modification as requisite; the addition of a little lead should eliminate brittleness, and the bad colour due to oxidation is prevented by adding aluminium. Details as to flux and operating temperature are given.—P. M. C. R.

The Influence of Temperature Regulation During Tinning on the Resistance of Tinned Copper Wire to Corrosion. M. O. Kornfeld (*Vestnick Elektropromishlennosti* (*Messenger of the Electrical Industry*), **1932**, (1), 21–24).—[In Russian.] Published data on the structure of the tin coating are reviewed, and an investigation made on a polished specimen of an oblique section of a tinned wire is described. The effect of rubber during vulcanization conditions has been studied with alloys of a composition corresponding with the layers formed in tinning. It is shown that the stability of the tin layer can be increased by maintaining a low copper content in the tinning bath, by keeping the temperature at the minimum and by suitably designing the buffing mechanism to avoid removing the outer stable tin layer.—N. A.

Testing the Tinning of Rubber-Insulated Copper Wire. A. R. Matthis (*Kautschuk*, 1933, **9**, 4–8; *Brit. Chem. Abs.*, **1933**, [B], 309).—A piece of wire 4 dm.^{2} surface is coiled and the exposed copper ends are waxed; it is then rotated with 50 c.c. of aqueous ammonia (d 0·91) in a horizontal, wide-necked bottle closed with a cork covered with tin foil, for 5 minutes. The dissolved copper is then determined. Judged by a comparison of the details and results with those of other methods, the new test has distinct advantages.—S. G.

Galvanizing Fluxes. W. H. Spowers, Jr. (*Wire and Wire Products*, 1933, **8**, 165–167, 184).—The use of muriatic flux causes heavy dross, and, in this respect, a neutral flux such as properly acidulated zinc chloride is a great improvement. Cleaning with sulphuric acid results in the formation of iron salts and causes a thickening of the interlining alloy which is brittle. Frothing with sawdust, bran, oatmeal, tallow, or glycerine is usually resorted to, and zinc ammonium chloride used as a flux. A new flux, known as No. 20 Flux, has been developed. This incorporates the frothing agent and is claimed to have many advantages over other fluxes for galvanizing work.—J. H. W.

On the Durability of Baths for Hot-Galvanizing, and on Preventing Their Corrosion. Heinrich Meyer auf der Heyde (*Stahl u. Eisen*, 1932, **52**, 999–1000; and (abstract) *Technique moderne*, 1933, **25**, 527).—The solubility of iron in zinc increases sharply between 475° and 495° C.; it is found that the life of the iron pans employed in hot-galvanizing is prolonged if the working temperature is kept below this range. Local attack may be avoided by careful erection; a suggested scheme for use with regenerative heating is illustrated, and directions are given for draught regulation and material and thickness of draught chamber. Excessive attack on bath material is attributed solely to local overheating, the nature of the iron appearing to have no appreciable effect on the rate of attack.—P. M. C. R.

Galvanization, a Means for Protecting Ferrous Metals from Atmospheric Corrosion. Marcel Lepingle (*Science et Industrie*, 1933, 17, 423–426).—Protective methods are summarized and briefly described. Galvanization is considered under three headings: (1) hot-galvanizing; (2) electrolytic processes, and (3) Sherardizing. A discussion of the hot galvanizing process is illustrated by reference to the iron–zinc constitutional diagram; a series of curves shows the solubility of iron in zinc between 440° and 600° C. for varying periods of contact. The time of contact, rate of cooling, surface condition of the iron, and impurities present in it are shown to affect the texture and other properties of the coating. The effects of cleaning and of galvanizing on the mechanical properties of the sheet are discussed.—P. M. C. R.

The Protection of the Cooling Systems of Internal Combustion Engines Against Corrosion. V. O. Krenig and S. E. Pavlov (*Tehnika Vosdushnogo Flota* (*Technology of the Aerial Navy*), **1933**, (3), 59–68).—[In Russian.] The addition of as little as 0·05% of potassium dichromate to tap water is sufficient to protect iron, brass, aluminium alloys, and zinc against corrosion at room temperature, but to afford protection to iron at 80°–90° C. at least 0·2% of dichromate is necessary. The dichromate materially increases the electrode potential of iron, but has little influence on those of aluminium alloys; so that iron under the above conditions is more electropositive than aluminium alloys. To obtain complete protection where the iron is in contact with a more electropositive metal, *e.g.* brass, an additional protection, *e.g.* zinc, must be present. In quadruple contacts, *e.g.* iron–brass–9% copper–aluminium alloy–zinc, the two last-named act as anodes and the corrosion they suffer (especially the aluminium alloy) is extremely slight.—N. A.

Protective Treatment of Ferrous Pipe. Thomas B. Downer (*J. Amer. Water Works Assoc.*, 1933, **25**, 605–632).—The corrosion of pipe-lines from water and from soil is considered and a general review given of protective methods and practices. The use of copper steels, or the application of zinc galvanizing or lead paints is considered to afford little protection underground. Tar dips are not permanent. Heavy centrifugal linings of bitumens or cement are most effective in preventing corrosion. Service pipes should be made of copper except for inactive waters and in well-drained soil.—J. C. C.

The Protection of [Steel and Iron] Pipes against Soil Action. K. H. Logan (*Electrochem. Soc. Preprint*, **1933**, Sept., 137–148).—Zinc coatings on iron and steel pipes buried in soil are more protective than lead coatings; after 8 years in various soils a 2-oz. zinc coating was relatively slightly attacked, although a few rust spots and pits were observed on the pipe. In highly acid or alkaline soil pitting of galvanized pipe may be expected in about 6 years. The value of concrete and bituminous coatings on bare steel pipes is also discussed.
—A. R. P.

The Effect of Composition and Pre-Treatment of Steels Upon the Life of Protective [Zinc and Paint] Coatings. Karl Daeves (*Electrochem. Soc. Preprint*, **1933**, Sept., 161–172).—Paint and zinc coatings show a considerably better adhesion to steels containing 0·2–0·5% copper than to ordinary steel. The effect of surface condition on the adhesion of paint coatings and the difficulties associated with effective removal of coatings of mill scale from steel are discussed.—A. R. P.

The Spray-Sherardizing Rust-Proofing Process. Anon. (*Engineering*, 1931, **131**, 750; and (abstract) *Science et Industrie*, 1931, **15**, 392).—The dry-vapour Sherardizing process is described. Its development, known as the Spray-Sherardizing process, consists in spraying zinc dust on to completed structures.

The surface to be protected is first cleaned with steel brushes, a bright green bitumen-base paint is applied with an ordinary sprayer, and zinc dust is sprayed on when the paint has become tacky, the colour contrast ensuring complete covering of the surface. The process is stated to be no more expensive than painting, with 2 to 3 times the durability; the electropositive character of zinc with regard to iron eliminates the formation of rust beneath the coating on exposure. The plant is described and illustrated.—P. M. C. R.

Metallization. Anon. (*Soudeur-Coupeur*, 1933, 12, (2), 1–5).—A description of the principles of, and equipment for, the process is followed by a comprehensive account of its applications.—H. W. G. H.

On the Heat-Resistance of Steel Sprayed with Aluminium. K. Stauffer (*Metallwirtschaft*, 1933, 12, 73–76).—The resistance of sprayed aluminium coatings on steel to heating in air at temperatures up to 1200° C. has been investigated.—v. G.

Paints for Aluminium and Its Alloys. H. Rabaté (*Peintures, Pigments, Vernis*, 1933, **10**, 64–65, 67–69; *Bur. Chem. Abs.*, 1933, [B], 595).—A general account is given of the suitability of coatings made from oils, asphalt, tar, nitrocellulose, and synthetic resins, and of the preparation of the metal surfaces.—S. G.

VI.—ELECTRODEPOSITION

(Continued from pp. 557–559.)

Chromium Plating at Low Temperatures and With Weak Current Density. A. Guerillot and J. Pierson (*Bull. Soc. franç. Élect.*, 1933, [v], 3, 859–866).—A summary of previous work on the possibility of chromium-plating on a commercial basis at a lower current density than that recommended by Sargent and others is followed by an account of investigations by G. and P. on the effect of various additions to the plating bath on low-current density plating, and by a description of the working at various temperatures of 5 types of commercial plating plant.—P. M. C. R.

Chromium Plating in the Cold. Anon. (*Galvano*, 1932, (7), 13–14).—Electrodeposition of chromium from a cold-bath has the advantages of reducing the need for excessive ventilation, reducing the current density, and giving a brilliant deposit.—E. S. H.

Chromium Plating in the Cold. O. Macchia (*Galvano*, 1933, (14), 13–16).—A review of recent literature.—E. S. H.

Considerations on the Use of "Protective Layers" for Chromium Baths. Anon. (*Galvano*, 1933, (5), 15–16).—The advantages and disadvantages of using a layer of kerosene or other oil over the surface of the bath are compared with those of the practice of an air draught for removing fumes.—E. S. H.

Chromium Plating of Tools and Mandrels. Anon. (*Galvano*, 1933, (8), 11–14).—In order to obtain chromium deposits which are particularly resistant to abrasion, curves are given showing the limits of current density under which such a deposit is obtained as a function of the temperature and of the sulphate content of the bath.—E. S. H.

Note on the Electrodeposition of Copper. E. Vuigner (*Bull. Soc. franç. Élect.*, 1933, [v], 3, 822–835).—Reviews the conditions for obtaining satisfactory deposits with optimum current efficiency.—P. M. C. R.

Electroplating Copper on Manganin. C. R. Cousins (*J. Sci. Instruments*, 1933, 10, 256–258).—Difficulties exist in obtaining an adherent deposit of copper, but the following method has been found successful. (1) The wire is made alternately anode and cathode for a few seconds each in a strong solution of caustic soda, the other electrode being of copper. This results in "demanganization" of the surface, and the chemistry of the process is discussed. (2) The wire is then made cathode for about 1 second in dilute sulphuric acid. The effect of this is unknown, but it gives the wire a golden colour, and may remove nickel. (3) The wire is then transferred to the copper sulphate plating bath, when a strongly adherent coating is obtained. Details are given of current densities, electrolyte concentrations, &c.—W. H.-R.

Free Cyanide in Brass Plating Baths. L. C. Pan (*Quarterly Rev. Amer. Electroplaters' Soc.*, 1933, **10**, (11), 33–38).—See abstract from another source, *J.*, this volume, p. 253.—A. R. P.

Electrodeposition of Iron–Copper–Nickel Alloys. III.—Deposition from Sulphate-Boro-Citrate Baths. Lawrence E. Stout and Charles L. Faust (*Electrochem. Soc. Preprint*, **1933**, Sept., 111–122).—A ternary alloy of copper, nickel, and iron can be deposited from alkaline sulphate solutions containing ammonium boro-citrate to prevent precipitation of iron and the reduction of the copper salt by the alkaline ferrous compounds. Better results are obtained if the solution consists solely of nickel and iron salts buffered with the boro-citrate and the copper is supplied by the use of a copper anode having the same area as the cathode. With increasing current density the iron content of the deposits increases rapidly to a maximum at which it remains constant, irrespective of further rise in current density; the increase in nickel content of the plates with increasing current density is not nearly so marked. The copper content decreases with increasing current density. Numerous examples of the effects of bath composition and current conditions on the composition of the deposits are tabulated.—A. R. P.

American and Continental Practice in Nickel Deposition. W. T. Griffiths (*Brit. Indust. Finishing*, 1932, **3**, 33–37, 57, 79–82).—See this *J.*, 1932, **50**, 315.—E. S. H.

On the Electrolysis of Metals. III.—Structure of Electrolytic Deposits of Silver from Its Molten Salts. K. M. Gorbunova (*Izvestia Akademii Nauk S.S.S.R.* (*Bulletin of the Academy of Sciences of U.S.S.R.*), 1933, **7**, (2), 255–266).—[In Russian.] The macro- and micro-structures of silver deposited electrolytically from a molten mixture of silver nitrate with alkali nitrates or chlorides have been studied with reference to the effect of silver concentration, temperature, and cathode current density, and the results are tabulated. In mixtures containing sodium and potassium nitrates the temperature was varied from 225° to 330° C., the current density from 0·005 to 1·0 amp./cm.^{2}, and the molecular ratio of the silver, potassium, and sodium nitrates from 1 : 1 : 1 to 1 : 5 : 5. In the series with the corresponding chlorides, the molecular ratio varied from 1 : 1 : 1 to 5 : 1 : 1 and 1 : 10 : 10, the temperature from 670° to 725° C. and the current density from 0·050 to 1·0 amp./cm.^{2}. The deposits obtained may consist of small, medium, or very large crystals extending into the body of the electrolyte and frequently short-circuiting the electrodes. The nature of the deposits varies somewhat according to whether the electrolyte consists of nitrates or chlorides, whilst the crystal size is governed by the concentration and current density. With nitrates, the deposit does not adhere firmly to the cathode, but with chlorides the converse is true, except at high current densities (0·5–1·0 amp./cm.^{2}). The microstructure of deposits obtained from chlorides during the initial stages of electrolysis indicates that the atoms of silver penetrate into the lattice of the growing crystals of the cathode. Owing to the low recrystallization temperature of silver it is impossible to obtain small-sized crystals by electrolysis at high temperatures. It is concluded that temperature is the basic factor which determines the process of electrocrystallization.—N. A.

Electrodeposition of Nickel and Chromium on Zinc Alloys. Anon. (*Galvano*, **1933**, (12), 13–15).—A bath recommended for nickel plating zinc-base alloys contains nickel sulphate 7·2 kg., ammonium chloride 3·25 kg., magnesium sulphate 0·3 kg. in 100 litres of cold water. No special precautions are required to apply subsequently a satisfactory coat of chromium.—E. S. H.

Purification of Nickel Baths Adulterated with Foreign Metals. Anon. (*Galvano*, 1933, (13), 14–15).—Simple analytical methods for the detection and elimination of copper, iron, zinc, and lead in nickel baths are described. —E. S. H.

Prevention of Injurious Effect of Antimony in Electrodeposition of Zinc and Copper. N. Kameyama and H. Iida (*Kōgyō Kwagaku Zasshi* (*J. Soc. Chem. Ind. Japan*), 1933, **36**, (4); *Bur. Chem. Abs.*, 1933, [B], 631).—[In Japanese, with English abstract in supplemental binding, pp. 173–174B.] Addition of KH tartrate in large excess of the antimony present, to an acid copper sulphate bath reduced the deposition of antimony to a low figure. In the electrodeposition of zinc the effect of KH tartrate was only slight.—S. G.

Electrodeposition of Tungsten from Alkaline Solutions. Anon. (*Galvano*, 1933, (10), 14–15).—Bright deposits of tungsten can be obtained by electrolyzing a solution of sodium tungstate, sodium carbonate, and dextrose, using a nickel anode.—E. S. H.

Selection of Electroplate Coatings for Iron and Steel. E. E. Halls (*Synthetic and Applied Finishes*, 1933, **4**, 45–50; *Brit. Chem. Abs.*, 1933, [B], 591).—Electrodeposited coatings of the "sacrificial protection" and the "blanket" types are discussed with special reference to the electromotive series of the metals. Metals prone to passivity cannot be used as "sacrificial" coverings. The relative behaviour of metals under mild corrosive conditions is often reversed under more rigorous attack. The outstanding features of zinc, cadmium, nickel, copper, and chromium electrodeposits are summarized.—S. G.

Barrel-Plating With Particular Reference to Optimum Loads and Costs. Gustaf Soderberg (*Quarterly Rev. Amer. Electroplaters' Soc.*, 1933, **19**, (10), 8–20).—The method of calculating the load and plating time to obtain a definite thickness of cadmium coating on iron and steel articles in barrel-plating is described in detail and the question of costing the work is fully discussed. —A. R. P.

The Decomposition of Cyanide [Plating] Solutions. R. M. Wick (*Quarterly Rev. Amer. Electroplaters' Soc.*, 1933, **19**, (10), 20–23).—In a plating solution containing 4·3 oz./gall. of free potassium cyanide (*i.e.* 0·5*N*) about 70% of the salt is decomposed after exposure to the air in a shallow vessel for 10 days at 25° C., potassium carbonate being formed by hydrolysis. Rise in temperature and the presence of carbon dioxide accelerate hydrolysis; above 45° C. formation of ammonia is one of the principal causes of loss of cyanide. Hence, to avoid undue loss of cyanide in plating baths the temperature should be kept as low as possible, agitation should be avoided, and alkali hydroxide should be added occasionally.—A. R. P.

Barrel-Plating with Duozinc Solution. F. F. Oplinger (*Quarterly Rev. Amer. Electroplaters' Soc.*, 1933, **19**, (10), 23–37).—For barrel-plating small steel parts by the Duozinc process the following recommendations are made: *electrolyte*—zinc cyanide 6, sodium cyanide 3, sodium hydroxide 6 oz./gall.; *anodes*—an alloy of zinc with 1% mercury with as large a surface as possible; *cathode current density*—8–10 amp./lb. for nuts and bolts, 5–10 amp./lb. for light stampings, 15 amp./lb. for screws; total amperage for 36-in. barrels, 400 amp.; *e.m.f.*—8–12 v.; *temperature*—90°–110° F. (32°–43° C.) for a volume of 150–250 gall.; *plating time*—20–30 minutes; *speed of barrel*—4–6 r.p.m., higher speeds reduce the cathode efficiency; *construction of barrel*—rubber-coated steel with perforated panels. The above recommendations are discussed at some length.—A. R. P.

The Theoretical Aspects of the Electrolytic Formation of Metallic Deposits. J. Salauze (*Bull. Soc. franç. Élect.*, 1933, [v], 3, 836–858).—Reviews the work of Nernst and Blum and Rawdon and others as applied to electrodeposition. Some fields for further investigation are indicated.—P. M. C. R.

The Protective Value of Electroplated Coatings. —— (*Quarterly Rev. Amer. Electroplaters' Soc.*, 1933, **19**, (10), 37–40).—A progress report of the Joint Inspection Committee of the American Electroplaters' Society, the American Society for Testing Materials, and the Bureau of Standards. Cf. *J.*, this volume, p. 255.—A. R. P.

Experiences in the Plating of Samples for Exposure Tests. P. W. Strausser (*Quarterly Rev. Amer. Electroplaters' Soc.*, 1933, **19**, (10), 40–46).—Some difficulties met with in preparing standard plates of nickel, chromium, copper, zinc, cadmium, and zinc–cadmium alloys for exposure tests are described, together with the means adopted to overcome them.—A. R. P.

p_H and Its Electrometric Determination. Edward B. Sanigar (*Quarterly Rev. Amer. Electroplaters' Soc.*, 1933, **10**, (11), 23–32).—An educational article. —A. R. P.

Simple Degreasing or Degreasing [with Simultaneous] Coppering? Anon. (*Galvano*, **1932**, (5), 11–12).—Degreasing by cathodic polarization in alkaline solutions is recommended for iron prior to coating with zinc or cadmium, and for certain aluminium alloys, and for nickel prior to chromium plating, whilst a bath containing copper is recommended for iron, copper, brass, zinc, lead, tin, and white alloys containing no aluminium.—E. S. H.

Degreasing Before Electrodeposition of Metal. Anon. (*Galvano*, **1933**, (11), 22–24; (12), 21–23).—A review of existing practice.—E. S. H.

Organization of Work in an Electrolysis Workshop. Henri Hervé (*Galvano*, **1932**, (5), 13–15).—E. S. H.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-Refining.)

(Continued from pp. 560–561.)

Linear Rate of Crystallization of Cathodic Lead Deposits. Alexander Glazunov and E. Bartuněk (*Chem. Obzor*, 1932, **7**, 172–175).—In continuation of earlier work (see this *J.*, 1932, **50**, 636) the rate of crystallization of electrolytic lead deposited from nitrate, chloride, and acetate solutions has been measured under the microscope.—R. P.

Studies on Overvoltage. VI.—The Mechanism of the Transfer of Electrolytic Hydrogen and Oxygen Through Thin Sheets of Platinum and Palladium. A. L. Ferguson and George Dubpernell (*Electrochem. Soc. Preprint*, **1933**, Sept., 253–279).—Evidence is adduced to show that electromotively-active hydrogen and oxygen do not diffuse through solid metals. Previous observations to the contrary are shown to have been due to porosity of the electrodes. The bearing of these facts on the theory of polarization and overvoltage is discussed and a theory is propounded to account for the blistering of metals used as cathodes.—A. R. P.

Metallized Glass–Hydrogen Electrodes. E. Newbery (*Electrochem. Soc. Preprint*, **1933**, Sept., 99–110).—Good bright adherent deposits of platinum or palladium on glass are obtained by dipping the glass in a 2% alcoholic solution of the chloride of the metal, burning off the alcohol, and heating over a Bunsen flame. Six treatments are necessary for a good coating opaque to sunlight. Similar deposits of silver may be obtained from an alcoholic solution of ammonio-silver oxide. Palladium-coated glass may be used as a bright hydrogen electrode in solutions where platinum or palladium black produces an undesirable catalytic action, but platinized platinum–glass electrodes are best for general use as hydrogen electrodes. The properties and uses of various types of metallized glass–hydrogen electrodes are described.—A. R. P.

VIII.—REFINING

(Including Electro-Refining.)

(Continued from p. 562.)

Modern Metallurgical Methods for Increasing the Purity of Aluminium; Their Technical Significance and Operation. Hans Bohner (*Metall u. Erz*, 1933, 30, 334–339).—Modern methods of preparing pure alumina for use in the electrolytic production of aluminium are described and a brief account is given of the Frary process of electrolytically refining aluminium. The economics of the processes described are briefly discussed.—A. R. P.

On the Course of the Oxidation of Liquid Copper Containing Small Quantities of Nickel, Arsenic, Tin, and Antimony. P. Siebe and C. Busse (*Metall u. Erz*, 1933, 30, 273–280).—During the refining of copper the impurities are oxidized in the following order: tin, antimony, nickel, arsenic, but the tin and antimony oxides formed are soluble in molten copper and therefore difficult to remove. Nickel oxide is also soluble in copper and very little enters the slag; that dissolved in the copper is reduced to metal again during the poling. Arsenic is removed chiefly by volatilization, and this is comparatively slow at the usual refining temperatures.—A. R. P.

Evaluation of the Process of Desulphurization and Dearsenification of Copper in Reverberatory Furnaces According to the Laws of Physical Chemistry. Em. Lubojatzky (*Metall u. Erz*, 1933, 30, 311–313).—The concentration of sulphides and arsenides in molten copper is inversely proportional to their vapour pressure. By the application of the law of mass action to the decomposition of sulphides and arsenides during the refining of copper, equations can be derived to represent the processes of desulphurization and dearsenification as a function of the temperature.—A. R. P.

On the Removal of Selenium and Tellurium from Copper Electrolysis Slimes. Max Heberlein (*Metall u. Erz*, 1933, 30, 363–366).—The slimes produced in an American electrolytic copper refinery contain an average of copper 46·5, silver 4·1, gold 0·4, lead 1·2, selenium 23·5, tellurium 2·5, arsenic 0·6, and antimony 0·5%. Roasting with sodium hydroxide followed by leaching with water removes most of the selenium, but very little tellurium. Roasting the slime alone converts all the selenium and tellurium into dioxides, and a subsequent leach with potassium hydroxide solution removes all the selenium and about 70% of the tellurium; dead-roasting is essential, *i.e.* not more than 0·1% copper must remain insoluble in sulphuric acid. The leach liquor is acidified with sulphuric acid, whereby tellurium dioxide is precipitated, and the filtrate is treated with more sulphuric acid and with sulphur dioxide to recover the selenium. The selenium may also be recovered from the alkaline selenite solution by electrolysis, or this solution may be treated with lime to recover the potassium hydroxide and the calcium selenite worked up by one of the above methods. The copper oxide residue from the leaching of the roast is extracted with spent electrolyte from the copper cells and the solution crystallized for copper sulphate or returned to the cells for the recovery of electrolytic copper.—A. R. P.

Electrolytic Refining of Copper by Use of the Complex Salt of Cuprous Chloride. XI.—Behaviour of Bismuth. Naoto Kameyama and Shoji Makishima (*Kōgyō Kwagaku Zasshi* (*J. Soc. Chem. Ind. Japan*), 1933, 36, (6); *C. Abs.*, 1933, 27, 4484).—[In Japanese, with English summary in supplemental binding, pp. 365–367.] See *J.*, this volume, p. 93. When more than 1 grm./l. of bismuth accumulates in the bath, it may reach 0·001% in the cathode deposit. It may also deposit on the anode. Under these conditions the cathode deposit becomes highly crystalline. Avoidance is possible by increase of copper and gelatin in the bath.—S. G.

The Technique of Electrolytic Copper. M. Altmayer (*Cuivre et Laiton*, 1933, 6, 135–143).—A review.—W. A. C. N.

IX.—ANALYSIS

(Continued from pp. 563–566.)

The Spectroscopic Examination of Thin Metallic Films. A. Hervey and E. S. Dreblow (*J. Sci. Instruments*, 1933, **10**, 224–225).—A note. For the spectroscopic analysis of very thin films of metals deposited on glass, *e.g.* deposits on the interior of valves, the glass is held in one copper electrode, and a discharge made to take place along the glass by holding the second electrode very near to its surface. As little as 10^{-6} grm. of metal can thus be detected.—W. H.-R.

New Method for the Rapid Analysis of Alloys Without Destruction of the Samples. A. Glazunov (*Chim. et Ind.*, **1930**, Special No. (March), 247–250; *C. Abs.*, 1930, **26**, 5666).—The previously described method (see this *J.*, 1929, **42**, 508) has been extended to the qualitative analysis of metals and alloys. If a single metal is present, its nature will be revealed by the coloured precipitate obtained on the paper. If the metals present merely form a mechanical mixture, by using a sufficiently low voltage only the metal having the highest potential will dissolve and react, and by raising the voltage the others may be successively dissolved. When the metals form solid solutions or true chemical compounds, the reagents must be selected so that each reacts with only one of the metals. It is hoped that by working under definite current density and time conditions, approximately quantitative analysis may be obtained from the intensity of the colours produced.—S. G.

Macro-Electrolytic Analysis of Co, Zn, Cd, Ag, and Hg. J. Guzmán and A. Rancaño (*Anal. Soc. españ. Fis. Quim.*, 1933, **31**, 348–355).—Details are given for the deposition of quantities of the order of 1–1·5 grm. of Co, Zn, Cd, Ag, and Hg in 1 hr. using a passive Fe anode (Pt anode for Hg) and a Cu cathode, previously silvered for Ag and Hg, and Cd-plated for Cd. For Co the electrolyte contains 40 grm. of $(NH_4)_2SO_4$, 20 grm. of Na_2SO_3, and 75 c.c. of NH_4OH (*d* 0·91); a constant voltage of 2·5 v. is maintained while the current falls slowly from 2·5 to 1·5 amp. For Zn the electrolyte contains 1 grm. of KCN, 20 grm. of $(NH_4)_2SO_4$, and sufficient NH_4OH to redissolve the precipitate; a current of 4 amp. at 4·2 v. is required. For Cd the solution contains 25 grm. of $(NH_4)_2SO_4$ and sufficient NH_4OH to redissolve the precipitate; current is supplied at 2·7 v. and falls slowly from 2·5 to 1 amp. For Ag the sulphate solution is treated with 20 grm. of $(NH_4)_2SO_4$ and 5 grm. of NaOH and electrolyzed at 1·2 v. Hg is deposited from a feebly acid $Hg(NO_3)_2$ solution with a constant current of 1·5 amp., the voltage being slowly raised from 1·7 to 2·9 v. The technique of the electrolysis has already been described for Ni and Cu (see *J.*, this volume, p. 141).—A. R. P.

Methods Used in the Analysis of Certain Lead Alloys. B. S. Evans (*Analyst*, 1933, **58**, 450–461).—*Determination of thallium:* The Pb (10 grm.) is dissolved in a mixture of 50 c.c. of 1 : 1 HNO_3 and 120 c.c. of citric acid (100 grm. in 200 c.c. H_2O), the solution is made alkaline with NH_4OH, cooled, and treated with 10 c.c. of 0·5% $AgNO_3$ and 20 c.c. of 4% KI, and the precipitate of AgI and TlI is collected next day and washed with 2% NH_4OH containing 0·1% KI. The AgI is removed by washing with KCN solution, the TlI dissolved in hot HCl, the Tl precipitated with NaOH and Na_2S, the TlS dissolved in HCl and Br, the solution boiled with SO_2, and the Tl titrated with 0·05*N*-$NaBrO_3$ at 55° C. A blank titration is necessary. *Determination of tellurium:* The metal is dissolved in 60 c.c. of 1 : 1 HNO_3 and 50 c.c. of tartaric acid (50 grm. in 200 c.c. H_2O), NH_4OH is added until the precipitate first formed redissolves, then tartaric acid until the solution is strongly acid to litmus, and, after cooling, the acid Pb tartrate is removed and the filtrate treated with 10 c.c. of 4% KI and 40 c.c. of 1 : 3 H_2SO_4. After 15 minutes the solution is filtered and the filtrate treated with 20 c.c. of 20% NH_4Cl and 2–3 grm. of

NaH_2PO_2, boiled to precipitate Te, and filtered. The Te is dissolved in 10 c.c. of HCl saturated with Br and the solution diluted to 300 c.c. with H_2O and 20 c.c. of HCl. The Te is reprecipitated as before and after washing is rinsed into the beaker, treated with 2–3 c.c. of 1 : 3 H_2SO_4 and 10 c.c. of 4% KI, and dissolved with an excess of 0·01*N*-I. After neutralizing with $NaHCO_3$ the excess I is titrated with 0·01*N*-$Na_2S_2O_3$ using C_6H_6 as indicator; starch is then added followed by 0·01*N*-I until the blue colour appears. 1 c.c. I = 0·000319 grm. Te. *Determination of cerium:* The Pb (10 grm.) is dissolved in 50 c.c. of 1 : 1 HNO_3, NH_4OH is added in slight excess followed by $CH_3{\cdot}COOH$ until acid, and the Ce is precipitated by shaking the solution at 90° C. with $NaBO_3$. Reprecipitation is necessary to remove all the Pb; the Ce is finally determined by oxidation with Na bismuthate followed by reduction with $FeSO_4$ and titration of the excess of the latter with $KMnO_4$. *Determination of antimony* in Pb alloys containing Tl is made by precipitating the Sb from the chloride solution with metallic Fe and conversion into Sb_2S_3 followed by dissolution in HCl and titration with $NaBrO_3$. Methods are also given for the determination of Ca and Ba in Pb-base bearing metals.—A. R. P.

On a Method of Increasing the Sensitivity of a Microchemical Reaction for Chromium. I. M. Korenmann (*Z. anal. Chem.*, 1933, 93, 268–271).—In testing for traces of CrO_3 by precipitation as Ag_2CrO_4 addition of a little Na_2SO_4 gives a crystalline precipitate of Ag_2SO_4 which is coloured yellow with Ag_2CrO_4 if Cr is present. The sensitivity of the test is much enhanced in this way. —A. R. P.

New Colour Reaction for Cobalt. A. Chiarottino (*Industria Chimica*, 1933, 8, 32–33; and (abstract) *Chim. et Ind.*, 1933, **30**, 53).—The Group III precipitate which is insoluble in HCl is dissolved in *aqua regia*, evaporated to dryness, neutralized if necessary, and warmed with 5–10 c.c. of dilute alcohol. The Ni is precipitated by a 1% dimethylglyoxime solution and filtered off. To the filtrate a solution of 0·5 grm. benzidine and 0·25 grm. dimethylglyoxime in 100 c.c. alcohol is added. If Co is present a characteristic orange colour is obtained. The reaction is sensitive for 0·01 mg. of Co.—W. A. C. N.

1 : 2-Diaminoanthraquinone-3-Sulphonic Acid as a Reagent for the Detection of Copper, Cobalt, and Nickel. J. V. Dubsky and V. Bencko (*Z. anal. Chem.*, 1933, 94, 19–20).—In alkaline solutions the reagent gives a blue-black precipitate of an adsorption compound with Cu, Ni, and Co salts. With Cu a violet coloration is produced in 1×10^{-6} *N*-solutions.—A. R. P.

β-Naphthol Reaction for Copper. Charles C. Fulton (*Amer. J. Pharm.*, 1933, **105**, 62–63; *Chem. Zentr.*, 1933, **104**, I, 3601).—As little as 1 part of Cu in 3×10^6 parts of solution can be detected by the greenish-yellow colour produced by adding 0·5 c.c. of 1 : 2 NH_4OH and 2 c.c. of C_2H_5OH containing 0·04 grm. of β-naphthol to the neutral solution under test.—A. R. P.

Use of Triethanolamine for the Detection of Traces of Gold and Silver and as a Characteristic Reagent for Manganese, Nickel, and Cobalt. E. Jaffe (*Ann. Chim. appl.*, 1932, **22**, 737–743; *Chem. Zentr.*, 1933, **104**, I, 3221–3222).—A 20% solution of triethanolamine gives the following reactions with solutions containing the metals: $Hg^{\cdot}$, grey precipitate of metal; $Ag^{\cdot}$, yellowish-brown flocculent precipitate soluble in excess giving a solution from which a Ag mirror is deposited on boiling; $Cu^{\cdot\cdot}$, reaction the same as that of NH_4OH; $Cd^{\cdot\cdot}$, white powdery precipitate insoluble in excess; $Hg^{\cdot\cdot}$, heavy white powder which becomes greyish on boiling with excess; $Pb^{\cdot\cdot}$, $Bi^{\cdot\cdot\cdot}$, $Sn^{\cdot\cdot}$, $Sb^{\cdot\cdot\cdot}$, heavy white precipitates insoluble in excess; $Al^{\cdot\cdot\cdot}$, $Cr^{\cdot\cdot\cdot}$, $Fe^{\cdot\cdot\cdot}$, gelatinous precipitates similar to those given by NH_4OH, but much more soluble in excess of the precipitant; $Mg^{\cdot\cdot}$, white amorphous precipitate insoluble in excess. $Au^{\cdot\cdot\cdot}$ in concentrated solution gives a reddish-yellow precipitate which dissolves to a yellow solution in excess or to a blood-red solution with 10–15 vols. of reagent to 1 vol. of solution; both solutions yield black precipitates of Au and some-gives a Au mirror on warming. Very dilute Au solutions yield red colloidal solutions of Au: the red colour is visible with 10^{-6} grm. of Au in 1 c.c. Mn gives first a white precipitate which becomes reddish-yellow on exposure to air and on addition of NaOH turns brown, then dark green, and the solution becomes emerald-green. Ni gives a blue solution which becomes emerald-green on addition of NaOH, and Co gives a carmine-violet solution which gives a precipitate with tartaric acid soluble in excess to a carmine-red solution becoming violet with an excess of NaOH.—A. R. P.

On Some Separations of Metals of the Ammonium Sulphide and Alkaline Earth Groups. Albert Krüger (*Z. anal. Chem.*, 1933, **93**, 422–429).—Zn can be separated completely from Fe, Al, Ni, Co, Cr, and the alkaline earths by saturating with H_2S at 70° C. the solution of the metals containing 0·7–1·5 c.c. of N-H_2SO_4 per 100 c.c., adding 2–3 drops of saturated $Na_2S_2O_3$ solution, again passing H_2S, adding 1–2 grm. of solid $Na_2S_2O_3$, cooling and filtering off the ZnS. If the filtrate is saturated with H_2S, and then heated under pressure in a hot-water bath, NiS, CoS, FeS, $Al(OH)_3$, and $Cr(OH)_3$ are precipitated in a granular readily filtrable form, leaving a solution containing only alkalis and alkaline earths.—A. R. P.

The Quantitative Separation of Aluminium from Iron. J. Haslam (*Analyst*, 1933, **58**, 270–272).—The Fe is removed by H_2S in ammoniacal tartrate solution and the Al then precipitated with 8-hydroxyquinoline.—A. R. P.

Electrolytic Separation of Copper from Arsenic and Selenium. M. G. Raeder and R. Holfors (*Kong. Norske Videnskab. Selsk. Forhandl.*, 1933, **5**, 171–174; *Chem. Zentr.*, 1933, **104**, I, 3602).—The HNO_3 solution of the elements is neutralized with NH_4OH, treated with KCN until the CuCN precipitate redissolves, then with a further 0·03–0·05 grm., made strongly ammoniacal (15 c.c. of NH_4OH, *d* 0·88), and electrolyzed at 70°–75° C. with 2–4 amp. at 4 v. using a rotating (600 r.p.m.) gauze cathode. All the Cu is deposited in 20 minutes free from As and Se.—A. R. P.

A New Reagent for Lithium in the Presence of Other Alkalis: Separation of Lithium from Magnesium: Quantitative Determination of Lithium: Separation of Arsenates from Arsenite. T. Gaspar y Arnal (*Ann. chim. analyt.*, 1933, [ii], **15**, 193–194).—Li is completely precipitated in 60–70% C_2H_5OH solutions by addition of Na_3AsO_4. If Mg is present it is first separated by addition of Na_3AsO_3.—A. R. P.

On the Use of the Mercury Cathode. W. Böttger [with Natalie Block and M. Micheff] (*Z. anal. Chem.*, 1933, **93**, 401–422).—Electrolyses of various metal solutions have been made under different conditions to determine which cathode gives the best results, (A) the amalgamated brass gauze cathode of Paweck (*ibid.*, 1924, **64**, 89) or (B) a liquid Hg cathode. For Zn in acid or alkaline solutions A gives the best results, but is not so good for Cd deposition. B is much the more satisfactory for Ni and Fe deposition. The purification of the Hg cathode is discussed and means for avoiding various sources of error are indicated.—A. R. P.

Working Technique with Hydrogen Sulphide in Qualitative Analysis. J. V. Dubský and V. Dostál (*Z. anal. Chem.*, 1933, **94**, 21–22).—A technique is described for passing several solutions with H_2S simultaneously from one Kipp apparatus at constant pressure.—A. R. P.

The Polarographic Determination of the Alkali Metals. Vladimír Majer (*Z. anal. Chem.*, 1933, **92**, 321–351).—Heyrovský's polarographic method with the dropping Hg cathode has been applied to the quantitative determination of K and Na; the original must be consulted for details of the apparatus and procedure.—A. R. P.

New Method of Determining Aluminium in Aluminium Alloys. W. Ehrenberg (*Chim. et Ind.*, 1933, **29**, 1382).—Abstracted from *Z. anal. Chem.*, 1932, **91**, 1–5; see *J.*, this volume, p. 258.—W. A. C. N.

An Apparatus and Procedure for the Electrolytic Estimation of Arsenic. Frank N. Moerk (*Electrochem. Soc. Preprint*, **1933**, Sept., 173–186).—The method described is a variation of the Gutzeit process for determining minute quantities of As. The AsH_3 is evolved by electrolysis under standard conditions in a specially designed apparatus and the action on the test-papers is controlled to give consistent stains under standard conditions. The original should be consulted for details.—A. R. P.

A Gravimetric Method for the Determination of Arsenic as $MgNH_4AsO_4,6H_2O$. J. Dick (*Z. anal. Chem.*, 1933, **93**, 429–433).—The solution containing the As as $(NH_4)_3AsO_4$ is treated with 3–5 grm. of NH_4Cl and 10–15 c.c. of magnesia mixture in excess of that required to precipitate the As. HCl is added dropwise until the precipitate just redissolves, and the solution is then neutralized with 2·5% NH_4OH and treated with one-third its volume of this reagent. After cooling to 0°–5° C. for 1–2 hrs. the crystalline precipitate is collected, washed in succession with 2·5% NH_4OH, C_2H_5OH, and $(C_2H_5)_2O$, dried in a vacuum desiccator at room temperature, and weighed as $MgNH_4AsO_4,6H_2O$, which contains 24·02% As.—A. R. P.

On the Determination of Beryllium. L. Fresenius and M. Frommes (*Z. anal. Chem.*, 1933, **93**, 275–279).—Ignition of $Be(OH)_2$ precipitates containing volatile chlorides or basic Be chloride leads to no loss of Be by volatilization; $BeCl_2$ is quantitatively converted into BeO on ignition. Mo is best separated from Be by means of tannin in acetate solution; an excess of tannin must be avoided, since it tends to dissolve the Mo. If Fe is present, both Fe and Mo are quantitatively precipitated by the tannin. Al is best separated from Be and P by 8-hydroxyquinoline; the Be is then recovered as $BeNH_4PO_4$. —A. R. P.

A Volumetric Method for the Determination of Bismuth. C. Mahr (*Z. anal. Chem.*, 1933, **93**, 433–437).—The Bi solution is treated with 30% KBr until the BiOBr first formed redissolves, and is then neutralized with NaOH, warmed to 40°–50° C., and treated with a warm solution of $[Cr(NH_3)_6](NO_3)_3$. The crystalline precipitate of $[Cr(NH_3)_6]BiBr_6$ is collected in a porous glass crucible, washed with 20–25% KBr solution, and then distilled with NaOH to liberate the NH_3, which is collected in standard H_2SO_4 and determined acidimetrically. In the presence of other metals, the first precipitate should be boiled with H_2O to obtain BiOBr, which is redissolved in KBr solution and the process continued as above.—A. R. P.

Simplification of the Methods of Treadwell and Mayr. Bromometric Determination of Bismuth. R. Montequi and J. González Carreró (*Anal. Soc. españ. Fis. Quím.*, 1933, **31**, 242–254).—The $Bi(NO_3)_3$ solution (0·5–1*N* in HNO_3) containing not more than 25 mg. of Bi is treated with an excess of $K_3Cr(SCN)_6$ solution and shaken with 5–10 drops of toluene. The precipitate is collected, washed, and boiled with dilute KBr solution; after cooling, HCl is added followed by 0·1*N*-$KBrO_3$ until the liquid is coloured yellow with Br. KI is then added and the liberated I titrated with $Na_2S_2O_3$. The difference between the two titrations multiplied by 0·58 gives the amount of Bi present. —A. R. P.

A New Rapid Method for the Macro- and Micro-Determination of Bismuth. G. Spacu and P. Spacu (*Z. anal. Chem.*, 1933, **93**, 260–265).—The cold $Bi(NO_3)_3$ solution is treated with KI to give $KBiI_4$ and then boiled with an excess of a concentrated solution of *trans*-$[Co\ en_2\ (SCN)_2]SCN$, whereby a crystalline orange-yellow precipitate of $[Co\ en_2\ (SCN)_2]BiI_4$ is obtained. On cooling, the precipitate is collected, washed with a dilute solution of the precipitant containing KI, then with C_2H_5OH and $(C_2H_5)_2O$, dried in a vacuum desiccator, and weighed; it contains 20·65% Bi. (*Note*: en = ethylenediamine.) —A. R. P.

Gravimetric Determination of Calcium and Its Separation from Magnesium. O. Brunck (*Z. anal. Chem.*, 1933, **94**, 81–86).—The technique of the oxalate separation is discussed in detail.—A. R. P.

Solubility of Calcium Oxalate in Some Salt Solutions. K. L. Maljaroff and A. J. Gluschakoff (*Z. anal. Chem.*, 1933, **93**, 265–268).—The solubility of CaC_2O_4 in 2% $(NH_4)_2SO_4$, NH_4NO_3, and NH_4Cl solutions is respectively 10, 12, and 27 mg./litre; in H_2O the solubility is 6 mg./litre. The presence of Mg salts increases the solubility in all cases.—A. R. P.

Detection and Determination of Cobalt with 1 : 2-Nitronaphthol. Hans Herfeld and Otto Gerngross (*Z. anal. Chem.*, 1933, **94**, 7–12).—The Co solution is treated with 3 c.c. of 10% H_2SO_4 and with a warm 3% solution of the reagent in 50% $CH_3{\cdot}COOH$. The precipitate is collected, washed with warm water, and evaporated with HNO_3 and H_2SO_4 to destroy organic matter. Eventually the excess acid is expelled by further heating and the $CoSO_4$ residue weighed. A colorimetric method for traces of Co is based on the red colour produced by addition of the reagent and excess of NaOH to the Co solution; a distinct pink colour is produced with 1 part of Co in 2×10^7 parts of solution.—A. R. P.

On the Quantitative Determination of Some Metals by Means of Anthranilic Acid. II.—A Simple Method for the Quantitative Determination of Cobalt, Nickel, and Copper. H. Funk and M. Ditt (*Z. anal. Chem.*, 1933, **93**, 241–247).—Anthranilic acid precipitates Co, Ni, and Cu from acetate solutions under the same conditions as previously described for Zn and Cd (see *J.*, this volume, p. 453). The precipitates can be dried at 105°–110° C. and weighed (factor for Co 0·1780, for Ni 0·1774, and for Cu 0·1894) or dissolved in HCl and the anthranilic acid determined bromometrically.—A. R. P.

Potentiometric Determinations in Alkaline Solution. Determination of Gold with Vanadyl Sulphate. Carlos del Fresno and Edmundo Mairlot (*Z. anorg. Chem.*, 1933, **214**, 73–76).—The $AuCl_3$ solution is made strongly alkaline with NaOH (7·5–30%) and titrated at 30°–70° C. with 0·1*N*-$VOSO_4$ solution; the reaction is $NaAuO_2 + 3VOSO_4 + 8NaOH = Au + 3NaVO_3 + 3Na_2SO_4 + 4H_2O$.—M. H.

Volumetric Determination of Lead by the Nickel Dioxide-Arsenite Method. R. Lang and J. Zweřina (*Z. anal. Chem.*, 1933, **93**, 248–260).—The $Pb(NO_3)_2$ solution or the $PbSO_4$ precipitate obtained in the usual separation methods is treated with 25 c.c. of 2·5*N*-NaOH, then with 20 c.c. of $Ni(NO_3)_2$ solution (135 grm. of crystals per litre) and 2 grm. of $K_2S_2O_8$ (Co and NH_4 salts must be absent). After shaking for 1 minute, 60–80 c.c. of 1 : 1 HNO_3 are added to dissolve the NiO_2 excess, and leave a residue of PbO_2, which is then dissolved by addition of 0·1*N*-Na_3AsO_3, the excess of which is titrated with $KMnO_4$ after addition of 10 c.c. of 1 : 1 HCl and 1 drop of 0·005*M*-KIO_3. For the determination of Pb in alloys containing Sb 0·3–0·5 grm. is dissolved by heating with 5 c.c. of concentrated H_2SO_4, and the cold solution is treated with 5–10 c.c. of HCl (*d* 1·19) and 1 grm. of KBr and boiled until fumes of H_2SO_4 are evolved; the treatment is repeated to remove all the Sb, and the $PbSO_4$ is collected and treated as described above.—A. R. P.

A New Semi-Micro- and Micro-Determination of Magnesium. A. Blanchetière and M. Arnoux (*J. Pharm. Chim.*, 1933, [viii], **17**, 97–107; *Chem. Zentr.*, 1933, **104**, I, 3747).—The method depends on the precipitation of $MgI_2,10H_2O, 2(CH_2)_6N_4$ by addition of KI and $(CH_2)_6N_4$ to the neutral Mg solution free from heavy metals. The precipitate may be determined volumetrically by titration of the I_2 content by the Volhard method or by addition of excess H_2SO_4 and titration of the excess with standard alkali.—A. R. P.

The Determination of Metals by Means of 8-Hydroxyquinoline. I.—The Effect of p_H on the Precipitation of Magnesium, Zinc, Cobalt, Nickel, Copper, and Molybdenum from Acetate Solution. H. Ronald Fleck and A. M. Ward

(*Analyst*, 1933, **58**, 388–395).—The p_H range within which precipitation by 8-hydroxyquinoline is complete in acetate solution is as follows: Mg 9·5–12·6, Zn 4·7–13·3, Co 4·3–14·5, Ni 4·5–14·5, Cu 5·4–14·5, Mo 3·7–7·4. No precipitation occurs when the p_H is less than 7·2 (Mg), 4·0 (Zn), 4·1 (Ni), 3·35 (Cu), 3·1 (Mo), or greater than 13·2 (Mg), 14 (Zn), 7·7 (Mo). Thus in acetate solutions, by adjustment of the p_H, separation of Mo and Mg from all the other metals is possible, but Co, Ni, Zn, and Cu cannot be separated from one another. —A. R. P.

Estimation of Manganese by Procter Smith's Method. A. Pinkus and L. Ramakers (*Chim. et Ind.*, 1933, **30**, 46).—Abstracted from *Bull. Soc. chim. Belge*, 1932, **41**, 529–548, 549–564; see *J.*, this volume, p. 369.—W. A. C. N.

Potentiometric Titration of Molybdenum. Blahoslav Stehlik (*Chem. Listy*, 1932, **26**, 533–537).—See abstract from another source, *J.*, this volume, p. 369. —R. P.

On the Determination of Potassium and Sodium in the Form of Sulphates. H. Remy and R. Siegmund (*Z. anal. Chem.*, 1933, **93**, 321–331).—The alkali sulphates become completely anhydrous only after heating at 400° C. (K_2SO_4) or 900° C. (Na_2SO_4). Addition of H_2SO_4 assists in expulsion of the H_2O; a further addition of $(NH_4)_2CO_3$ promotes expulsion of the excess SO_3. K_2SO_4 begins to volatilize above 800° C.—A. R. P.

Contribution to the Analytical Determination of the State of Silicon in Aluminium and in Aluminium–Silicon Alloys. P. Urech (*Z. anorg. Chem.*, 1933, **214**, 111–112).—SiH_4 is always evolved when Al or its alloys containing Si are dissolved in H_2SO_4 or HCl without addition of HNO_3. In the dissolution of such materials in H_2SO_4 (*d* 1·6) or 2*N*-HCl a loss of 0·033–0·040% Si or of 0·045–0·047% Si, occurs; this loss is independent of the Si content of the alloy. —M. H.

Application of Mercurimetry to the Determination of Silver. J. V. Dubský and J. Trtílek (*Z. anal. Chem.*, 1933, **93**, 345–348).—For the determination of Ag in alloys the HNO_3 solution is diluted to 0·2*N*-HNO_3 and the Ag precipitated with excess of standard NaCl solution, the excess being titrated with $Hg(NO_3)_2$ solution using diphenylcarbazide or, better, diphenylcarbazone as internal indicator.—A. R. P.

Determination of Tungsten with 8-Hydroxyquinoline in Complex Oxalate Solution. A. Jílek and A. Rysánek (*Coll. Trav. chim. Tchécoslov.*, 1933, **5**, 136–138).—W can be separated from Sn by treating the neutral oxalate solution of the metals containing $(NH_4)_2C_2O_4$ with 8-hydroxyquinoline. The precipitate is ignited to WO_3 for weighing.—A. R. P.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

(See also "Testing" and "Pyrometry.")

(Continued from pp. 566–567.)

A Precision, High-Power Metallographic Apparatus. Francis F. Lucas (*Metal Progress*, 1933, **24**, (4), 21–25).—Abbreviated from a paper read before the American Society for Steel Treating. The apparatus is intended for high-power photography with monochromatic light, the character of which can be controlled by rotating the mounting until the desired line in the spectrum produced by a spark gap or mercury lamp bears on the vertical illuminator of the microscope assembly. This is mounted separately from the illuminating apparatus, to increase the stability demanded by long-exposure work. The objectives may be of standard type or corrected for infinity tube length, the latter giving superior results.—P. M. C. R.

A New Optical Dilatometer.—I. Fr. Bollenrath (*Z. Metallkunde*, 1933, **25**, 163–165).—The instrument which is provided with a device for optically recording the extension–temperature curve is described in detail; it has several advantages over the Chevenard differential dilatometer, especially for the dilatometric investigation of materials with a low strength at high temperatures.—M. H.

A Useful Magnifier. Anon. (*J. Sci. Instruments*, 1933, **10**, 255).—Describes the Beck "Luminex" magnifier. This is a combination of a magnifying glass and electric torch arranged so that light is reflected on the object under examination. An adaptation as a microscope for examining Brinell impressions is also made.—W. H.-R.

New Profilograph Measures Roughness of Finely Finished and Ground Surfaces. E. J. Abbott and F. A. Firestone (*Automotive Ind.*, 1933, **69**, 204–207).—A description of recent improvements in the Profilograph. See *Metal Progress*, 1932, **21**, (4), 57, and this *J.*, 1932, **50**, 367.—P. M. C. R.

A Universal Automatic Filtration Apparatus. Jaroslav Chloupek and Vladislav Z. Daneš (*Chem. Obzor*, 1932, **7**, 237–240).—A simple inexpensive, self-contained, and safe automatic filtration apparatus is described for use with almost every form of filtering device, such as sintered glass crucibles, porous porcelain crucibles, ordinary or Büchner funnels, in the ordinary, or an inert atmosphere, with or without suction. The relative efficiencies of continuous and intermittent filtration procedures are compared.—R. P.

A Recording Photodensitometer for X-Ray Powder Photographs. W. O. Milligan (*Rev. Sci. Instruments*, 1933, **4**, 496).—A cheap and robust form of photodensitometer enabling intensities of spectra to be determined with an accuracy within 4–5% of accepted values is described.—J. S. G. T.

An Improved Apparatus for the Measurement of Poisson's Ratio. A Correction. W. A. Zisman (*Rev. Sci. Instruments*, 1933, **4**, 507).—Corrections necessary in Z.'s paper (*J.*, this volume, p. 454) are noted.—J. S. G. T.

A High-Temperature X-Ray Camera for Precision Measurements. A. H. Jay (*Proc. Phys. Soc.*, 1933, **45**, 635–642).—A precision X-ray camera designed for taking X-ray spectra by the powder method at temperatures up to about 600° C. is described.—J. S. G. T.

An Integrating Photometer for X-Ray Crystal Analysis. B. Wheeler Robinson (*J. Sci. Instruments*, 1933, **10**, 233–242).—Describes the construction of a photo-electric photometer for the measurement of integrated X-ray intensities in crystal analysis photographs. The general principle is that, on the same emulsion as that used for the photograph, a calibration wedge is imprinted by exposure behind a slit covered by a rotating cam, so that, along the length of the slit, exposure is proportional to distance. This calibration wedge is developed with the photograph, and is then cut away and placed under one exploring beam of the photometer, whilst the other beam travels over the area of the spot to be measured. The position of the wedge is altered until the two beams give an exact balance of density as measured by two photo-electric cells. The position of the wedge, which is mounted in a sliding carrier, is thus a linear measure of the X-ray density at the point under the exploring beam, and a simple integrating device gives a very good estimation of the total density of the whole X-ray spot. The instrument is simple and inexpensive to construct, and gives results in good agreement with those of the ionization spectrometer.—W. H.-R.

Gas-Tight Welding [of Metal Wires] to Fused Silica. E. Podszus (*Sprechsaal*, 1933, **66**, 215).—In order to weld metal wires to fused silica a special ceramic joining piece is prepared. It has at one end a composition which can be readily welded to fused silica, and at the other end merges into a glass.—J. W.

XI.—PHYSICAL AND MECHANICAL TESTING AND RADIOLOGY

(Continued from pp. 567–569.)

The Relationship Between Static and Dynamic Loading. B. Garre (*Z. Metallkunde*, 1933, 25, 206).—The relationship between the phenomena of fracture under static and dynamic loading postulated by Ljungberg (see this *J.*, 1931, 47, 103) holds good only for hard materials with an accuracy of about 10%. With medium hard and soft materials, however, considerable deviations exist. This is due to the fact that a number of assumptions on which that postulation is based do not prove to be absolutely correct.—M. H.

Supplementary Methods of Stress Analysis. Herbert J. Gilkey and Elmer O. Bergman (*Civil Eng.*, 1932, 2, 97–101; correspondence, M. M. Frocht, 377).—A general review, with selected bibliographies, is given of experimental methods of studying complex stress distributions in intricate structures. The plaster model or "brittle-material" method, the membrane analogy method, methods involving yield lines, and photo-elastic methods are among those briefly described. The inherent limitations of all methods based on the similarity of action of model and prototype are pointed out, and the need for the exercise of engineering judgment in interpreting results is emphasized.
—J. C. C.

The Determination with Models of Internal Stresses in Arbitrarily Loaded Supporting Structures by the Deformation Gauge. K. Schaechterle (*Beton u. Eisen*, 1933, [D], 32, 174–176).—The adjustments and limitations of the gauging apparatus are described, and the theoretical basis of its working is explained. A short description is given of the construction of the celluloid models employed. Necessary approximations are indicated, and a formula is given for calculating actual moments from the results obtained on models of any given scale.—P. M. C. R.

Technique of Using Extensometers in Aeronautical Structures. Georges Ivanow (*Aéronautique*, 1932, 14, 187–191).—Measurement of the local deformation in a loaded structure gives information regarding the distribution of stresses which is obtainable in no other way. The Huggenberger extensometer is recommended for this work. Different methods of mounting it are described in detail, and the precautions necessary for accurate results enumerated. For observations on structures in motion, the Ritz extensometer, in which no magnifying devices are employed, is recommended. In this instrument, a record of deformation is obtained by the trace of a fine diamond on a glass or "cellon" tablet. A photographic enlargement of the record is subsequently made for examination.—J. C. C.

Comparison of Single-Step Long-Time Creep Results with Hatfield's Time-Yield Stress. A. E. White and C. L. Clark (*Amer. Soc. Steel Treat. Preprint*, 1933, Oct., 1–14).—The experiments have been conducted on samples of steel. It is stated that although there is a trend towards a relationship between the values obtained by the two methods mentioned, the variations are so great that no regular law is discoverable. The outstanding merit of Hatfield's proposal is the saving of time over the creep testing methods at present in vogue. Results for 3 steels at 455° C. and for 11 at 537° C. are given. It is concluded from these that the time-yield method may be used qualitatively in order to classify a series of steels of given type at a given temperature.—W. A. C. N.

Amsler 3000-Kg. Testing Machine, with Electric Furnace, for Determining the Creep Point of Four Test-Pieces Simultaneously. Anon. (*Bull. tech. Suisse Romande*, 1932, 58, 138–142).—The results of ordinary static tensile testing cannot be accepted as criteria for the selection of materials which will, in practice, be exposed to prolonged stress at high temperatures. The phenomena of creep are briefly summarized, and a description is given of a testing machine, installed by the Swiss Federal Laboratory for Testing Materials, for the investigation of creep in metallic samples. Four test-pieces can be tested simultaneously. Each is contained in a separate compartment of an electric furnace, which admits of testing-temperatures up to 800° C. Independent loading is secured for each piece (load varies from 50 to 3000 kg.), and the respective elongations are observed on a micrometer scale reading to 0·001 mm. They are, further, automatically recorded. Test-pieces are 10 mm. in diam. and 100 mm. gauge-length. The structure and adjustments of the machine are described and illustrated, with devices for neutralizing variations of current and ensuring a steady testing temperature.—P. M. C. R.

A Machine for Determining the Fatigue Limit of Metals. Walther Saran (*Engineering*, 1932, 133, 731–734; and (abstract) *Technique moderne*, 1932, 24, 394).—An autographically recording machine is described for short-time fatigue testing, primarily of light-alloy sand-castings. In the correlation of static and dynamic tests, unavoidable experimental errors may be eliminated if both types of test can be performed on the same machine. The present apparatus provides for this, and, further, for the superposition of static on dynamic stress, and for high-temperature testing; pure sinusoidal stresses can be applied, and the stress, strain-energy and temperature of the test-piece can be independently measured as the load increases. Provision is also made for keeping the test-piece cool, if necessary. The construction and manipulation of the machine and the interpretation of results are fully described, and the effect of the form of the test-piece is discussed.—P. M. C. R.

A New Device for Creep Testing. F. H. Norton and J. A. Fellows (*Metal Progress*, 1933, 24, (4), 41–43).—A furnace is described for determining "creep" in specimens of 10-in. gauge-length. The expansion of the austenitic steel furnace tube automatically operates a current-breaking device and thus ensures close temperature control. The method of winding the furnace, the setting of the apparatus for a specific working temperature, and the routine of observation are described, and sample observations are recorded.

—P. M. C. R.

Static Principles of Vibration Fracture. W. Kuntze (*Mitt. Material., Sonderheft* 14, 1930, 17–22).—The characteristic features of vibration fracture are summarized and distinguished from those of tensile and of compressive fractures. The behaviour of materials under repeated tensile loading, and the influence of previous deformation, are graphically illustrated, and certain conclusions are applied to a consideration of vibratory fractures, with a view to elucidate their peculiar localized deformation. Investigations on the elastic properties of copper (W. Kuntze, *ibid.*, pp. 3–7) establish a maximum value of load permitting complete elasticity without proportionality. It is suggested that slip first appears when this limit is exceeded, and hence that the methods indicated might be employed for other materials, and to the establishment of values for their resistance to vibration stresses.—P. R.

An "Over-Night" Endurance Limit Test. H. F. Moore and H. R. Wishart (*Automotive Ind.*, 1933, 68, 211).—An abstract of a paper read before the American Society for Testing Materials. See *J.*, this volume, p. 317.—P. R.

The Torsion Impact Test. G. V. Luerssen and O. V. Greene (*Amer. Soc. Test. Mat. Preprint*, 1933, June, 1–15).—An impact machine is described which has been used to determine quantitatively the impact resistance of hard materials, so that this property may be controlled during the manufacture and use of the latter. Previous work is reviewed. It is believed that this method of subjecting standard specimens to impact under torsion provides a means of making an accurate comparison of impact values, similar to that which is possible by the use of standardized methods on softer materials.

—W. A. C. N.

On an Improved Apparatus for the Static Determination of the Torsion Modulus of Crystal Rods and Its Application to Single Crystals of Zinc. E. Goens (*Ann. Physik*, 1933, [v], **16**, 793–809).—The torsion modulus of zinc single crystals has been determined with a new apparatus (described) which obviates any bending of the rod during the test.—v. G.

Elastic Measurements on Copper by Means of the Martens Mirror. W. Kuntze (*Mitt. Material.*, *Sonderheft* **14**, 1930, 3–7).—In copper, where the elongation becomes progressively greater for equal increments of load, the measurement of elastic stretching is complicated by such factors as: (1) previous loading; (2) lag; (3) time of loading, and (4) the regulation of testing conditions. K. investigates (1) and (2) by a series of autographically recorded load-extension tests. Experimental conditions and method of loading are explained with reference to a specimen stress–strain diagram, which is used for the evaluation of the effects under consideration. The elongation (x_0) under an infinitely small initial load was determined for annealed material by extrapolation, thus facilitating comparative tests to establish the influence of the applied loads. Residual hysteresis effects were eliminated by artificial ageing: their influence is shown graphically, as is the effect of straining and subsequent heat-treatment on the elongation values.—P. M. C. R.

Interpretation of High-Temperature Tensile Tests. M. Sauvageot (*Rev. Mét.*, 1933, **30**, 319–322).—S. emphasizes the importance of giving full and precise details of the condition of material and of the testing when results are published. Reference is made to specific examples.—H. S.

New Bend Testing Machine. A. C. Blackall (*Wire and Wire Drawing*, 1933, **8**, 270, 284).—A description is given of the new Johnson bend testing machine, in which both the jaws gripping the wire slide simultaneously towards the centre line of the bending arm with a screw motion. In another machine, the wire is gripped in a vertical position by plates attached to the sides, and both the bending arm and the gripping device are fitted with guides, so that the wire is in a vertical position before bending begins.—J. H. W.

Critical Evaluation of the Bend Test for Welded Test-Pieces. K. Jurczyk (*Elektroschweissung*, 1932, **3**, 154–155).—In the bend test as usually performed, the angle of bend is not a true indication of weld ductility, since deformation does not take place equally in weld and parent metal. J. describes an apparatus in which the welded test-piece is bent round a pin in such a way that the deformation must be the same for weld, transition, and parent metal. The apparatus may be adapted to measure the bending moment applied to the specimen. It is suggested that the quality of a specimen should not be measured by its bend angle, but by its freedom from cracking after bending through 180° in the above apparatus, round a pin of given diameter for a given thickness.—H. W. G. H.

Hardness [of Metals] and Stress. Hans Kostron (*Mitt. staatl. tech. Versuchsamtes*, 1932, **21**, 17–31; *Chem. Zentr.*, 1933, **104**, II, 121–122).—The hardness of the stretched side of hard-drawn copper and normalized steel rods under a bending load has been measured with various testing machines. The scleroscope and impression hardness-testing machines all showed qualitatively a reduction in hardness due to the tensile stresses produced by bending. The degree of deformation of circular impressions varies with the induced stresses, being at a maximum when these are equivalent to about half the yield point; this deformation is attributed to the unevenness of the surface produced by the irregular flow induced by the stress. The change in hardness is the resultant of (*a*) the softening effect of the tensile stress; (*b*) the disturbance of the stress distribution caused by the permanent deformation round the impression, and (*c*) the increase in hardness produced by cold-work during the stretching caused by the bending. The reduction in hardness in the elastic range is less than that expected by theory owing to the effect of (*b*), whilst (*c*) opposes the decrease in hardness at the yield point. The hardness and irregularity of the impression are strongly influenced by the depth of the impression.—A. R. P.

On the Hardness of Metallic Elements. Masakatu Tokunaga (*Kinzoku no Kenkyu*, 1933, **10**, (9), 393–408).—[In Japanese.] The Rockwell, as well as the Shore, hardness have been measured for 27 metallic elements, and a conversion curve for these two hardness scales has been made. The relation between the hardness and atomic number has also been obtained.—S. G.

A Contribution to the Determination of the Initial Hardness in the Ball Hardness Test. E. Franke (*Z. Metallkunde*, 1933, **25**, 217–219).—The ball hardness test gives relative hardness values which allow only a conditional comparison of the hardness of different materials. These relative hardness values are higher than the initial hardness values, owing to the strengthening (cold-hardening) which takes place by the impression of the ball. The initial hardness is obtained if the value of the additional hardness (being due to the strengthening) is deducted from the normally determined hardness value. The experimental determination of the approximate initial hardness is possible by means of the scleroscope or the Herbert pendulum hardness tester. The initial hardness is: $H_I = \frac{H \times P_0}{P}$, where H is the normally determined ball hardness, P_0 the pendulum or scleroscope hardness of the material, and P the pendulum or scleroscope hardness of the cold-hardened zone of the impression of the ball.—M. H.

Hardness Testing with Preliminary Load (Rockwell Method) in Its Application to Standard Brinell Values. A. Wallichs and H. Schallbroch (*Stahl u. Eisen*, 1931, **51**, 366–368; and (summary) *Metallurgist* (Suppt. to *Engineer*), 1931, **7**, 110–111).—The ball-hardness and indentation-hardness values as obtained by the original Rockwell machine are correlated with Brinell values. Conversion curves are given for a variety of ferrous and non-ferrous materials; their interpretation is explained, and the effect of variations in ball-diameter is discussed.—P. M. C. R.

Determination of Hardness by the Method of Scratching as Applied to Metals. K. M. Juriew and V. A. Novopavlovskiy (*Sobshenia Leningradskogo Instituta Metallov* (*Communications of the Leningrad Institute of Metals*), 1933, (14), 116–156).—[In Russian.] In order to obtain satisfactory results by the scratching method, the diamond must be carefully selected and checked against a standard; the setting of its point must be permanent during scratching and illumination during measurement must be constant. Furthermore, a study of the structure of the metal must simultaneously be made, since the scratching method gives the hardness of individual structural constituents and calculation of the average value may give incorrect results. The diamond must be set at the greatest possible angle towards the surface of the specimen to obtain a scratch with even edges. The hardness number is best calculated by the expression: $H = \frac{P}{\lambda^2}$kg./mm.², which gives the same result with all loads on the point. Comparison with a ball test can be made by introducing a coefficient determined experimentally for a given metal and apparatus (the hardness number must be expressed on Mayer's scale).—N. A.

Diamond Hardness-Testing Machine. R. Guillery (*Rev. Mét.*, 1933, **30**, 287–291).—The machine described is of the type which observes the difference in penetration of a ball or point applied to the metal under examination under two different loads applied successively. Hydraulic pressure is used for accuracy and cheapness.—H. S.

Bowen Impressor Hardness-Testing Machine. Anon. (*Machinery* (*Lond.*), 1933, **42**, 651).—A brief description of the "Impressor" machine. See *J.*, this volume, p. 568.—J. C. C.

New Type Herbert Pendulum Hardness Tester. Anon. (*Machinery* (*Lond.*), 1933, 42, 744). **Herbert Pendulum Hardness Tester. A Simplified Model.** Anon. (*Found. Trade J.*, 1933, 49, 123).—See *J.*, this volume, pp. 568, 569.—J. H. W.

The Firth Hardometer. Anon. (*Machinery* (*Lond.*), 1932, **40**, 311, 694–695).—Illustrated descriptions. See this *J.*, 1928, **40**, 616; 1929, **42**, 565.
—J. C. C.

125 Kilogrammes Hardness-Testing Machine. Anon. (*Mech. World*, 1933, 93, 452).—See *J.*, this volume, p. 375.—F. J.

Magnetic Testing of Welded Joints and Pieces. J. Pfaffenberger (*A.E.G. Mitt.*, 1933, (4), 133–135).—The method depends on the deflection of magnetic lines of force by discontinuities, blow-holes, cracks, &c. Such deflections induce varying intensities of current in a coil contained in a testing handle, with which the entire joint, even in parts which are normally difficult of access, is easily explored: an amplifier transmits correspondingly varying sounds through head-phones worn by the operator. The apparatus is claimed to be cheaper, more easily operated, and more generally applicable than an X-ray testing plant.—P. M. C. R.

RADIOLOGY

Relative Merits of Film and Paper for Industrial X-Ray Work. Ancel St. John and H. R. Isenburger (*Amer. Soc. Test. Mat. Preprint*, 1933, June, 1–9).—An acceptable X-ray negative should show perceptible shadows through the most opaque portion under examination, sufficient contrast to disclose a marker of 2% of the relative plate thickness through the thinnest portion under examination, and lead to unmistakable identification of the region examined. In the tests described the characteristics of good-quality film and paper as regards sensitivity, contrast, convenience in use, and cost are considered. The technique of the experiments is fully described. In respect of speed and contrast there is little to choose between film and paper. The balance is in favour of the paper with regard to general convenience. Paper is considerably less costly than film.—W. A. C. N.

Lattice Distortions and the Detection of Internal Stress [in Metals] with X-Rays. H. Mark and G. von Susich (*Z.V.d.I.*, 1932, 76, 1049–1052).—A brief review of recent work on the detection of deformations in the crystal lattice by the deterioration of the sharpness of the X-ray lines, and of various methods which have been proposed for their qualitative and quantitative evaluation.—v. G.

The Use of X-Rays for the Investigation of Elastic Stresses in Crystalline Substances for the Determination of Elastic Changes of Orientation. A. P. Komar (*Zhurnal Tehnicheskoi Fiziki* (*Journal of Technical Physics*), 1932, 2, (7–8), 671–681).—See *J.*, this volume, p. 292. A review.—N. A.

Material Testing with X-Rays. E. Brandenberger (*Schweiz. Bauzeit.*, 1933, 102, (4), 39–42).—A review of the principles of absorption and interference of X-rays and their application to the technical testing of materials.—J. W.

The X-Ray Inspection of Aluminium Alloy Welds. N. C. Hypher (*Metallurgia*, 1933, 8, 145–146, 148).—The application of aluminium alloys to aircraft and automobile construction is increasing the need for reliable welds, and the X-ray inspection of such welds is of importance. The uses and limitations of direct X-ray inspection of certain high-duty alloys of the "R.R." series welded either by the oxy-acetylene or the electrical "spot" method are discussed. The welds inspected did not exceed 3 in. in thickness, but welds up to 6 in. can be examined. Consideration is given to radiographs showing such defects as lack of fusion and union, gas pockets, seams and cracks, and inclusions of oxide and slags, produced by oxy-acetylene welding, and it is stated that radiography is of no value in detecting such faults in the case of electrical "spot" welds due to their construction. Reference is also made to the examination of structures and welds by the X-ray diffraction picture obtained by reflecting a pin-hole beam of X-rays at the surface of the point to be inspected. This is a new non-destructive method of inspection, at present in the research stage, which promises to be of value in determining the state of stress in metal parts and welds.—J. W. D.

The Capacity and Economy of the X-Ray Method for Testing Welds. R. Berthold (*Elektroschweissung*, 1932, **3**, 201–205).—The technique of X-ray examination for welds is described in order to explain how the type of weld influences the number of exposures and the depth of penetration necessary for a satisfactory test. It is pointed out that the exposure required increases with the thickness of material and decreases with increased tube voltage, whereas the sensitivity of the method, *i.e.* the capacity for detecting very small defects, decreases with increasing tube voltage and thickness. Consequently a compromise must be sought for the most economical working. The method of doing so is fully explained and is illustrated by a table giving the essential data for testing typical types of weld.—H. W. G. H.

Sensitivity of the Gamma-Ray Method of Radiography. John T. Norton and Alfred Ziegler (*Amer. Soc. Steel Treat. Preprint*, **1933**, Oct., 1–9).—Using a capsule of radon as the source of γ-rays, various thicknesses of iron, changing by definite measured steps, were radiographed and the optical density of the film so produced was measured by the densitometer. Hence the sensitivity was determined. It is defined as the change in thickness necessary to produce a 2% change in film density under certain specified conditions. The sensitivity is found to be nearly constant in value—1·3% of the thickness of the object—within the region of 2½–6 inches of iron. The use of radon for γ-ray radiography is said to offer a very practical solution to the problem of the radioactive source.—W. A. C. N.

XII.—PYROMETRY

(Continued from pp. 569–570.)

New Micropyrometer for Determining Melting Points of Alloys. Anon. (*Electric J.*, 1932, **29**, 152).—The material is heated on a resistance element consisting of a platinum strip 0·5 in. wide and 0·005 in. thick in a chamber which can be evacuated or filled with any gas desired. Observations of the first signs of fusion are made through a quartz window with the help of a microscope. The special feature of this equipment is that the temperature is automatically recorded by a total radiation pyrometer in conjunction with a recording potentiometer.—J. C. C.

Apparatus for Temperature Measurement and Temperature Regulation. Alfred Grunwald (*Siemens Z.*, 1933, **13**, 141–146).—An illustrated description of some modern apparatus.—M. H.

Pyrometric Economies. W. Bowen (*Eng. Rev.*, 1933, **47**, 102).—See *J.*, this volume, p. 457.—P. M. C. R.

Pyrometric Economies. H. Pickard. W. Bowen (*Eng. Rev.*, 1933, **47**, 274–276).—Correspondence on "Pyrometric Economies," by W. Bowen (see preceding abstract). H. P. states that the low e.m.f. of the Pyrofer couple is likely to diminish accuracy as well as to necessitate a less robust indicator than is required by Chrome–Alumel or iron–Constantan couples. B. considers that a similarly designed indicator can combine high sensitivity and considerable robustness, and considers in some detail the importance of errors due to resistance and millivolt changes.—P. M. C. R.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 570–574.)

The Relationship Between the Engineering and the Foundry Trades. L. H. Pomeroy (*Proc. Inst. Brit. Found.*, 1930–1931, 24, 65–77; discussion, 77–93; and (abstract) *Mech. World*, 1931, 90, 200–201, 221–222).—P. advocates closer collaboration between foundry and designer; certain practical problems are indicated which could profitably be investigated under such conditions. The interpretation of mechanical tests is discussed, especially with regard to the relative reliability of castings and forgings. In the subsequent discussion, the different conditions in Great Britain and in the U.S.A. were considered in relation to efficiency, and certain research developments were reviewed.—P. R.

Contribution to the Study of the Casting Properties of Metals and Alloys. Paul Bastien (*Publ. sci. tech. Ministère de l'Air*, No. 20, 1933, 95–143).—Experiments on the ease with which pure metals fill the mould during casting ("castability") show that this is the resultant of numerous factors, among which the specific heat, latent heat of solidification, and melting point play a part as important as that played by the viscosity. The castability (C) increases linearly with increasing difference between the casting temperature and the melting point. For any given type of mould the castability of an alloy depends on the casting temperature, the mould temperature, the fluidity, the heat content, the solidification range (R), and the type of crystallization. Tests on lead–antimony, antimony–cadmium, and tin–antimony alloys show that C is inversely proportional to R and reaches a relative maximum when the material melts congruently (pure metals, eutectics, compounds) and a minimum with saturated solid solutions. C is better when the crystals which separate from the liquid have convex faces than when dendritic crystals separate. These two points are particularly emphasized by the good castability of the compound SbCd. Commercial magnesium has a low castability due to the presence of impurities in solid solution and possibly to the effects of oxide skins; addition of copper or aluminium improves considerably the castability. The effect of additions to the sand on the castability of magnesium alloys and the shrinkage and piping of castings of aluminium–copper–magnesium alloys have also been studied.—A. R. P.

Considerations on the Solidification of Metal Ingots. W. Roth (*Z. Metallkunde*, 1933, 25, 134–137; and (abstract) *Met. Ind.* (*Lond.*), 1933, 43, 448).—The temperature distribution during the period of solidification of an ingot of a pure metal has been calculated and the results are shown in diagrams and discussed. The formation of a zone of acicular crystals is explained by the existence of a temperature gradient in the liquid portion of the ingot. The theoretical considerations are in accordance with results of temperature measurements made at different places within an ingot of 70 : 30 brass in a cast-iron mould.—M. H.

On the Cooling of Ingots in Chill Moulds, Especially Brass Ingots in Water-Cooled Moulds. Walter Roth (*Giesserei*, 1933, 20, 413–419).—Equations have been deduced for calculating the temperature changes during the cooling of ingots in water-cooled moulds. From these equations the temperature gradient inside the ingot, the rate of cooling, and the time of solidification can be determined. The various methods by which the cooling conditions can be altered are discussed, and it is shown that the effects of the mould dressing, which opposes by far the greatest resistance to heat transfer, cannot be appreciably modified. By suitable selection of the mould material the time of solidification of brass ingots can be varied by about 50%, and, by changing the rate of flow of the water through the mould, by about 15%. Numerous tests have shown that ingots of 70 : 30 brass with a rapid rate of cooling solidify at a constant temperature and not through a temperature range as indicated by the equilibrium diagram of the copper–zinc system; it is therefore concluded that this brass has very little tendency to segregation. The grain-size and transcrystallization of the ingots depend chiefly on the casting temperature and rate of cooling, and, since only relatively small changes can be made in the latter factor in chill casting, it follows that the casting temperature is of primary importance for obtaining a desired casting structure.—A. R. P.

Efficient Casting Design. F. C. Edwards (*Foundry Trade J.*, 1932, 47, 161–162, 363, 364; and *Canad. Mach.*, 1933, 44, (2), 32–34).—Correct design should anticipate probable shrinkage stresses, and should not be influenced by previous association with other types of work: a consideration of faulty and improved flat-top designs illustrates the requisite adaptation of design to working conditions. Bracket and flanged castings are also considered. Suitable modifications of ribs, lightening cores, and lugs are suggested, and shown diagrammatically.—P. M. C. R.

Melting Aluminium in Crucible Furnaces. Anon. (*Metallbörse*, 1931, 21, 915–916; and (abstract) *Light Metals Research*, 1931, 1, (22), 21).—Serious attack on crucibles used for melting aluminium is caused by the affinity of the metal for iron and silicon at temperatures within the operating range, by the prolonged heating necessitated by the high specific heat of aluminium, and by the corrosive effects of aluminium oxide and of certain fluxes. Mechanical erosion generally follows chemical attack, and temperature variations and furnace gases cause further damage. Attack can be minimized by the use of high-carbon steel crucibles, by preserving the crucible surface without scraping between heats, and by coating the interior with a paste made of alumina and graphite. If a tilting furnace can be used, large heats are preferable. Graphite crucibles are recommended, and their preparation is described, with directions for their economical use.—P. M. C. R.

Gas Content of Aluminium Casting Alloys. H. Nipper (*Light Metals Research*, 1933, 2, (32), 8–14).—Translated from *Z. Metallkunde*, 1933, 25, 65–67; see *J.*, this volume, p. 326.—J. C. C.

Aluminium–Bronze Cog-Wheels Manufactured at the Marty Works at Nikolaev for Internal Combustion Engines. —— Klimow (*Liteinoe Delo* (*Foundry Practice*), 1933, (3), 21–24).—[In Russian.] Detailed description of the experiments on the manufacture of cog-wheels in the State Marty Works at Nikolaev.—N. A.

Development of a Technical Casting Process for Beryllium–Copper Alloys. G. Masing and W. Pocher (*Heraeus Vacuumschmelze* [10*th Anniv. Volume*], 1933, 339–348).—Casting of "beryllium–bronze" is attended with the same difficulties as are met with in casting "aluminium-bronzes," namely, the inclusion of oxide skins and the formation of long, thread-like, and often branched pipes within the ingot. Sound castings of rods may, however, be obtained by using moulds slightly tapering towards the bottom inside and towards the top outside, so that the wall thickness is much greater at the bottom than at the top; the moulds should be bolted to a heavy cast-iron bottom plate and should have a sand casting-head tapering outwards from bottom to top. With this arrangement the casting solidifies from the bottom upwards and piping is thus avoided.—A. R. P.

Copper–Nickel Alloys. Anon. (*Modern Eng.*, 1933, 7, 12–15).—The properties, melting, casting, and working of cupro–nickels are discussed.—H. W. G. H.

Bells, Hand Bells, and Carillons. V. Cheilly (*Cuivre et Laiton*, 1933, 6, 243–245).—A discussion of the factors which have to be borne in mind when adjusting the tone of bells.—W. A. C. N.

The Manufacture of Tin–Bronzes. A. P. Smiriagin (*Liteinoe Delo* (*Foundry Practice*), 1932, (11), 23–24).—[In Russian.] Hints are given on the following points: melting of new metal charges, melting of charges containing scrap, amount and composition and method of using fluxes, rate of pouring, mould temperature, lubrication of chill-moulds, and the characteristic properties of moulding sands.—N. A.

The Filling of Bearings with Lead-Base Babbitts. A. N. Alimov (*Vestnik Metallopromishlennosti* (*Messenger of the Metal Industry*), **1930**, (5), 130–137).—[In Russian.] Non-porous homogeneous castings of lead-base Babbits containing more tin than antimony can be obtained by preheating the moulds to 150°. When the tin content does not exceed the antimony, good castings can be obtained by stirring the molten metal in the mould with an iron rod.—D. N. S.

"Rapidor" Gate Saw. Anon. (*Mech. World*, 1933, **94**, 789).—This new model gate-sawing machine is arranged so that the blade can cut the gate as nearly as possible flush with the casting.—F. J.

Position and Results of the Pressure Casting Method. W. Brunnckow (*Z. Metallkunde*, 1933, **25**, 190–194).—In pressure casting the melt is cast in permanent moulds under a high pressure. It shows the following three characteristics as compared with die-casting: (*a*) the molten metal is in a crucible outside the casting machine and the necessary quantity is added each time to the machine by means of a ladle; (*b*) the compressed air does not act directly on the melt, but by means of a press stamp; (*c*) at the moment of casting the melt is not fully liquid, but somewhat pasty, *i.e.* below the liquidus temperature. Pressure casting machines constructed by Eckert and Polàk are described. The mechanical properties of pressure castings of 60 : 40 brass, lead brass (58% copper, 2% lead), red-brass, and tin–lead bronze are compared with those of sand-castings and pressed bodies. The technical and economical limitations of pressure casting and pressing are discussed.—M. H.

Modern Casting Machines. Anon. (*Giesserei*, 1933, **20**, 94–96).—Illustrations with brief descriptions are given of new types of machines for making small pressure castings (chiefly for cast iron).—A. R. P.

The Dust Problem in the Foundry Industry. E. G. Meiter (*Amer. Found. Assoc. Preprint*, **1933**).—The importance of reducing the dust nuisance, particularly in regard to particles with largest dimension less than 10^{-3} mm. (which are liable to promote occupational diseases), is receiving serious study in the U.S.A., more especially on account of its legal aspect. Since, according to Stoke's law, such particles fall only 20·3 ft. in 24 hrs., a large amount of particles of this order of size is found in the ordinary foundry atmosphere. Samples for test are collected by causing a measured volume of air to impinge on a wet plate, which is revolved with its lower half in a water-bath. The collected dust is filtered through a 280-mesh sieve, and a microscopic count on a suitably ruled square is made of all particles of less than 10 microns largest dimension contained in an aliquot portion of the original sample. The reduction of silicosis should be brought about by reduction to within safe limits of air-borne dust and subsequent maintenance to ensure that this limit is not exceeded. Methods for removing light accumulated dust are discussed, such as: (1) washing off; (2) blowing off; (3) brushing, or (4) removal by vacuum, and the reduction of the formation and spreading of dust are discussed. Particular attention should be paid to (1) prevention of dust flying when floor-sweeping; (2) maintenance of dust-tightness of sand-blast and exhausting systems; (3) isolation, so far as practicable, of dusty processes; (4) suitable ventilation wherever possible, and (5) insistence on operators of equipment causing dust wearing respirators, helmets, &c. In a short discussion, various systems were discussed and vacuum-cleaning was advocated.
—R. B. D.

Keeping a Clean and Orderly Foundry. A. D. Lynch (*Amer. Found. Assoc. Preprint*, **1933**).—A brief review of practical details of the methods of carrying out the principles outlined in a paper by Meiter (preceding abstract).
—R. B. D.

Green-Sand Cores. Frank Whitehouse (*Iron and Steel Ind.*, 1933, 6, 399–401).—The relative advantages of dry-sand and green-sand cores are considered from the three essential aspects of reliability, quality, and cost. Green-sand cores, if properly made can be relied on, and are effective substitutes for dry-sand cores in green-sand moulds, but not in dry-sand moulds, and green-sand cores are also stated to be cheaper both to mould and fettle. The manufacture of green-sand cores is also considered in detail.—J. W. D.

Testing Foundry Sand. Anon. (*Mech. World*, 1933, 94, 819).—A brief note on the report on routine methods for testing green sands, issued by the Sands and Refractories Sub-Committee of the Institute of British Foundrymen. —F. J.

Modern Furnaces for Drying Cores and Moulds. H. Kalpers (*Maschinenkonstrukteur*, 1933, 66, 132–134).—The importance of drying conditions has increased with the prevalent use of oil in core-preparation: if a critical temperature, depending on the nature and amount of the binding material, is exceeded, the core is likely to crumble. Types of furnace for small and for larger work are described, with details as to fuel (gas, oil, coal, or coke), approximate dimensions and working temperatures.—P. M. C. R.

The Suitability of Certain Canadian Sands for Use in Sand-Blasting. L. Heber Cole, R. K. Carnochan, and W. E. Brissenden (*Canad. Dept. Mines, Mines Branch*, No. **727**, 1932, 1–41; and (abstract) *Canad. Mach.*, 1932, 43, (7), 46–50).—A series of tests in a commercial sand-blasting machine was made on certain Canadian sands, which were used on weighed steel plates of standard dimensions. Photomicrographs show the nature of the surface developed in each case, and also the character of all the original sands, as well as of certain sands after using. Testing conditions are described in detail, and results are tabulated together with shape, composition, lustre, and condition of sand after treatment. Granulometric analyses are also given. Angular grains appear to cut more quickly than rounded granules, and to give a more satisfactory surface for subsequent enamelling or painting. Within certain limits, fine sands are more efficient than coarse, and a slow feed increases cutting power.—P. M. C. R.

Determination of the Degree of Dispersion of Clay-Containing Moulding Sands. P. P. Berg (*Liteinoe Delo* (*Foundry Practice*), 1933, (1), 21–24).—[In Russian.] Of the two indirect methods used, determination of the degree of adsorption is preferable to determination of sp. gr. of the aqueous suspension. In the first method a procedure has been elaborated differing somewhat from those already known. A graph showing the relation between the clay content and the amount of moisture adsorbed for clay-containing sands from various deposits is given.—N. A.

The Determination of Clay Content in Moulding Sand According to A.F.A. Method (Theoretical Basis). K. Karlov (*Niimash Izvestia Nauchno-issledovatelskogo Instituta mashinostroenia i metalloobrabotki* (*Bulletin of the Scientific Research Institute of Machine Building and Metal Treatment*), 1933, (1), 41).—[In Russian.] The theories of precipitation, determination of the size of clay particles, importance of adding caustic soda, and estimation of clay content by Aulich's method are examined.—N. A.

Pattern Shop and Foundry Practice. Anon. (*Machinery* (*Lond.*), 1933, 42, 661–666).—A brief account is given of the equipment of the pattern shop and foundry of the works of G. and J. Weir, Ltd., Glasgow, and their production methods are outlined. Single castings up to 7 tons weight in cast iron and 6 tons weight in brass or bronze can be made—J. C. C.

Handling Materials in the Small Brass Foundry. D. G. Anderson and B. F. McAuley (*Mech. Handling and Works Transport*, 1932, 19, 237–239, 403–405).—A paper read before the American Foundrymen's Association, 1932; see *J.*, this volume, p. 42.—J. C. C.

XIV.—SECONDARY METALS: SCRAP, RESIDUES, &c.

(Continued from p. 571.)

Secondary Metal Output Lower in 1932 than in 1931. Anon. (*Daily Metal Reporter*, 1933, 33, (158), 6).—A decrease of 40% in the total production of secondary metal in the U.S.A. on the value for 1931 is recorded by the U.S. Bureau of Mines for 1932. The figures for copper, lead, zinc, tin, aluminium, antimony, and nickel and their principal alloys are analyzed for both years in a table.—P. M. C. R.

Scrap and the Lead Market. Samuel Tzach (*Eng. and Min. J.*, 1933, 134, 371–373).—An economic survey.—R. Gr.

Treatment of Platinum-Iridium Scrap. C. Campbell (*Sands, Clays, and Minerals*, 1933, 1, (4), 29–31).—Dry and wet methods for recovering platinum and iridium from scrap containing them alone or in admixture with other precious metals are briefly described. [*Note by abstractor*:—The methods described do not represent modern practice and the descriptions given are very poor.]—A. R. P.

The De-Tinning of Tinplate. Herbert Kurrein (*Chem.-Zeit.*, 1932, 56, 849–851; and (abstract) *Technique moderne*, 1933, 25, 491).—The reduction of tinned scrap to manageable proportions often renders parts of the material inaccessible to the solvent, with consequent loss of tin and poor quality in the recovered base material. This difficulty is eliminated by simultaneous rolling and perforation of the compacted scrap. Careful cleaning removes such adherent substances as paper, lacquer, paint, and previous contents of tins. The development of methods of preferentially attacking tin is traced. Chlorination, a highly favoured process, develops so much heat that product and residue may both suffer, and hence special methods of cooling are necessary. Other methods are: electrolysis in alkaline solution; the displacement of lead by tin in certain compounds, leading to the formation of a solution of sodium stannate for subsequent treatment; and the solution of the tin by direct contact with a more highly electro-negative metal, *e.g.* copper, and the separation of the dissolved tin by electrolytic or chemical precipitation.—P. R.

Baling Scrap Metal for Re-Use. Anon. (*Compressed Air Mag.*, 1933, 38, (7), 4177).—An electrically operated press is described for the baling of tinplate, round or flat wire, and other sheet- or thin-metal scrap. Details of working, capacity, and output are given.—P. M. C. R.

XV.—FURNACES AND FUELS

(Continued from pp. 575–577.)

FURNACES.

A Brief Review of Modern Applications of Heat to Various Non-Ferrous Furnaces. Gilbert Evans (*Met. Ind.* (*Lond.*), 1933, 43, 215–218, 239–241).—Describes and illustrates various types of reverberatory and reheating furnaces for non-ferrous metals, and discusses the selection of the fuel or the method of heating and the chief points to be considered in the design of the furnaces. —J. H. W.

Industrial Furnaces. J. S. Atkinson (*Fuel Economy Rev.*, 1933, 12, 24–30).—Recent developments in industrial furnaces are briefly reviewed. Amongst the subjects discussed are: continuous billet, ingot, and slab furnaces; soaking pits for ingots; normalizing furnaces, and rotary melting furnaces. —J. S. G. T.

Some Problems of Furnace Heating Practice. (Sir) Robert A. Hadfield and R. J. Sarjant (*Fuel Economy Rev.*, 1933, 12, 72–78).—Problems of furnace heating are reviewed, more especially from the points of view of the latest developments and the scope for improvement of current practice. Amongst the subjects discussed are: the economic position of competitive fuels, heat transmission, and control instruments.—J. S. G. T.

Fuel Comparison for Billet Reheating Furnaces. G. W. Akerlow (*Gas Age-Record*, 1933, **72**, 103–106).—The respective costs (dollars) per ton of reheating billets by furnaces fired with coal, oil, and gas are: coal, 3·13; oil 5·65; gas 5·13.—J. S. G. T.

Continuous-Type Furnaces Employed in Forging Aluminium Alloys. J. B. Nealey (*Iron Age*, 1933, **132**, 22, 23, 58).—The furnaces used in forging aluminium alloys are described and illustrated. The work is forged at 840° F. (450° C.), and the furnaces are gas-fired and automatic and continuous in both heat control and operation.—J. H. W.

Continuously Working Electric Furnaces. U. Aschmann (*Siemens Z.*, 1933, **13**, 135–141).—An illustrated description of modern continuous annealing furnaces, *e.g.* for strip, wires, ingots, lacquered articles, &c.—M. H.

Forced Air Circulation Electric Furnaces. Anon. (*Nickel Bull.*, 1933, **6**, 114–116).—The construction and operation of electric furnaces for low-temperature annealing using forced air circulation are described. Centrifugal fans are said to be superior to propeller fans for the air circulation. These types of furnace result in rapid heat transfer and enable the progress of the heat-treatment to be recorded by noting the temperature of the air entering and leaving the charge.—J. H. W.

Note on the Possibilities of the Electric Furnace in the Foundry. B. R. Bryne (*J. Inst. Locomotive Eng.*, 1933, **23**, 227–262; discussion, 262–269; and (abstract) *Locomotive*, 1933, **39**, 67).—A survey of the principal types of arc and induction melting furnaces is contained in the first part of this paper. The remainder deals principally with the use of the arc furnace for melting high-duty cast irons in the foundry.—J. C. C.

High-Frequency Melting Furnaces. D. H. Beckmann (*A.E.G. Mitt.*, **1933**, 111–115).—The principle of the high-frequency induction furnace is briefly considered, and suitable frequencies are quoted for various materials. The construction of transformer, furnace, and condensers is described and illustrated, and appropriate types of furnace are suggested for works and laboratory installations.—P. M. C. R.

Thermal Conductivity of Acheson Graphite. A. P. Crary (*Physics*, 1933, **4**, 332–333).—The thermal conductivity of Acheson graphite has been measured over the range $-150°$ C. to $+700°$ C. The conductivity decreases very slightly between $-150°$ C. and 200° C., and then more rapidly at higher temperatures. The law relating the thermal conductivity (K) with the temperature (T ° C.) proposed by Bidwell, *viz.* $K/aC = B + A/T$, in which aC is the atomic heat, and A and B are constants, is confirmed.—J. S. G. T.

Electric Arc and Arc Resistance Furnaces and Their Power Factor. Axel Wejnarth (*Trans. Electrochem. Soc.*, 1933, **63**, 309–343).—The subject is discussed theoretically and mathematically, and the conclusions have been confirmed by experiments on carbide and ferro-alloy furnaces.—A. R. P.

A Molybdenum Resistance-Furnace of New Design. G. Burrows and F. L. Clark (*J. Sci. Instruments*, 1933, **10**, 248–250).—Describes the design of a tube furnace using molybdenum resistance strips as heating elements. An input of less than 2 kw. increases the temperature to 1850° C., at which the furnace may be used continuously. Higher temperatures can be reached for a short time, but are limited by the available refractories, which are at present of alumina. Notes on refractories for high temperatures are given.—W. H.-R.

Modern Resistance Furnaces in Industry. E. Schmidt (*A.E.G. Mitt.*, 1933, 116–122).—The economy, durability, and easy control of resistance furnaces make them especially suited for heat-treatment; models intended for various temperature ranges are illustrated and described. Melting, soldering, and drying furnaces are also considered.—P. M. C. R.

On Silit II Heating Rods. Fr. J. Mann (*Siemens Z.*, 1933, **13**, 155–158).—The properties of Silit and its use as a heating element in electric furnaces are discussed.—M. H.

FUELS.

Industrial Uses of Town's Gas. C. M. Walter (*Fuel Economy Rev.*, 1933, **12**, 30–35).—The applications of town's gas to normalizing and annealing furnaces and as a fuel for transport work are briefly reviewed.—J. S. G. T.

Limits of Inflammability of Natural Gases Containing High Percentages of Carbon Dioxide and Nitrogen. G. W. Jones and R. E. Kennedy (*Amer. Gas J.*, 1933, **139**, (2), 21–23).—In continuation of a previous part (*J.*, this volume, p. 576), tables are given for the composition limits of inflammability of methane, ethane, nitrogen, and carbon dioxide mixtures and of mixtures of propane with carbon dioxide and butane with nitrogen.—J. S. G. T.

Effect of Atmospheric Humidity in Gas Calorimetry. Francis Fahey (*Gas Age-Record*, 1933, **72**, 149–152).—A formula and tables are given for determining the effect of atmospheric humidity on the calorific value of gases of nominal calorific value 210–2000 B.Th.U. per ft.^{3}.—J. S. G. T.

The Advantage of Clean Coal to Industry. R. A. Mott (*Fuel Economy Rev.*, 1933, **12**, 6–8).—When the reduction in efficiency in the use of coal expressed in pence per ton, including the cost of transport of ash to and from the consumer's works, exceeds 6*d*. per ton, the reduction of ash content by coal cleaning is desirable. British coals are the most readily cleaned of all coals.—J. S. G. T.

XVI.—REFRACTORIES AND FURNACE MATERIALS

(Continued from pp. 577–581.)

Refractory Materials for the Induction Furnace. J. H. Chesters and W. J. Rees (*J. Iron Steel Inst.*, 1931, **123**, 479–494; discussion 495–500; also (abstracts) *Refractories J.*, 1932, **8**, 283–286; and *S. African Eng.*, 1931, **42**, 143–144). —The steep temperature gradient between molten metal and water-cooled coil demands from linings for induction furnaces of the coreless type a good sintering ability, high corrosion resistance, and low shrinkage. Methods of grading and testing lining materials are discussed. Factors tending to increase the durability of linings are: the use of materials of higher slag resistance; a reduction in the permeability of the material, by better grading or by attaining a higher sintering temperature; an improvement in the hot strength of the lining, effected either by the use of a bond, by the crystallization of the material, or by the interaction of 2 ingredients to form a bonding compound. The use of pre-burned materials is also discussed. Points raised in the discussion were the importance of heat-insulation, the relative merits of fritting-in and of pre-burning, the use of zircon, and the adsorptive energy of lining materials.—P. M. C. R.

Highly-Refractory Cements for Electric Furnaces. Anon. (*Compressed Air Mag.*, 1933, **38**, 4109).—A description of two grades of magnesia cement for electric furnace linings. A cement for use with ferrous alloys gave 76 consecutive heats with a pouring temperature of about 1730° C.; another gives good results with high-copper and other non-ferrous alloys. The refractory consists mainly of the very pure Californian magnesite, carefully graded before the addition of special binding materials. The method of application is of great importance and is fully described.—P. M. C. R.

Relation Between the Alumina Content and the Temperature of Incipient Softening (of Refractories). Marcel Lepingle (*Chim. et Ind.*, 1930, Special No. (March), 320–331; *C. Abs.*, 1930, 24, 5450).—After discussing theoretically the effect of increasing Al_2O_3 contents in binary Al_2O_3–SiO_2 refractories, bringing out the practical impossibility of judging of the quality of a refractory merely from its total Al_2O_3 and Seger cone fusibility, results are given and discussed of tests carried out on samples of various compositions by the Hecht method (heating a cylinder 50 mm. high by 35·7 mm. in diam. under a constant load of 2 kg./cm.^{2} and noting the temperatures at which expansion ceases, at which the sample begins to give way, and at which the rate of collapse tends to infinity) and of compressive tests after heating for 1 hr. at 250°, 500°, 750°, 1000°, 1250°, and 1500° C. For all refractory products there is an "incipient fusibility" temperature which is scarcely indicated by the usual determination of the temperature of incipient softening. This temperature seems to depend on the content of fluxing agents, their distribution, and the ease with which vitrification can take place. Determination of the compressive strength after baking at various temperatures affords a method of determination, by comparison, of the quality and probable behaviour, in the fire, of different refractories.—S. G.

Refractory Material from Chrome–Steel Slag [Siemensit]. Anon. (*Compressed Air Mag.*, 1933, 38, 4178).—The physical and mechanical properties of Siemensit are described. See *J.*, this volume, pp. 210, 328.—P. M. C. R.

The Production of Dense Fireclay Masses by Mixing Fractions of Various Grain Sizes. Hans Pickler (*Tonind. Zeit.*, 1933, 57, 334–335, 356–357).—The density of products made from crushed and graded burnt clay depends on the fineness of the finest particles, on the distribution of grain-size in the various fractions, and on the amount of intermediate-sized fractions. Maximum density cannot be obtained by increasing the quantity of fine material in the mixture if the quantity of intermediate material exceeds a certain limit.—E. Bl.

Preparation of Articles Resistant to Slags from Magnesia and Alumina. Hermann Salmang and Nikolaus Planz (*Arch. Eisenhüttenwesen*, 1933, 6, 341–345).—Describes the best conditions for the manufacture of refractory slag-resisting crucibles of magnesia, alumina, spinel, and mixtures of 45% magnesia and 55% alumina and of 2% magnesia and 98% alumina.—J. W.

XVII.—HEAT-TREATMENT

(Continued from p. 582.)

Heat-Treatment of Aluminium Castings. Wirt S. Scott (*Metal Progress*, 1933, 24, (3), 21–24).—Uniformly high quality in light alloy castings necessitates not only good foundry practice, but also close temperature control and even heat distribution in subsequent heat-treatment. The responsibilities of the metallurgist with regard to existing heat-treating equipment are discussed. A pit-type electric furnace is described and illustrated, and the procedure in the case of alloys of aluminium 95, copper 5% is recorded. The furnace has shown a maximum variation in heat distribution of not more than ± 8° F. (4·5° C.) over a period of 2 years, with an operating temperature of 1000° F. (538° C.). The annealed castings show a tensile strength of 12·4 to 14·4 tons/in.^{2}, with elongation 8–12%.—P. M. C. R.

Cold-Treating Dural with Solid CO_2. Anon. (*Amer. Machinist* (*Eur. Edn.*), 1931, 75, 439–441; and (abstract) *Technique moderne*, 1932, 24, 188–189).—The rapid age-hardening of Duralumin rendered it necessary to use rivets made of this material within 15 minutes after treatment. It was found that keeping the rivets at a low temperature retarded the hardening process; the results of ageing and storage at various temperatures are shown graphically. Various methods of rivet storage at low temperatures are described: the chilling medium most in favour is solid carbon dioxide. Possible developments of the method are outlined.—P. M. C. R.

The Tempering of Duralumin Sheet in Relation to the Time of Heating. N. V. Geveling (*Tehnika Vosdushnogo Flota* (*Technology of the Aerial Navy*), **1929**, (10), 640–650).—[In Russian.] The time necessary for complete heat-treatment of Duralumin sheet has been determined by: (1) direct measurement with a thermocouple of the temperature inside the specimen; (2) by the differential thermocouple, one junction of which was inserted into the specimen, and the other immersed in the heating bath, and (3) a complex thermo-electric system consisting of a Duralumin ribbon (an end of which was permanently immersed in the heating bath), the salt of the bath, and the specimen itself; on immersing the specimen in the bath a couple is formed between the salt and the specimen until the latter attains the temperature of the surrounding medium. By the first two methods sheets 0·3–0·6 mm. thick reached the temperature of the bath in 26–60 seconds after immersion and according to the third method 16–120 seconds. The time required for complete dissolution of $CuAl_2$ and Mg_2Si into solid solution has been determined from mechanical tests on similar sheets heat-treated at 485° C. for 15 seconds to 60 minutes, quenched, and aged for 7 days at room temperature. Annealing for 65 minutes before quenching was found to be necessary for obtaining the maximum ageing effect.—N. A.

On the Annealing of Duralumin. S. M. Voronov and P. A. Vargunin (*Tehnika Vosdushnogo Flota* (*Technology of the Aerial Navy*), **1931**, (12), 833–843; **1932**, (1), 40–57).—[In Russian.] Duralumin containing copper 4·35, manganese 0·90, magnesium 0·50, silicon 0·28, and iron 0·65%, was hot-rolled with 2 reheatings, from 50 mm. to 4·5 mm. sheet and then cold-rolled to 3 mm. without previous annealing. Subsequent cold-rolling to 0·4 mm. thick was carried out with intermediate annealing at 3, 1·5, 0·8 mm. The annealing temperatures were 300°, 350°, 375°, 400°, 450°, 475°, 500°, and 525° C., and the specimens were quenched after 1, 3, 5, 10, 15, 30, 60, or 180 minutes. Normal values for the mechanical properties of annealed Duralumin (tensile strength 23 kg./mm.^{2} and elongation 15%) are obtained after heating for 30 minutes at 325° C. or for 10–15 minutes at 350° C., respectively. The most reliable criterion of quality of Duralumin is the tensile test. Examination of the structure shows that the elongation of the Duralumin grains is preserved even after 3 hrs.' annealing at 525° C. In works' practice it appears that the best results are obtained with a preliminary heating to just above the "critical annealing temperature" (350° C.), rapid cooling to just below the normal annealing temperature, and holding this temperature for the appropriate time. This procedure reduces the annealing time to 50–60% of that generally required. A production technique is worked out and types of annealing furnaces are discussed.—N. A.

XVIII.—WORKING

(Continued from pp. 582–584.)

Investigation of Aluminium and Duralumin Tubes. I. U. Pedder (*Karelskiy Nautchno-Issledovatelskiy Institut* (*Scientific and Research Institute of Karelia*), **1933**, (2), 1–18).—[In Russian.] The wide and increasing uses of aluminium and aluminium alloy tubes in structural and mechanical engineering have caused greater attention to be paid to the problem of their strength and reliability. This investigation was accordingly carried out to determine: (1) the chemical composition; (2) the best methods of testing; (3) the reliability; (4) the macro- and micro-structures. The chemical composition of the aluminium tubes varied between iron, 0·39–0·70; silicon, 0·27–0·51; copper, trace–0·12%; and the composition of the Duralumin was copper, 4·27–4·60; magnesium, 0·55–0·70; manganese, 0·40–0·50; silicon, 0·12–0·24; iron, 0·37–0·52%. Reliability was tested by hydraulic pressure registered on a recording manometer. Examination of the structure revealed that the danger area of the tubes is the inner surface, which is always the first to develop cracks. These are almost invariably longitudinal in the case of aluminium, but are occasionally transverse in the case of Duralumin. There is also a tendency for minute cracks to develop first at points of local strain and these gradually spread. It is concluded that: (1) external flaws influence the mechanical properties of tubes; (2) the reliability both of aluminium and Duralumin tubes does not depend on the rate of change of internal pressure when the external pressure is unity; (3) reliability is not a constant value for tubes of the same material, but depends on the relation $n = \frac{R}{R_1}$ where R and R_1 are the internal and external radii respectively; (4) there is no apparent connection between reliability and tube thickness; (5) the thicker the walls of the tubes, the greater the amplitude of variation of the maximum pressure which can be borne by the tube; (6) destruction of the tube structure always starts near the fracture of the inner surface layers. It is recommended that the safety pressure be taken as half that recorded in the tests.—M. Z.

The Bending of Copper Tubing. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1933, 9, 149).—Directions are given for the bending of copper tubing of varying forms and sizes.—P. M. C. R.

Temperature Control on Sheet and Tinplate Rolls. Anon. (*Fuel Economist*, 1933, 8, 666).—In connection with a previous paper on this subject (*ibid.*, 1933, 8, 489) attention is directed to the necessity for correct preheating of the rolls before use in order to reduce breakages.—J. S. G. T.

Adjustable Sheet-Straightening Machine. Anon. (*Mech. World*, 1933, 93, 290).—Sheets which require straightening frequently have local buckles which are difficult to remove. A new machine is illustrated and described which has adjustable rolls by means of which pressure can be applied as desired to part of the sheet.—F. J.

Nichrome Ribbon Manufacture. S. A. Pogodin (*Sobshenia Leningradskogo Instituta Metallov* (*Communications of the Leningrad Institute of Metals*), 1933, (13), 97–106).—[In Russian.] Suitable conditions for the manufacture of Nichrome ribbon (nickel 57, chromium 14–18, manganese 3, carbon 0·25, silicon 0·47, sulphur 0·03%, and iron the remainder) have been determined. The alloy is melted in a high-frequency furnace in graphite crucibles lined with magnesite, and cast at 1450° C. Before hot-rolling the 70–75 kg. ingots are heated at 900°–950° C. for 2–3 hrs., then at 1150° C. for not less than 2 hrs. The furnace is preferably oil-fired with sulphur-free oil so as to prevent contamination of the metal with sulphur. Rolling must begin at 1150° C. and finish at not below 950° C. Such a narrow rolling range necessitates the use of two- or three-high mills, or of continuous mills. The rolled sheets (3–4 mm. thick) are annealed at 1050°–1100° C. for 3 hrs. The sheets are then cold-rolled with intermediate annealings in a muffle furnace after every 4 passes. Before rolling and after every annealing the metal should be pickled at 60° C. in a 20% sulphuric acid containing 2% of potassium bichromate. The thickness is reduced from 3 mm. to 0·10 mm. in 19 passes; the last reduction not exceeding 0·05 mm. in order to obtain a ribbon of uniform thickness.—N. A.

On the Use of Phosphor-Bronzes for Wire. S. D. Tzypurdeev (*Metallurg* (*The Metallurgist*), 1932, 7, (12), 60–65).—[In Russian.] The difficulties of using phosphor-bronzes for the manufacture of wire, owing to the brittleness of the alloy at high temperatures are examined (cf. N. M. Nadejdin, *Metallurg*, 1931, (8)). Various techniques of casting and rolling were tested, and the conclusions reached that existing methods of casting and hot-rolling are unsuitable, and that another type of alloy with similar mechanical properties should be employed. It is also suggested that the method of centrifugal casting might be advantageously employed.—M. Z.

A Note on the Effect of a Backward Pull Upon the Tension Required to Draw Wire. F. C. Thompson (*Iron Steel Inst. Advance Copy*, 1933, 1–5).—Mild steel and 7% nickel-silver wires were drawn with a backward pull applied by a dead weight. As the back tension increased, the pull needed to effect the reduction increased in a linear relationship. This observation corrects a contrary statement previously made by T. and his associate. The results of similar tests carried out in the University of Sheffield are discussed.—J. H. W.

High-Speed Wire-Drawing. Anon. (*Mech. World*, 1933, **94**, 790).—A (British) wire-drawing machine is illustrated and described. It is suitable for drawing ferrous and non-ferrous metals to any dimension between 30 and 50 S.W.G. at drawing speeds up to 5000 ft. per minute. A variable-speed gear gives any spooling speed from 2000 ft. to 4000 ft. per minute at will while the machine is running.—F. J.

Wire-Drawing Dies. Richard Saxton (*Met. Ind.* (*Lond.*), 1933, **43**, 169–170).—The properties and applications of stone and of steel dies for wire-drawing are compared and the drawing angles found efficient in practice for various metals are given.—J. H. W.

Winding Machines with Constant Tension. K. Ruf (*Heraeus Vacuumschmelze* [*10th Anniv. Volume*], 1933, 388–395).—Devices are described and illustrated by the aid of which fine wires and strip may be wound on reels at constant tension.—A. R. P.

Making a Seamless Neck. John Langton (*Mech. World*, 1933, **93**, 103–105).—The drawing of tapered-sided seamless shells always presents more difficulties than that of straight-sided shells, for which reliable empirical rules are available. A method described and illustrated has been tried in practice.
—F. J.

Forging and Stamping Light and Ultra-Light Alloys. E. Decherf (*Aciers spéciaux*, 1933, **8**, 102–108).—Concludes the description of rough shaping, consisting of complete hammering of the initial billet, the stamping only requiring one pair of dies. Stamping flanged connecting rods in steel and in a light alloy are compared and the use of rough stamping dies for this purpose is described. See *J.*, this volume, p. 214.—J. H. W.

Close Limits on Machine Forging Work. S. A. McDonald (*Mech. World*, 1933, **93**, 599–601).—The utility and advantages of the forging-machine (as distinct from the drop-forge) are discussed.—F. J.

Small-Screw Production. H. Bentley (*Mech. World*, 1933, **93**, 624–625).—Considerable development has taken place during recent years in methods of manufacturing screws up to ⅛-in. in diam. Cold-forging and finishing machines are being used to an increasing extent for the production of the various types of small steel and non-ferrous metal screws, these machines being used for heading, nicking, and thread rolling, and tests made on the finished products have shown them to be equal in strength to screws produced by hot-forging or by turning from the solid bar. The cold-heading, slotting, and screwing operations are described.—F. J.

Tools for Aluminium. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1933, **9**, 139–140).—Suitable modifications in the adjustment and cutting angle of tools, as well as in lubrication, must be made in order to obtain the best results in machining aluminium and its alloys. Directions are given for setting and selection of tools for cutting, drilling, grinding, sawing, and threading.—P. M. C. R.

Recent Investigations in Theory of Metal Cutting. Friedrich Schwerd (*Amer. Soc. Mech. Eng. Preprint*, **1933**,).—In order to study the formation of the " built-up edge " which occurs in metal cutting, a special method of lighting and photography has been developed. The source of light was obtained by a discharge of condensers at a tension of 50,000 v. and with instantaneous currents of from 10,000 to 20,000 amp. By this means instantaneous exposures of 0·000001 second are possible.—W. P. R.

Cemented Carbide Cutting Tools. Malcolm F. Judkins (*Amer. Soc. Mech. Eng. Preprint*, **1933**).—J. gives photomicrographs of typical carbide compositions in use at present. Relatively large differences in depth of cut produce only a slight shortening of tool life, but small differences in the amount of feed per revolution shorten the tool life considerably.—W. P. R.

The Economic Uses of Cemented Carbide and Other High-Duty Alloy Tools. J. H. Garnett and E. W. Field (*J. Inst. Production Eng.*, 1933, **12**, 224–251; discussion, 252–266).—A description is given of the characteristics and methods of manufacturing tungsten carbide, molybdenum–titanium carbide, and Stellite (cast cobalt–chromium–tungsten alloy). In connection with cutting-tool practice, a review is given of shank materials, tool shapes, and cutting methods. Detailed comparisons are made between the cost of machining with cemented carbide and high-speed steel tools on typical classes of work. Examples of the successful application of cemented carbide tools are quoted.
—J. C. C.

Oils for Use in the Cutting and Drilling of Metals. Walter Reichel (*Maschinenbau*, 1933, **12**, (3), 61–66).—v. G.

XIX.—CLEANING AND FINISHING

(Continued from pp. 581–585.)

Modern Methods of Cleaning Metals. C. J. S. Warrington (*Canad. Chem. and Met.*, 1933, **17**, 77–78).—Pickling baths for removing scale and oxides with inhibitors for preventing dissolution of the metal, and degreasing by organic solvents are discussed.—A. R. P.

Use of Chlorinated Solvents in Degreasing Metallic Articles. Anon. (*Galvano*, **1933**, (15), 15).—Some details of the trichlorethylene vapour cleaning process are given.—E. S. H.

Apparatus for Degreasing Metallic Articles with Trichlorethylene. Anon. (*Galvano*, **1933**, (16), 19–21).—The apparatus and cleaning procedure are described.—E. S. H.

Use of Chlorinated Solvents for Cleaning Metallic Articles. Anon. (*Galvano*, **1933**, (14), 17–18).—The advantages of the trichlorethylene process are discussed.—E. S. H.

The Pickling of Metals. Anon. (*Heat-Treat. and Forging*, 1931, **17**, 959–960, 965; and (abstracts) *Mech. World*, 1932, **91**, 39–40; *Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 44–45).—Sulphuric acid is the most usual pickling medium; the questions of concentration, de-greasing, acid consumption, maintenance of acid bath, temperature, pickling time, the use of inhibitors, and possible substitutes for sulphuric acid are considered. Adjustments of bath concentration for certain materials are indicated, with corresponding temperature range and allowing for the effect of inhibitors. Some average pickling times are given, but these are subject to modification owing to surface condition of material, varying accessibility to pickling fluid, and handling arrangements.—P. M. C. R.

Chemical Coloration of Brass. [Georg Gross] (*Galvano*, **1933**, (11), 25–26).—Translated from *Metallwaren-Ind. u. Galvanotech.*, 1932, **30**, 455; see *J.*, this volume, p. 279.—E. S. H.

Sand Blast for Cleaning Metal Surfaces. A. S. Jamieson (*Power Plant Eng.*, 1933, 37, 398).—The advantages of a portable sand-blasting plant are enumerated, and suitable working pressures, nozzle materials, receptacles, and protective measures are indicated, together with a variety of applications.—P. R.

XX.—JOINING

(Continued from pp. 585–590.)

Light Metal Rivets. K. Guler (*Z. Metallkunde*, 1933, 25, 214–217).—(1) Sheets and profiles of aluminium alloys should always be riveted with rivets having the same or only slightly different composition, otherwise severe corrosion takes place due to potential differences. This is shown by corrosion experiments in sea-water with Avional and Duralumin sheets riveted with Avional, Duralumin 681a, and Duralumin 681n. Rivets of the latter, with a composition different from that of the sheets, were practically completely destroyed by intercrystalline corrosion. (2) The influence of annealing and ageing on the mechanical properties of Avional (silicon 0·3–0·6, iron 0·3, manganese 0·5, magnesium 0·55, copper 3·8, aluminium 94·4%) and Anticorodal (silicon 1·0, iron 0·3, manganese 0·7, magnesium 0·65, copper 0·1, aluminium 97·25%) is described and shown graphically. Avional is quenched at 490°–510° C. and age-hardened at room temperature, whereas Anticorodal must be quenched at about 550° C. and aged at 130°–160° C.—M. H.

Rivets for VLW Light Alloys (Lautal and Bondur). Anon. (*Z. Flug. u. Motor.*, 1933, 24, 210).—A summary of Leaflet No. 42, published by Vereinigte Leichtmetall-Werke, Bonn. Directions are given for the use of rivets in Bondur, Lautal, Pantal, Scleron, Albondur, Allautal, KS–Seewasser, BS–Seewasser, Mangal, and Silumin.—P. M. C. R.

The Application of the Hydrogen Brazing Method to the Manufacture of Internal Combustion Engines. Fr. Sass (*J. Amer. Soc. Naval Eng.*, 1933, 45, 330–343).—A method for connecting steel parts by welding them with copper in a hydrogen atmosphere is described, where the welding material is a copper–nickel–zinc alloy with a melting point of approximately 1150° C., as such an alloy is found to give a better joint than pure copper. The process is carried out in a special electric furnace, in which a hydrogen atmosphere is maintained, with the result that parts are obtained which are entirely free of scale, and, being automatically annealed by the brazing process, are also free of internal stress. The furnace and the process are described in detail, together with the manufacture of such parts as cylinder covers, piston heads, and fuel lines of Diesel engines.—J. W. D.

On the Choice of Solder for Aluminium. M. O. Kornfeld (*Vestnick Elektropromishlennosti* (*Messenger of the Electrical Industry*), 1932, (1), 19–20).—[In Russian.] Joints which are exposed to moisture should be made with high-melting solders such as aluminium–zinc or aluminium–silicon alloys. Low-melting solders are useful only if the joint is protected from moisture; the best solders for this purpose are pure zinc or zinc with 5% aluminium.—N. A.

The Arc Welding of Aluminium and Some Properties of the Welded Metal. L. Anastasiadis (*Z. Metallkunde*, 1933, 25, 97–98, 141).—Theoretical considerations with regard to the electric arc welding of aluminium with the aid of a suitable flux are put forward. Practical hints for butt-welding which proved to be most suitable are dealt with. Successful experiments were carried out with commercial aluminium and aluminium containing 5% silicon. Photomicrographs of welded joints are given. The joint of a butt-welded aluminium sheet (8 mm. thick) had a tensile strength of 15 kg./mm.² and an elongation of 25%, compared with 15 kg./mm.² and 40% for the soft sheet.—M. H.

The Welding of Aluminium. Werner Fröhlich (*Canad. Chem. and Met.*, 1933, 17, 56–58, 79–80).—The factors which affect the resistance to corrosion and strength of welds in aluminium and its alloys are discussed. Methods of welding and suitable fluxes and welding rods are described.—A. R. P.

Joints in Aluminium Pieces. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*, 1933, **9**, 137–139).—The following welding and joining processes are reviewed: hammer-welding, (gas) fusion welding, spot, seam and butt-welding, soldering, and riveting. The aluminium oxide skin necessitates the use of fluxes, or of the chlorine–hydrogen flame, in gas welding; practical directions are given for various types of work, and for the subsequent treatment of joints. The special applications of the different electrical processes are considered, as are those of soldering; the latter is of especial value in the repair of casting defects. Approximate compositions and properties of soldering alloys are given. Riveting is stated to be especially applicable to aluminium and its alloys, affording in certain cases the only practicable method of joining.—P. M. C. R.

Welding Castings in Light Alloys of Aluminium. Anon. (*Soudeur-Coupeur*, 1933, **12**, (4), 8–9).—Some general advice on the welding of castings is given and 4 examples are illustrated with particulars of the welding technique used in each case.—H. W. G. H.

Ultra Modern. Anon. (*Oxy-Acetylene Tips*, 1933, **12**, 39).—Describes the repair, by oxy-acetylene welding, of a cast aluminium ornamental plaque, 4 ft. in diameter.—H. W. G. H.

Welded Aluminium Sheet-Metal Work. Anon. (*Soudeur-Coupeur*, 1933, **12**, (4), 5–7).—Twenty examples are illustrated and brief particulars given. —H. W. G. H.

Welding Aluminium. Anon. (*Soudeur-Coupeur*, 1933, **12**, (4), 4).—Hints on technique are given.—H. W. G. H.

The Indispensable [Aluminium] Flux. Anon. (*Soudeur-Coupeur*, 1933, **12**, (4), 1–3).—Describes the effects of the alumina film on weldability and the invention of the first effective flux by Paul Odam. It is emphasized that the manufacture of such a flux requires great care, particularly to ensure complete dryness of the constituents.—H. W. G. H.

Repair by Welding of Locomotive Copper Tube Plates. Anon. (*Soudeur-Coupeur*, 1933, **12**, (3), 1–4).—For a successful repair, the essentials are: good preparation for welding, rapid working, absolutely regular functioning of the blowpipes, and thorough hammering of the weld metal and the neighbouring parent metal until almost cold. Two large (about 3000-litre) blowpipes, fitted with hand shields, are used, and the filler rods, about ¼ in. diameter, are of pure copper, sometimes containing a little phosphorus. No flux is used. The special technique employed is fully described in this article, which is illustrated by photographs of repairs in various stages of execution—H. H.

Tests Tell the Story. Anon. (*Oxy-Acetylene Tips*, 1933, **12**, 82–83).—For carrying potash solution, copper piping with bronze joints was found mechanically and chemically suitable. The bronze welding rod was more economical and easy to use than copper rod.—H. W. G. H.

Improvements.—Oxywelding of Brass and Bronze Improved by Correct Flame Adjustment. Anon. (*Modern Eng.*, 1932, **6**, 317–319).—From *Oxy-Acetylene Tips*, 1932, **11**, 119–122; see *J.*, this volume, p. 398.—H. W. G. H.

The Oxy-Acetylene Welding of Lead. R. Meslier (*Rev. Soudure autogène*, 1931, **23**, 2414–2415; and (translation) *Mech. and Welding Eng.*, 1932, **6**, 72–73).—The technique of oxy-welding lead can be readily acquired by a moderately skilled worker, and welded lead structures, several of which are illustrated, are not subject to hair-cracks, slag inclusions or other common defects. The preparation of lead sheet for horizontal, vertical, and inclined welding is described.—P. M. C. R.

Arc Welding of "Nickel-Clad" and "Monel-Clad" Steel Sheets. Rud. Müller (*Elektroschweissung*, 1932, **3**, 229–230).—The steel side of the sheet is welded first, in the usual way, penetration being intentionally incomplete. After careful cleaning of the deposited metal, flux-coated nickel or Monel metal electrodes are used to complete the weld from the opposite side. For thin sheets, the complete weld may be made of the nobler metal. The Arcatom process is also used with success. It is important to avoid, as far as possible, contamination of the nickel or Monel metal deposit with iron. This can be detected by placing over the seam a strip of blotting paper soaked in concentrated ammonia and leaving it for some days in the air.—H. W. G. H.

New Method of Welding the Extra-Hard Alloy "Pobedit."—I. G. E. Varshavski (*Neftjanoe Khoziastvo* (*Oil Economy*), 1932, (12), 24–32; *Brit. Chem. Abs.*, 1933, [B], 672).—[In Russian.] The manufacture of Pobedit, a solution of tungsten carbide (WC) in cobalt, is described. The metal is welded to the drill with yellow copper and $Na_2B_4O_7$.—S. G.

The Welding of Drills with the Alloys "Wokar" and "Pobedit." V. S. Fedorov and N. G. Postarnak (*Neftjanoe Khoziastvo* (*Oil Economy*), 1933, (2), 109–112).—[In Russian.] A critical examination, based on experimental data, of the instructions for welding super-hard alloys.—N. A.

Galvanized Piping. Anon. (*Oxy-Acetylene Tips*, 1933, **12**, 133–135).—Except in piping exposed to highly corrosive agents such as dilute acids or alkalis, welded or bronze-welded joints in galvanized pipe have been found to be entirely satisfactory in practice. Even though the galvanizing is removed to some extent in welding, the exposed metal is more highly resistant to corrosion than that of a threaded joint.—H. W. G. H.

The Welding of Non-Ferrous Metals. Ernst Greger (*Z. Öster. Ing. Arch. Vereines*, 1933, **85**, (29/30), 161–163).—The principles of the various methods of welding copper, aluminium, and their alloys, as well as nickel, silver, and lead, are briefly discussed.—J. W.

The Resistance Welding of the Non-Ferrous Metals. M. von Schwarz and F. Goldmann (*Z. Metallkunde*, 1933, **25**, 142–143, 194–196).—(1) The methods, process, and practice of resistance welding (spot-, seam-, butt-, and edge-welding) are discussed. (2) The absolute tensile strength and the specific shear strength of spot-welded joints of age-hardenable aluminium alloys (experiments were carried out with Duralumin) can be increased by thermal after-treatment (ageing), the increase of the former being the higher the thicker the sheet. Spot-welding of age-hardenable aluminium alloys can be performed in such a way that the strength of the joint is considerably increased without after-treatment. This is due to the complex nature of the age-hardening phenomena and the special features of the spot-welding method.
—M. H.

Modern Machines for Electric Resistance Welding. H. Wilbert (*Siemens Z.*, 1933, **13**, 153–155).—Machines for butt-, seam-, and spot-welding are described.—M. H.

Development of Electric Spot-Welding Machines. E. R. Ruck (*A.E.G. Mitt.*, 1933, (4), 122–125).—Several spot-welding installations are described and illustrated, together with an automatic control apparatus.—P. M. C. R.

The Modulator Process—a New Method of Seam Welding. E. Rietsch (*A.E.G. Mitt.*, 1933, (4), 125–128).—The Modulator process permits seam-welding to be carried on with uninterrupted current but with intermittent feed. The modulator, a single-phase transformer, neutralizes fluctuations in current arising from local supply or from variations in the section or surface of the material. The apparatus is therefore applicable to thin or thick sheet with no special surface preparation, and the method can be applied to copper, aluminium, and brass as well as to iron and steel.—P. M. C. R.

Concerning Stress Distribution in Fillet Welds. Otto Mies (*Elektroschweissung*, 1932, **3**, 141–147).—Theoretical analysis of stress distribution in fillet welds is followed by calculation of the best shape of fillet in the light of M.'s conclusions.—H. W. G. H.

Concerning the Distribution of Stresses in Weld Seams. —— Pilgram (*Elektroschweissung*, 1932, 3, 231–233).—A short theoretical analysis.—H. H.

Correct Measurement of Weld Seams. Hans Schmuckler (*Elektroschweissung*, 1932, 3, 211–212).—A weld gauge and scriber are described. The former can be used to measure the reinforcement of butt welds and also the " throat " and " leg length " of fillet welds by means of three graduated slides. The scriber is designed for scribing the " leg lengths " of large fillet welds. It is pointed out that the gauge measures the true effective " throat " of fillets of unequal " leg length."—H. W. G. H.

A New Weld Gauge and Scriber. E. P. S. Gardner (*Elect. Welding*, 1933, 2, 178–179).—Describes the gauge and scriber designed by Schmuckler (see preceding abstract).—H. W. G. H.

Standard Equipment for Contact Electrowelding Manufactured by the " Elektrik " Works. A. I. Ahun (*Vestnick Elektropromishlennosti* (*Messenger of the Electrical Industry*), 1933, (2–3), 2–5).—[In Russian.] A brief description of the equipment supplied by the " Elektrik " Works according to the 1932 schedule.—N. A.

Gas Absorption During Welding Studied in Controlled Atmosphere. Anon. (*Automotive Ind.*, 1933, 69, 190).—A special welding hood with controlled atmosphere is used by the Westinghouse Electric Manufacturing Co. in a study of nitrogen absorption by welds. Absorption is greater with low proportions of nitrogen than when the welding atmosphere contains 98% of the gas; it is therefore assumed that the nitrogen is absorbed in the form of one of its oxides.—P. M. C. R.

Automatic Arrangements for Carbon Arc Welding. Carl Ritz (*Siemens Z.*, 1933, 13, 150–153).—A brief illustrated description of some welding apparatus for special purposes.—M. H.

Maintenance Costs Cut by Arc Welding. A. F. Davis (*Gas Age-Record*, 1933, 72, 129–130, 134).—Repairs by arc welding are exemplified and illustrated.—J. S. G. T.

The Physics of Electric Arc Welding. Anon. (*Mech. World*, 1933, 94, 725–727).—In producing a stationary arc the ability of a hot cathode to emit electrons is utilized. The stream of electrons disrupts the air and increases the conductivity of the gap. The voltage required to maintain the arc is low and depends on the material, the arc-length, and the magnitude of the current. For arc-welding with alternating current of common frequencies, flux-coated electrodes are used in order to keep the arc stable.—F. J.

Automatic Arc-Welding Machines by the A.E.G. E. Thiemer (*A.E.G. Mitt.*, 1933, (4), 129–131).—Recent types of welding head carrying, respectively, tungsten and carbon electrodes are described and illustrated.—P. R.

Machine Welding by the Arcatom Process. E. Thiemer (*A.E.G. Mitt.*, 1933, (4), 131–133).—The welding head described carries two tungsten electrodes, and is said to be suitable for the welding of all classes of metal. There is less general heating of the material than in the autogenous welding process, and the protective hydrogen flame is so adjusted that there is no wastage of gas. A special application to the welding of tubes is illustrated.—P. R.

Electric Welding in England. Henry E. Metkaf (*Vestnick Ingenerov i Tehnikov* (*Messenger of the Engineers and Technologists*), 1933, (3), 101–105).—[In Russian.] The following subjects are discussed: electrodes; designs of welded articles; training of welders and equipment of shops; electric welding in shipbuilding, and in machinery, automobile, and locomotive construction.
—N. A.

Electrical Welding Equipment. Anon. (*Vestnick Elektropromishlennosti* (*Messenger of the Electrical Industry*), 1933, (2–3), 5–6).—[In Russian.] New Russian types of apparatus are described.—N. A.

Comparative Study of Oxy-Acetylene and Arc Welding. R. Meslier (*Rev. Soudure autogène*, 1933, 25, 2678).—A short introduction emphasizes that the choice of welding method often depends on local conditions which this preliminary article does not pretend to discuss. Although each case must be studied on its own merits, the general principles may be outlined. The nature of the metal to be welded is the first consideration, and the acetylene process is preferred for non-ferrous metals and cast iron. For steels, the choice of process is governed by other factors such as the works facilities, the properties required in the weld, the preparation of the parts to be welded, the type and position of the welds, the possibility of deformation, and the thickness and size of the articles to be welded. Where water-tightness is required, for example, the oxy-acetylene process gives the best results, but difficulty is found in welding internal angles, where the arc process is ideal, as also in all cases where the preparation of the work allows for fillet welding. Vertical and overhead welding is more easily accomplished by oxy-acetylene, but the arc process usually produces less distortion. Very heavy masses and very thick sheets can be welded only by the arc method, but very thin material is more easily welded with the blowpipe. The immediate fusion produced by the arc makes it superior where short runs of welding are necessary, as in structural work. [*Note by abstractor.*—Subsequent articles in this series deal with specific examples of welded work, for which the two processes are compared. These examples are, however, all ferrous.]—H. W. G. H.

Noteworthy Progress. Anon. (*Oxy-Acetylene Tips*, 1933, 12, 5–9).—A review of oxy-acetylene developments during 1932, containing brief references to the economy of oxy-acetylene welding for thin aluminium and the use of an oxidizing flame for brasses and bronzes. Mention is made of the increased importance of testing, procedure control, and the education of welders.—H. H.

Innovations and Tendencies in Autogenous Welding. R. Granjon (*Rev. Soudure autogène*, 1933, 25, 2750–2758).—A general survey of new ideas and tendencies is followed by a more detailed description of improvements in equipment for both arc and blow-pipe welding. Diagrams, photomicrographs, and photographs illustrate the article.—H. W. G. H.

A New Medium for Protected Gas Welding. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1933, 9, 163).—Certain metallic carbonyls find advantageous application in "protected" gas-welding processes, as they evolve a relatively large volume of carbon monoxide in proportion to an almost negligible residue of metal, thus affording efficient protection for the weld together with the minimum of contamination. Iron pentacarbonyl is especially recommended, but the carbonyls of nickel, uranium, chromium, and vanadium are also successfully used. Hydrocarbons, certain of the higher alcohols, or waxes may be used as binding material for solid carbonyls, and metallic powders may be added to carbonyls for introduction into the weld.—P. M. C. R.

Brewers Modernize Their Equipment. Anon. (*Oxy-Acetylene Tips*, 1933, 12, 149–153).—The use of the oxy-acetylene process for repair work and installation of new equipment are described. The principal non-ferrous metals concerned are aluminium, copper, and lead.—H. W. G. H.

The Design of Jigs and Fixtures for Welding. Anon. (*Oxy-Acetylene Tips*, 1933, 12, 101–107).—The importance of well-designed jigs and fixtures for production work is emphasized. Many useful designs are illustrated and typical applications described.—H. W. G. H.

Carbon Shapes and Paste. Anon. (*Oxy-Acetylene Tips*, 1933, 12, 41).—The use of carbon blocks, rods, sheet, and paste, particularly in repair work, is described.—H. W. G. H.

Draft Regulations Relative to the Classification, Construction, Use, Examination, and Testing of Acetylene Generators. —— (*Rev. Soudure autogène*, 1933, 25, 2758–2762).—These suggested regulations have been drawn up by a

Committee of the Chambre Syndicale de l'Acétylène et de la Soudure Autogène and are published in order to give opportunity for criticism, which is invited. —H. W. G. H.

Method of Testing Low- and High-Pressure Hydraulic Valves for Safety against Back-Flow of Oxygen and Carrying-Over of Water. Eduard Sauerbrei and Gottfried Lammer (*Autogene Metallbearbeitung*, 1933, 26, 17–21).—An apparatus is described by which hydraulic back-pressure valves may be subjected to every mishap which could occur in working. The behaviour under sudden back-pressure of oxygen, pressure-volume relationships for different inlet pressures, the permissible speed of flow for different inlet pressures without sucking in of air, and, indeed, all characteristics can easily be determined. —H. W. G. H.

Safe Storage of Cylinders and Carbide. Anon. (*Oxy-Acetylene Tips*, 1933, 12, 137–138).—An explanation of the principles underlying the regulations issued by the [U.S.] National Board of Fire Underwriters.—H. W. G. H.

For Teaching Autogenous Welding and Oxy-Cutting. M. Courtier (*Rev. Soudure autogène*, 1933, 25, 2773–2775).—In a preliminary discussion on teaching welding, it is emphasized that scientific manual training is highly essential. Two aids to this are then described. These consist of specially designed work-benches, one for welding and the other for cutting. The first permits of holding small articles in all conceivable positions to give practice in every type of weld, and the second provides for training in both hand- and machine-cutting. —H. W. G. H.

The Teaching of Autogenous Welding. A. Desmarges (*Bull. Soc. Ing. Soudeurs*, 1933, 4, 1111–1121).—An account of the facilities available in France for obtaining tuition in welding.—H. W. G. H.

Oxy-Acetylene Welding Blowpipes with Several Flames for Hand Operation. E. Zorn (*Autogene Metallbearbeitung*, 1933, 26, 9–15).—A long description of two types of double-flamed "Griesheim" blowpipes. In the first, which is used for material of thickness 2–4 mm., the auxiliary flame preheats the work, and in the second, used for thicker material, the auxiliary flame preheats the welding rod. Both are used "right-hand," and considerable advantages are claimed in ease, quality, and speed of welding.—H. W. G. H.

Examination of Cutting Nozzles by Optical Means. P. Séon (*Rev. Soudure autogène*, 1932, 24, 2644).—Abstracted from an article by H. Malz and H. v. Conrady, *Autogene Metallbearbeitung*, 1932, 25, 282–287.—H. W. G. H.

Sheet Welding in Production. Earl Kelser (*Welding Eng.*, 1932, 17, (4), 42–45; and (abstract) *Welding News*, 1932, 3, 24–25).—From a paper presented at Purdue University Welding Conference, Dec. 11, 1931. Acetylene welded joints are found particularly suitable for work which is subsequently to be enamelled. Butt-welding or certain of its modifications are almost invariably employed. Suitably designed jigs are employed to control or direct the expansion and contraction of the material, to facilitate handling, and to increase the speed of production; an example of their use is described. Certain details of welding practice are emphasized, and methods of finishing and testing are briefly indicated.—P. M. C. R.

Recent Developments in the Manufacture of Welded Structures. L. Miller (*Trans. Manchester Assoc. Eng.*, 1931–1932, 81–111; and (abstract) *Mech. World*, 1932, 91, 104–107, 128; discussion, 112–128).—A continuation of a paper read before the Association in 1929 (*ibid.*, 1928–1929, 119–148; this *J.*, 1930, 44, 608). The paper deals mainly with ferrous materials, but is of general interest; it deals with the economies effected by adopting welded construction, the necessary modifications of design, the training of welders, the development of apparatus and technique, and some examples of welded structures.—P. M. C. R.

Carbon Dioxide as Flame Preventer in Welding. Floyd Sandall (*Oil Weekly*, 1933, 70, (3), 24).—The execution of oil-tank repairs by fusion welding involves either expensive cleaning or great danger from the ignition of explosive gases. The injection of carbon dioxide into containers needing repair is found to prevent ignition even when acetylene torches are employed.—E. F.

Conventional Representation of Welds on Drawings. Association Belge de Standardisation (*Soudeur-Coupeur*, 1933, 12, (3), 8–12).—This report is published by a sub-committee appointed by the A.B.S. to work in conjunction with the main committee for designs and technical documents. The work of the committee is described and its proposals, subject to modification, are fully and clearly illustrated. They cover all methods of welding and all types of weld, and include both definitions and symbols.—H. W. G. H.

XXI.—INDUSTRIAL USES AND APPLICATIONS

(Continued from pp. 596–597.)

New Uses of Binary Alloys of Aluminium and Magnesium. Anon. (*Alluminio*, 1933, 2, 168).—A note on some new aluminium alloys of the Magnalium type. Hydronalium, Duranalium, BS-Seewasser, contain 3–10% magnesium, 0·2–0·6% manganese, and have good mechanical and chemical properties (cf. J., this volume, 490, 549).—G. G.

Aluminium v. Tinplate for Fish Canning. Anon. (*Canning Ind.*, 1933, July; and *Aluminium Broadcast*, 1933, 4, (11), 13–14).—Experimental packs of various fish have shown no signs of hydrogen swells after storage for periods up to 3½ yrs. when the fish were first properly dried. The amount of aluminium dissolved in the contents varied from 10 to 100 parts per million.—J. C. C.

The Use of Aluminium in the Construction of Hydrogen Peroxide Bleaching Machinery. H. Tatu (*Rev. Aluminium*, 1933, 10, 2079–2086).—As the result of a series of experiments, aluminium is considered a very suitable material for the construction of bleaching machinery using hydrogen peroxide. The tests consisted in comparing the resistance of aluminium with that of other commonly used materials, such as glass, porcelain, iron, and copper, to the action of dilute alkali solutions, bleaching baths and hydrogen peroxide. The construction of the machinery in aluminium is described.—J. H. W.

The Use of Light Metals in Salt Works. E. Siegmund (*Metallwirtschaft*, 1933, 12, 91–92).—The aluminium alloys KS-Seewasser and the somewhat harder BS-Seewasser have shown a very good resistance to corrosion in salt works.—v. G.

Aluminium in the Cotton and Wool Industries. J. R. Whitelegg (*Textile Manufacturer*, 1932, June, July; and (reprint) *Aluminium Broadcast*, 1933, 4, (10), 8–16).—The characteristics of aluminium and aluminium alloy sheet, and of the aluminium casting alloys are described, and a detailed account is given of their applications in textile machinery.—J. C. C.

Technical and Constructive Treatment of Light Metals. W. Zarges (*Metallwirtschaft*, 1933, 12, 59–62).—Technological considerations for the use of light metals in constructional parts.—v. G.

Light Metal-Alloy Pistons and Rods in High-Speed Industrial Engines. Benedict J. Isidin (*Trans. Amer. Soc. Mech. Eng.*, 1931, 53, 109–115; and (abstract) *Marine Eng.*, 1931, 54, 349–350).—A paper read before the Oil and Gas Power meeting of the Society. Suitable aluminium alloys used for pistons and piston rods preserve the necessary rigidity required and overcome thermal difficulties, and such parts operate cooler and give better performances than when iron and steel alloys are used. Cast and heat-treated alloys are recommended for pistons and strong wrought alloys for connecting rods, and a saving in weight of 50 and 40%, respectively, is obtained in these parts when compared with ferrous materials. Problems in piston design such as (1) estimation of heat absorbed by piston head; (2) determination of thermal stresses; (3) determination of stresses due to explosion pressure; and (4) proper provision for heat transfer from head to rings and piston skirt are also fully discussed in relation to aluminium alloys.—J. W. D.

Duralumin Applied to Aircraft Construction. W. H. Lewis (*J. Roy. Aeronaut. Soc.*, 1933, 37, 681–693).—The composition, heat-treatment, and age-hardening of Duralumin are discussed. Corrosion properties and methods of protection against corrosion are mentioned, special reference being made to anodic oxidation. The properties and advantages of Duralumin as a structural material for aircraft are discussed in detail, and stress values are given. Typical forms of construction are illustrated.—H. S.

Hull and Float Maintenance. J. Jarvis (*Aircraft Eng.*, 1933, 5, (48), 27–30).—Reference is made to the working of Duralumin, Alclad, and " stainless " steels in the construction and maintenance of hulls and floats in these materials. Riveting and defects produced in riveting are described in detail. Methods of protection are described briefly.—H. S.

Fast Light Cruisers of Recent Construction. —— Bunje (*Allégement dans les Transports*, 1933, 2, (9–10), 116–118).—A brief description of the customs cruisers " Brumuser " and " Bremse," of which the superstructure, machinery, foundations, framework, and partitions are of V.L.W. light alloy. —R. B. D.

Axle Boxes in Light Alloys. M. Hug (*Allégement dans les Transports*, 1933, 2, (9–10), 111–116).—Tests made of railway axle-boxes cast in various aluminium alloys by repeated blows with 50 kg. weights followed by blows with a heavy drop hammer suggest the possibility of a new application of light alloys. Boxes in certain alloys are now being tested in service.—R. B. D.

The Pullman Aluminium Car. P. Parke (*New York Railroad Club Proc.*, 1933, May; and *Aluminium Broadcast*, 1933, 4, (11), 2–8).—An aluminium sleeper car exhibited at the Chicago Exhibition is described. It weighs 96,980 lb., as compared with 180,000 lb. for a steel Pullman of similar design. —J. C. C.

On Contact Unions of Aluminium and Copper. L. E. Mashkilleyson and M. S. Sokolov (*Vestnik Elektropromishlennosti* (*Messenger of the Electrical Industry*), **1932**, (4), 192).—[In Russian.] The best electrical contact between copper and aluminium is obtained by cleaning the contact surfaces under a layer of vaseline, greasing them over with it, and covering the contact immediately on assembly with an asphalt varnish.—N. A.

The Aluminium Experimental Free-Transmission Cables on the Isle of Sylt. Committee for Aluminium Free-Transmission Cables of the Deutsche Gesellschaft für Metallkunde (*Z. Metallkunde*, 1933, **25**, 170–172; and (short abstract) *V.D.I.-Nachrichten*, 1933, **13**, (29), 4).—The surface condition and the changes in tensile strength and electrical conductivity of free-transmission cables of copper, Aldrey, and aluminium (99·6% and 99·2%) during exposure for 5 years to extremely severe weather conditions have been investigated. The light metal cables proved to be as satisfactory as those of copper.—M. H.

Aluminium in Central Stations—Bars and Connecting Lines. M. Preiswerk (*Alluminio*, 1933, 2, 209–215; and *Schweiz. Tech. Zeit.*, 1933, 220).—The use of aluminium in electric generating stations, transformer stations, and distributing systems, in the form of bus-bars, rods, tubes, and wires, has the following advantages: good behaviour in case of short circuits or arcs, facility of erection, good joints, economy.—G. G.

Competition for Chairs in Aluminium. Anon. (*Alluminio*, 1933, 2, 166–168).—Details of a competition for designs of aluminium chairs promoted by the *Bureau de l'Aluminium*, Paris.—G. G.

Aluminium Foil. Anon. (*V.D.I.-Nachrichten*, 1933, 13, (24), 2).—A short note on the use, manufacture, and properties of aluminium foil.—J. W.

Alfol, a Metallic Insulator. Anon. (*Science et Industrie*, 1933, 17, 438).—Alfol consists of layers of aluminium foil 0·007 mm. thick, separated by light

non-metallic packing; its density, thermal conductivities at various temperatures, approximate melting-point, and working temperature range are given.
—P. M. C. R.

Aluminium Foil as a Heat Insulator. H. N. Bassett (*Eng. Rev.*, 1933, 47, 160).—The substitution of aluminium foil for dull-surfaced insulators produces a 75% reduction of heat-flow across an intervening air-space. Suitable arrangements of aluminium foil are described, and heat losses at various temperatures are compared for 85% magnesia composition and aluminium.
—P. M. C. R.

Aluminium Foil—A Heat Insulator for Power Plant Equipment. Anon. (*Power*, 1933, 75, 717–718).—The use of aluminium foil as a heat-insulating material in power-plant equipment is described.—F. J.

[Stelliting] Latest Diemaking Practice Used in a Chinese Plant. Anon. (*Machinery* (*N.Y.*), 1933, 39, 470–471).—Examples of the use of Stellite-coated stamping and forming dies are described and illustrated.—J. C. C.

Advances Made in the Field of Gas Welding and Cutting. Anon. (*Machinery* (*N.Y.*), 1933, 39, 386–387).—A general review. Reference is made to applications of the process of hard facing with Stellite.—J. C. C.

The Advantages of Using Copper and Brass in Metallic Cappings. The Bad Effect of Rust on Paint Work. J. Meyral (*Cuivre et Laiton*, 1933, 6, 215). —An essay on the bad effects which accrue when artistic ironwork is used in exposed positions, and the advantages of using copper, which acquires a patina that is much more permanent than rust and ordinarily need not be covered with paint.—W. A. C. N.

A Copper Membrane Gas-Molecule Sieve. Callendar's Theory of Osmosis. D. L. Warrick and Edward Mack, Jr. (*J. Amer. Chem. Soc.*, 1933, 55, 1324–1332).—Copper membranes were prepared by distillation of the zinc from thin sheet 70 : 30 brass (0·0028 cm. thick) *in vacuo* in a quartz tube at temperatures from 400° to 900° C. The membrane thus prepared was clamped and sealed in a pipe coupling with large-surfaced steel ends. After evacuation, gas was admitted to one side and the transpired portion collected in the low-pressure side. Typical rates of transpiration are given for a number of gases. The membranes prepared at 600°–900° C. were far more porous to the small molecule gases than membranes made at lower temperatures, and would readily pass large molecules, such as C_6H_6, which the low-temperature membranes completely obstructed. The transpiration was a molecular rather than a viscous flow. Experiments using copper membranes with water and sugar solution gave results which agreed with predictions from Callendar's theory of osmosis sufficiently well to support the theory.—R. G.

Ten Years' Progress in Copper–Nickel Condenser Tubes. Robert Worthington (*Marine Eng. and Shipping Age*, 1933, 38, 266–267).—A brief review, showing the wide extent to which copper–nickel condenser tubes have gained acceptance during the last decade, not only in American, British, and foreign navies, but also in all large merchant fleets. They have been fitted to vessels sailing practically all the recognized sea routes of the world, and have successfully withstood the action of the many varying kinds of cooling waters to which they are subjected. It is stated that such tubes are now generally recognized by marine engineers to be the best available, and are being fitted in increasing numbers to provide against condenser failures. In the new ships of the U.S. Navy, 330,000 lb. of copper–nickel tubes are being fitted. See also *J.*, this volume, p. 531.)—J. W. D.

(U.S.) Navy Orders Nickel–Copper Condenser Tubes. Anon. (*Daily Metal Reporter*, 1933, 33, (101), 3).—Cf. preceding abstract. 330,000 lb. of nickel–copper condenser tubing are to be installed in a new cruiser, and 6 new destroyers, for the U.S. Navy. The specified composition of the alloy is copper 75, nickel 20, and zinc 5%.—P. M. C. R.

Compo Bearings. Anon. (*Automobile Eng.*, 1933, 23, 347).—Oil retaining bushes of phosphor–bronze are produced as die-pressings by a process which leaves the structure of the material so porous that it absorbs oil in quantities up to 40% of the volume of the material. The material, which is not merely a compressed body of a mechanical mixture, but a true alloy with a solid solution structure, is strong and will withstand a pressure of 75,000 lb./in.^{2}, and its high oil content permits bearing loads much greater than those carried by ordinary bearing metals. Bearings of this alloy do not require either oil grooves or lubricator holes such as are necessary in bushes of ordinary phosphor–bronze.—J. W. D.

Characteristics and Conditions of Employment of Some Copper Alloys as Bearing Metals. M. A. Ricard and H. Ackermann (*Cuivre et Laiton*, 1933, 6, 239–242).—These alloys exhibit microscopical evidence of a texture favourable to their use as anti-friction metals. On the other hand, their high copper content preserves their malleability and plasticity. Comparisons are made with the ordinary white-metal bearing alloys. The rapid development of the Diesel engine furnishes an example of the possibilities of copper-base bearing metal alloys. The discussion is illustrated by a series of photomicrographs. —W. A. C. N.

High-Duty Brass and Bronze Castings. J. Arnott (*Metallurgia*, 1933, 7, 185–186).—High-duty castings calling for either high strength or resistance to some form of wear are considered for different types of severe service conditions.—J. W. D.

Lead in Building. Anon. (*V.D.I.-Nachrichten*, 1933, 13, (24), 2).—F. W.

Lead Pipe for Interior Plumbing Systems. Anon. (*Dutch Boy Quarterly*, 1933, 11, 12–13).—The advantages of lead pipe are summarized.—E. S. H.

Beautiful Architectural Lead Work, King's County Hospital (New York). Anon. (*Lead*, 1932, 2, (6), 4–5; 1933, 3, (1), 4–5; and (summary) *Met. Ind.* (*Lond.*), 1932, 41, 494).—An account of the extensive applications of lead in a recent hospital building. Details of lead work at window-heads, sills, mullions, grilles, and spandrels are illustrated: the building is roofed with lead sheet, which is also used for gutters and in many ornamental details.—P. R.

Monel Metal in Filtration and Dry Cleaning Equipment. Anon. (*Nickel Bull.*, 1933, 6, 98–99).—Describes the application of Monel metal in the form of finely woven multiplex or Hollander cloth in leaf filters.—J. H. W.

Jewellers Set High Standard for Platinum. Anon. (*Daily Metal Reporter*, 1933, 33, (113), 6).—An international conference of jewellers, recently held at Rome, agreed that all articles labelled as "platinum" shall contain at least 95% of that metal.—P. M. C. R.

Consumption of Silver in the Arts and Industries of the United States. Charles White Merrill *et al.* (*U.S. Bur. Mines Economic Paper* No. 14, 1932, 1–18; and (short abstract) *Met. Ind.* (*Lond.*), 1932, 41, 122).—The report shows the quantities of silver used in various industries in 1928 and 1929 and is based on a canvass begun in 1930. The U.S.A. are second only to Mexico in the mine production of silver, and are first in the production of secondary silver and in refining. Among occidental nations they are first as regards silver monetary stocks, and are also the world's leading consumers of silver in the arts and industries. Whilst extensive additional uses for other common metals have been found during recent years, the absorption of silver has not increased at an equivalent rate, in spite of its adoption on a large scale for photography, dental amalgams, solders, and electroplating. Data are given for the silver-consuming industries of the U.S.A. and the relative importance of the various avenues of demand is discussed. In the chemical industry silver compounds are mainly intermediate products. Sterling silver ware accounts for more than one-third of the total consumption of the metal in industry, but the high ratio of returned scrap to finished products reduces the relative importance of actual consumption. The motion picture productions consume, nowadays, the largest amount of silver absorbed by the photographic industry.—W. A. C. N.

Silver Consumption in the Arts and Industries of the United States in 1930 and 1931. Charles White Merrill (*U.S. Bur. Mines Information Circ.* No. 6647, 1932, 1–7).—See preceding abstract for consumption 1928–1929. The consumption of silver in the U.S.A. is practically static. Figures are tabulated showing the amount of silver used in all the important silver-using trades in that country, during each year of the period 1928–1931.—W. A. C. N.

Block Tin Pipe for Draught Beer Equipment. George O. Hiers (*Dutch Boy Quarterly*, 1933, **11**, 9–10).—Block tin pipe, having an internal diameter of 0·375 in., external diameter of 0·515 in., and a bursting strength of 1200 lb./in.^{2}, is used for conveying beer from the kegs to the bar. A cooling coil of about 50 ft. of block tin pipe is inserted. The tin is not corroded and does not give a taste to beer; it is pliable, easily soldered, and can withstand considerable internal pressure. The pipes are cleaned regularly with solutions of sodium carbonate or trisodium phosphate. Tin-lined lead pipe is sometimes used, but requires replacing when the tin lining becomes worn through cleaning. Taps and ferrules are usually of tin-lined brass.—E. S. H.

The Use of Titanium in Steelmaking. George F. Comstock (*Blast Fur. and Steel Plant*, 1933, **21**, 412–414).—Discusses the application of titanium as a deoxidizer and alloying element in the steel industry.—R. Gr.

The Patent Position in the Field of Hard Metals. K. Becker (*Metallwirtschaft*, 1933, **12**, 64–65).—A review of the German and foreign patent literature dealing with sintered tool alloys containing hard carbides, especially tungsten carbide.—v. G.

Zinc-Base Alloy Die-Castings Find Steadily Widening Field of Commercial Application. Joseph Geschelin (*Automotive Ind.*, 1933, **69**, 72–75).—The economy, good finish, and excellent casting properties of the recently developed zinc alloys for die-casting have led to their widespread adoption for a variety of purposes, which are tabulated. Tables also give the effects of two years' normal ageing on the properties of four such alloys, and also the impact strength, tensile strength, and elongation of sand-cast malleable iron, sand-cast brass, cast-iron, and die-cast aluminium alloys (analyses unspecified) compared with those of the new zinc alloys.—P. M. C. R.

Metal and Gelatin Foils. Heinrich Wiesenthal (*Kunststoffe*, 1932, **22**, 150–151).—A short account is given of the manufacture and use of tin and aluminium foil.—J. W.

Thermostatic Metals. Anon. (*Metallurgia*, 1933, **8**, 140).—The use of bi-metal strip in the manufacture of thermostats is discussed. Various combinations of dissimilar metals are used depending on the accuracy required, and a special manufacturing process is necessary to ensure absolute rigid and permanent union between the two metals, if accurate and consistent results over extremely long periods of use are to be attained. In designing an instrument it is often possible to calculate the exact amount of movement in the element for a given change of temperature, and a formula is given for such a calculation.
—J. W. D.

The Metallurgists' Contributions to Automotive Development. P. M. Heldt (*Automotive Ind.*, 1933, **69**, 64–68).—The increased uses in the automotive industry of recently developed alloys are reviewed. Apart from the alloy steels, the materials considered are the zinc-base die-casting alloys, aluminium alloys in pistons, cylinder heads, trucks and body-work, and magnesium and its alloys in light castings.—P. M. C. R.

Design Improvements Bring About Better Evaporation. Anon. (*Chem. and Met. Eng.*, 1933, **40**, 253–254).—The Buffalo Foundry and Machine Co. has employed a number of new methods in the production of its lead evaporators.

Tube sheets are covered with sheet lead, making the protective covering an integral part of the tube sheet. The tubes are also of a new type, consisting of pure lead reinforced by a perforated inner tube which adds strength without impairing the heat transfer.—F. J.

The Non-Ferrous Metals at the Motor Exhibition. Anon. (*Metallwirtschaft*, 1933, 12, 92–94).—v. G.

XXII.—MISCELLANEOUS

(Continued from pp. 597–598.)

Auguste Mesnager (1862–1933). Anon. (*Rev. Mét.*, 1933, 30, 171–172).—An obituary notice and biography.—H. S.

A Half-Century of Research on Metals and Alloys. The Exhibit of the Scientific Research Laboratories at the XIIIth Salon de l'Aéronautique (18 Nov.–4 Dec. 1932). L. Guillet and J. Galibourg (with preface by H. Le Chatelier) (*Rev. Mét.*, 1933, 30, 119–141).—Metallurgical microscopes, apparatus for thermal analysis, and thermo-magnetic studies, dilatometers, macrographs, X-ray spectrographs, electron spectrographs, mechanical testing machines, and hardness-testing machines exhibited are described. Exhibits of metals and alloys illustrating materials formerly used as well as modern products are described briefly. Brief reference is made to a number of documents of special historic interest which were exhibited.—H. S.

Non-Ferrous Metals in Germany. —— Wolf (*V.D.I.-Nachrichten*, 1933, 13, (24), 1).—A short review.—J. W.

Development of the German Metal Industry with German Materials. W. Guertler (*Maschinenkonstrukteur*, 1933, 66, 111–112); **German Materials for the Metal Industry.** W. Guertler (*V.D.I.-Nachrichten*, 1933, 13, (24), 1–2).—Abstract of a lecture on the development of German metal technique from German materials.—J. W.

Alloy Iron Ring Carriers Reduce Cylinder Wear and Give Aluminium Pistons Longer Life. E. Mahle (*Automotive Ind.*, 1933, 68, 578–582).—Most cylinder wear is traceable to excessive wear on the piston rings and consequent wear on the cylinder bore. Working conditions are considered, and the operating temperatures are found to be sufficient to cause substantial softening of the piston alloy. The introduction of ring carriers of hard (nickel-bearing) cast iron is found almost entirely to eliminate ring wear. The effect on Brinell hardness of various temperatures is shown by a series of comparative curves for grey iron, aluminium–copper, aluminium–silicon, and magnesium. Wear coeffs. for the same materials are given, and several designs of pistons with hard ring carrier are illustrated.—P. M. C. R.

Skirt Wear Not to Blame. Anon. (*Automotive Ind.*, 1933, 68, 407–408).—An account of cylinder wear on Bohnalite pistons, with a chart showing the distribution of wear for three passenger models. Considerations affecting wear are summarized.—P. M. C. R.

Copper and Bronze in Antiquity. H. Bréau (*Cuivre et Laiton*, 1933, 6, 225–226).—The only metals employed in alloys used in the earliest days were copper, tin, and lead, with small percentages of accidental ingredients, such as iron and zinc. Bronzes of Grecian times were principally made of an alloy approximately: copper 62, tin 32, lead 6%. The Romans increased the copper content to about 84% and reduced the tin to 6%. Instances of early methods of producing articles from such alloys and of the processes involved are given. *Cera perduta* casting is mentioned as one of the earliest operations. The advances made in technique through successive centuries are discussed.
—W. A. C. N.

Gold and Silver as Money Metal. T. A. Rickard (*Trans. Inst. Min. Met.*, 1932, 41, 132–139; discussion, 140–233; and (abstract) *Indust. Australian*, 1932, 87, 68).—The joint use of silver with gold as standard coinage is advocated on account of the decreased production of gold. It is not anticipated that silver production can increase sufficiently to disturb appreciably such a dual monetary standard, as much of the world's silver is now a secondary product of the beneficiation of ores of other metals (copper, lead, and zinc), and (in discussion) only 8% of this silver is used to-day for coinage. Discussion and correspondence are appended.—P. M. C. R.

Gold in Canada. A. H. A. Robinson (*Canad. Dept. Mines, Mines Branch* No. 730, 1932, 1–92; and (abstract) *Science and Art of Mining,* 1933, 43, 200–201).—The physical and chemical properties of gold are described, and the composition of some of its common alloys is given. The economic importance of the metal is emphasized. A summary of the modes of occurrence of gold, and of the history of gold production, leads to a more extended survey of the Canadian gold production.—P. M. C. R.

Goldsmiths' and Silversmiths' Work: Past and Present. W. Augustus Steward (*J. Roy. Soc. Arts*, 1933, 81, 837–846, 853–863; and (summary) *Met. Ind.*, (*Lond.*), 1933, 43, 125–128, 178).—Cantor Lectures. The sources and production of gold and silver are reviewed. Methods of working the metals and their alloys are summarized and prehistoric, Egyptian, Sumerian, Assyrian, Mycenæan, Hellenic, and later examples are described in some detail.—P. M. C. R.

Manganese: General Information. Robert Ridgway (*U.S. Bur. Mines Information Circ.* No. **6729**, 1933, 1–30; and (summary) *Metallurgia*, 1933, 8, 111–113).—Information is given under the following headings: properties of manganese, manganese minerals, and the mode of their occurrence, world sources and details of production from the various sources, metallurgical and chemical uses of manganese ores, marketing and prices of ores, exports from the principal producing countries and imports into the most important consuming countries for the years 1926–1931, political and commercial control, *bibliography*.—A. R. P.

Manganese for National Defence. Report of Sub-Committee on Manganese of the [A.I.M.M.E.] Committee on Industrial Preparedness. —— (*Amer. Inst. Min. Met. Eng., Contrib.* No. 48, 1933, 1–35).—This report is chiefly concerned with the question of securing adequate supplies of manganese ores in the U.S.A. The various sources of supply of the ores and the characteristics of the different types of manganese ore are described. The article is of more interest to steel metallurgists than to the non-ferrous industries.—A. R. P.

Twenty Years of Mercury Vapour Power Development. Anon. (*Power Plant Eng.*, 1933, 37, 263–268).—An historical survey of the development of the mercury boiler from 1913 to the present time.—P. M. C. R.

Mercury in Native Silver. W. H. Newhouse (*Amer. Mineralogist*, 1933, 18, 294–299).—Silver amalgams are known to occur in a number of mining districts: the presence of small proportions of mercury in native silver, is less generally recognized but is very frequent, especially when associated with cobalt ores. Metallographic investigations of native silver or silver–antimony may give rise to erroneous conclusions as to temperature conditions if the frequent presence of a significant proportion of mercury is overlooked. The origin of native silver amalgams is considered.—P. M. C. R.

Silver—Its Place as Currency. H. S. Denny (*Indust. Australian*, 1933, 88, 107–108).—The composition of certain British coinage alloys is discussed, with a historical survey of the standardization of coinage. Silver production is analyzed, and the possible effects of the proposed Australian restandardization are considered.—P. M. C. R.

Pewter—To-Day and Yesterday. Anon. (*Dutch Boy Quarterly*, 1933, **11**, 14–15).—Mainly historical. From the 11th to the 18th century pewter contained about 5–15% of lead, but modern pewter consists of tin hardened with a small amount of antimony and copper. The absence of lead removes the former objection to the use of pewter as a container for foods of acid content. —E. S. H.

The Lord Warden of the Stanneries. Anon. (*Tin*, 1933, (June), 7–8).—The control and administration of the tin mines and workings of Cornwall and Devon from the 12th to the 19th centuries are outlined.—J. H. W.

Powder Metallurgy. Charles Hardy (*Eng. and Min. J.*, 1933, 134, (9), 373–374).—Cf. *J.*, this volume, p. 468. Reviews the subject, outlining the methods of production, the properties, applications, and advantages.—R. Gr.

The Metallurgical Aspect of Coal-Face Machinery. J. R. Jenkinson (*Colliery Eng.*, 1933, 10, 231–233).—The application of modern metallographic methods to colliery work is described. Their incidence with regard to selection of materials, repair, and breakdown in service is indicated, with illustrations.—P. M. C. R.

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XXIV.—BOOK REVIEWS

(Continued from pp. 603–608.)

Alfred Mond, First Lord Melchett. By Hector Bolitho. Med. 8vo. Pp. xi + 392, with a frontispiece and 16 illustrations. 1933. London: Martin Secker. (21*s.* net.)

Alfred Mond, First Lord Melchett, was an outstanding figure in the industrial development of post-war Britain. He will, I think, be remembered chiefly as the founder of Imperial Chemical Industries, that mighty concern which embraces within its control all sorts of manufactures from high explosives to "Zip" fasteners. He was much else beside—barrister, art connoisseur, politician, Zionist leader—and in each achieved no small measure of success. He was one of the first of our great industrialists who saw what a great contribution science could make to industrial development. Still, great as was his appreciation of science, he was not a scientist of anything like the stature of his father, Ludwig Mond. At Cambridge he devoted a great part of his time to teaching the undergraduates to play poker, with the result that when the pass lists of the Science Tripos were published he was able to telegraph his father "Ploughed: Alfred." Even so, he became, like his father, a Fellow of the Royal Society (I note this is not included in his list of distinctions in an early page of the book), and, in his later years, five Universities conferred honorary degrees on him. He had an ambition to become Prime Minister of England: he served in the Government as Minister of Health. Here in this book his life story is told: much of it is taken up with an account of his political career. Metallurgists will find most to interest them in the life story of Ludwig Mond which prefaces the main theme. Here is given an interesting account of Ludwig Mond's development of the manufacture of soda at Winnington, the discovery and development of the carbonyl process for the manufacture of nickel, and the establishment of the Power Gas Corporation. Old Ludwig strikes one as having been a lovable sort of person, not without a keen sense of humour. Exemplifying this, let this suffice: In 1898, the birth of Alfred Mond's son, the present Lord Melchett, was expected. The baby did not arrive as early as was anticipated, and Ludwig, inconvenienced thereby, as he was due to leave for Italy, remarked, "In all their lives, women have only one calculation to make and they always get it wrong." Ludwig's courtship of Frida Löwenthal reads like an idyll. Altogether, the book is interesting reading and its price is very reasonable. I have noted two important misprints, *viz.* Harber for Haber (p. 292), and C. S. Jagger, the distinguished sculptor who executed a death mask of Lord Melchett, which illustrates the book, becomes William Jagger in the index.—J. S. G. THOMAS.

Greek and Roman Plated Coins. By William Campbell. (Numismatic Notes and Monographs, No. 57.) Fcap. 8vo. Pp. 174, with numerous plates and illustrations. 1933. New York: American Numismatic Society, Broadway at 156th St.

Many of the problems of coin-making in ancient times are still unsolved, and a metallographical examination of a number of specimens, followed by attempts to reproduce the structure, are the best means at our disposal for arriving at a reasonable explanation of the methods employed. Professor Campbell has given an account of his examination of a number of Greek and Roman coins which consist of a copper core (with one exception) coated with silver. Such coins were produced either officially by the mints when they were short of silver, or by forgers of the period. In any case, one is justified in assuming that the coins are of the period which they purport to be and are not modern forgeries. In discussing possible methods of manufacture, therefore, one must take into consideration the means at the disposal of the ancient coiners and the extent of their metallurgical knowledge. Their possible methods of coating copper with silver were as follows: (1) by dipping a copper blank into molten silver; (2) by means of the Sheffield Plate method, *i.e.* by hammering a layer of silver on to the copper and heating until diffusion had taken place; (3) by joining the two metals by means of silver-solder; (4) Professor Campbell also suggests that the blanks may have been covered with the powdered copper–silver alloy and heated until the alloy "ran" and covered the surface. The difficulty of coating *two* sides of a blank by this method is obvious. Similarly, dipping the blank into molten silver presents certain difficulties, the chief being that marks where the tongs held the blank would inevitably remain. However the silver was applied, the coins would be struck after plating.

Professor Campbell sectioned the coins, mounted them in fusible alloy, and polished and etched them. The large number of photographs show a layer of silver, a layer of copper and silver eutectic, and the copper core. Particular care was also taken to examine the section at the periphery, because if the silver was put on in the form of sheet, overlapping and joining at this point would be most noticeable. All the coins showed some corrosion between the two layers of metal. Although the structure of the copper is shown by etching, in no case has the structure of the silver layer been described, nor is it shown in any of the photographs. This seems to be a serious omission, as the structure of the silver might prove to be a valuable clue. At the periphery of certain coins there was distinct overlapping of the silver layer, and in some cases the eutectic had diffused between the two parts. Two experiments are described in which a silver strip was heated between two copper strips with and without a silver solder. Both gave similar structures, but the specimen with the solder gave a more uniform union. The evidence everywhere is inconclusive, and Professor Campbell thinks that both methods were employed. References to the literature on plated coins and the use of solders in antiquity are included in the pamphlet, but do not throw any light on the problem. It must be admitted that the use of silver solder makes the process much more difficult and is not justified by the evidence given. The only fact that definitely emerges from this investigation is that the copper and silver were heated in contact until diffusion took place. A more careful investigation of the structure of both copper core and silver coating would probably give more information, and this side of the problem has been almost completely neglected.—C. F. Elam.

Phase Rule Studies : An Introduction to the Phase Theory. By J. E. Wynfield Rhodes. With an Introduction by E. L. Rhead. Cr. 8vo. Pp. x + 131, with 58 illustrations. 1933. London : Oxford University Press (Humphrey Milford). (6*s.*)

Gibb's phase rule is one of those magnificent generalizations of physical theory which, whilst it can be rigorously established only by the use of abstruse and recondite mathematics, is comparatively simple in its applications. Some text-books attempt a more or less rigorous proof of the rule; most are content with a statement of the rule, without proof. This little book is included in the latter category. And it is well, I think, that students of chemistry and metallurgy should accept the rule as an act of faith, as, except for the mathematician, the beauty of the rule is found in its applications. The book treats the subject in a simple manner, and applications of practical importance are reached almost at its beginning. A brief introduction is followed by the discussion of systems comprising one, two, three, four, or more components and their graphical representation, miscellaneous applications, *e.g.*, to liquid, crystals and allotropy, and experimental methods employed in phase-rule work. There is a brief bibliography and an adequate index. The author's obligations to the larger work of Findlay and that on metallography by Desch are obvious. As one who read both these works in his student days, I can say unashamedly that I found them difficult. This little book, used as an introduction to the larger volumes, would have helped me much. It is as a very necessary introductory book on the phase rule that I unhesitatingly recommend the book to all students of metallography and chemistry. It is beautifully clearly printed, and its whole make up is satisfactory in every way; its price is extremely reasonable.—J. S. G. Thomas.

Werkstoffprüfung in der Eisen- und Stahlgiesserei. Ein Handbuch für den Gebrauch in der Praxis. Von Gerhart Tschorn. (Die Betriebspraxis der Eisen-, Stahl-, und Metallgiesserei. Eine Sammlung von Einzelabhandlungen aus dem Gebiete praktischer Giessereitechnik. Herausgegeben von Hubert Hermanns. Heft 19.) Med. 8vo. Pp. vii + 196, with 169 illustrations. 1933. Halle (Saale): Wilhelm Knapp. (Brosch., R.M. 12; geb., R.M. 13.30.)

This book deals exclusively with the testing of ferrous materials, but the general principles that are discussed are equally applicable to non-ferrous work. Initially there is a review of the objects of strict examination of metals and alloys, followed by a description of the essential details in the lay-out, erection, and equipment of a laboratory. It is emphasized that all testing should be carried out systematically, and schemes for its development and the recording of results are suggested. The proper location of the test-pieces and their preparation for examination are thoroughly discussed. The actual methods of testing are divided into 8 sections as follows : (1) chemical analysis, qualitative and quantitative; (2) fuels; (3) examination of fluxes; (4) refractories; (5) slags; (6) physico-mechanical properties, including the usual physical tests and the determination of specific gravity, magnetic properties and X-ray exploration; (7) metallographic inspection; (8) tables of composition of raw materials and final products. Various useful tables comprise the last section of the book. Illustrations, figures, and tabular matter have been carefully selected, and are included in very clear fashion. Where necessary, mathematical explanations are given, but there is no overburdening of the text with intricate calculations. Primarily intended solely for the works' metallurgist in whose hands the examination and testing of all materials—from the raw state to the finished product—mainly lie, it should also be valuable to all those having connection with foundry work and to students who desire to obtain a fairly comprehensive insight into casting methods and the testing of castings.—W. A. C. Newman.

Wechselwirkung zwischen Röntgenstrahlen und Materie in Theorie und Praxis. Herausgegeben von J. Eggert und E. Schiebold im Auftrage der Deutschen Gesellschaft für Technische Röntgenkunde beim Deutschen Verband für die Materialprüfungen der Technik. (Ergebnisse der technischen Röntgenkunde, Band III.) Med. 8vo. Pp. ix + 211, with 114 illustrations in the text. 1933. Leipzig: Akademische Verlagsgesellschaft m.b.H. (Brosch., M. 17; geb., M. 18.80.)

This handy little volume, comprising 19 lectures delivered at a Conference held in Münster in May, 1932, summarizes very concisely the present-day position of the theory of X-rays and their technological applications. The authoritative character of the lectures will be realized if we mention, by way of example, that Professor Laue, the discoverer of the diffraction of X-rays, contributes a section on the place of X-rays in general physical theory, whilst Professors Eggert and Schiebold discuss recent X-ray technique. Other contributors include Professors Debye, Heisenberg, Mark, Coster, Dr. Seemann, and Dr. Regler. The lectures of most interest to metallurgists are probably those contributed by O. Fischer (Recent apparatus for testing materials with X-rays), M. Widemann (Modern X-ray methods of testing heavy metal products), F. Regler (Quantitative measurements of elastic stresses in technical samples and steel work by X-rays), W. Schmidt (Measurements of thermal expansion of iron by means of X-rays), and E. Schiebold (Investigations of crystal structure during 1930–1932). Most of the sections conclude with a brief bibliography of the subjects discussed. The volume is well printed on good paper and the illustrations are very clear. An adequate subject-index is provided. The price of the volume is not unreasonable, and the book can be heartily recommended to physicists and metallurgists.—J. S. G. THOMAS.

Spectroscopy in Science and Industry. An Introductory Manual Describing its Applications to Industrial and other Practical Problems. By S. Judd Lewis. Cr. 8vo. Pp. vii + 94, with 41 illustrations. 1933. London and Glasgow: Blackie and Son, Ltd. (3*s*. 6*d*. net.)

This book describes the principles and practice of spectrum analysis clearly and simply. The author gives detailed accounts of the apparatus and methods used for recording both absorption and emission spectra, and also useful instructions for interpreting the results obtained. He devotes a section to quantitative methods which gives a fair impression of the present state of this rapidly-growing subject, to which he has himself contributed.

The chapters on the scientific and industrial applications of spectrum analysis are most instructive and stimulating reading, metallurgical applications are touched on here, but not in great detail.

The book as a whole is sufficiently readable to be recommended to the average person who is interested in science; it should certainly be read by every analyst. Unfortunately, it does not give much guidance as to where further information on the subject can be obtained; sources are cited for points of detail, but there is no bibliography. There is an index, and reasonably few misprints occur.—E. VAN SOMEREN.

Die Chemische Emissionsspektralanalyse. II Teil.—**Anwendung in Medizin, Chemie, und Mineralogie.** Von Walther Gerlach und Werner Gerlach. Med. 8vo. Pp. viii + 191, with 73 illustrations. 1933. Leipzig: Leopold Voss. (R.M. 13.)

Although this book is not written for the metallurgical worker, no metallurgist who uses spectrum analysis should ignore it.

The book begins with a most valuable description of the various light-sources used in obtaining spectra, which with modern variations of the spark and arc are six in number. The authors then proceed to a less detailed account of the experimental technique and apparatus in general.

A valuable discussion of the sensitivity of spectrum analysis, and the influence of discharge conditions on sensitivity follows; this and the following chapter, on quantitative analysis by homologous lines, collect and discuss material which has not yet been summarized elsewhere. The authors' criticisms, based on a wide experience of the subject, are particularly valuable. The extent of the tables of homologous lines published so far is still disappointingly small; workers outside Germany largely use other methods.

A long section on the detection and estimation of metals in animal and vegetable organic materials follows; apart from the interesting technique used by some workers this section is of no importance to the metallurgist. It is followed by a useful section collecting work which has been done on special problems, such as the detection of antimony in copper and of small quantities of some rarer elements. Unfortunately the experimental details given are not always sufficiently complete to be a guide to other investigators.

A short section on minerals is followed by two very useful tables. The first is of the coincidences between spectrum lines which are likely to be confusing in analytical work, the second is on checking the purity of metals spectrographically without making a full quantitative analysis. Platinum, iridium, rhodium, aluminium, silver, zinc, and lead are dealt with in this table.

The book closes with a bibliography of recent papers on spectrum analysis, and an index which covers the first volume of the work as well as this one. The bibliography surprisingly omits the Japanese workers, such as Iwamura.

One of the authors, with fresh collaborators, is preparing a further volume of tables for quantitative chemical spectrum analysis.—E. VAN SOMEREN.

Organic Reagents for Metals. By the Staff of the Research Laboratory of Hopkin & Williams, Ltd. Pp. 61. 1933. London: Hopkin & Williams, Ltd., 16–17 Cross St., Hatton Garden. (1s.)

The search for specific reagents for metals or groups of metals has occupied the time of numerous investigators during the past 20 years, and as a result many valuable new analytical methods involving the use of complex organic compounds have been discovered. Within the last few years the price of these reagents has been so reduced as to bring them within the reach of all analysts, but, with few exceptions, details of the processes involved are scattered through the journal and abstract literature of the world. Analysts will therefore welcome this little book, in which are given procedures for the use of 17 of the most important of these reagents for the detection and determination of metals, together with copious references to the literature. All the procedures given have been tested in the authors' laboratory, and in many cases minor modifications have been made in the original method to increase the accuracy or otherwise improve the method. The substances discussed include "cupferron," α-benzoinoxime, dihydroxytartaric acid, dimethylglyoxime, 8-hydroxyquinoline, α-nitroso-β-naphthol, picrolonic acid, salicylaldoxime, and zinc uranyl acetate, besides several reagents for spot tests. Every metal analyst should possess this book.—A. R. POWELL.

Handbuch der technischen Elektrochemie. Herausgegeben von Victor Engelhardt. Erster Band. 3 Teil: *Die technische Elektrolyse wässeriger Lösungen. A.—Die technische Elektrometallurgie wässeriger Lösungen. Die Galvanotechnik.* Bearbeitet von Gerhard Elssner. Roy. 8vo. Pp. xiii + 448, with 214 illustrations. 1933. Leipzig: Akademische Verlagsgesellschaft m.b.H. (Brosch., M. 39; geb., M. 41.)

In the preface to Part II of Volume I it was stated that the section on electrodeposition could not be ready in time for inclusion in its proper place in Volume I, but fortunately, by obtaining the assistance of Dr. Elssner, it has appeared much earlier than was expected, and now forms the final part of this volume.

After a short discussion of the applications of electrochemical theory to electrodeposition, the author embarks on a detailed consideration of the practical aspects of the subject. In a section occupying about 100 pages existing information is summarized under various headings, of which the chief are types of plant, factory layout, power generation and distribution, switching, temperature control and filtering of the electrolyte, preparation of work before plating, automatic plant, and costing. The various types of plant and apparatus are well illustrated by photographs and line drawings. Then follows a series of chapters, occupying about one-third of the book, each devoted to a particular metal and the special technique which it involves. This information is somewhat condensed, but very full references to the literature are given, in which the work of English and American authors appears to predominate. The section closes with an account of the electrodeposition of alloys.

The last section of the book deals with "Galvanoplastik," or the fabrication of finished or partly finished pieces by electrodeposition. This chapter is particularly interesting, since there is very little published information on the subject. The volume maintains the high standard of the "Handbuch," and should be an invaluable reference book in every metallurgical library. The only criticism that can be levelled at the production of the book is its weight—nearly 3 lb.—which makes it very inconvenient to handle.—C. J. SMITHELLS.

Die Bedeckungstheorie der Passivität der Metalle und ihre experimentelle Begründung. Von W. J. Müller. Med. 8vo. Pp. 102, with 65 figures and 31 tables. 1933. Berlin: Verlag Chemie G.m.b.H. (Br., R.M. 6; geb., R.M. 7.)

This book will be welcomed by all workers on passivity and corrosion of metals and allied subjects, for it collects the fundamental data and theoretical conceptions on which all serious work on these subjects must of necessity be based. The introductory chapter gives a short account of the theoretical basis of the earlier work on the subject. The development of the subject is considered in the following chapters, and it is shown that anodic passivity is a time phenomenon, and from this fact the film theory of passivity is developed. It is shown in the two final chapters that by means of this theory it is possible to explain the most involved phenomena of passivity. The theory is not based on any special assumption, but on the laws of Ohm, Faraday, and Hittorf, together with the conception of metallic potential as put forward by Nernst.

Much information on the subject, collected from a very wide and diffuse literature, has been incorporated in the book. A certain amount of the author's unpublished data is also included.

The book therefore gives a very acceptable account of the nature of passivity, and puts forward a new basis on which the problems of corrosion may be investigated. Consequently this volume becomes a necessity for all those engaged in the study of corrosion and the protection of metals, and to these it can be warmly recommended.—James F. Spencer.

Die Formsande und Formstoffe. Vorkommen, Eigenschaften, Aufbereitung und Prüfung. Von Karl Schiel. (Die Betriebspraxis der Eisen-, Stahl- und Metallgiesserei. Eine Sammlung von Einzelabhandlungen aus dem Gebiete praktischer Giessereitechnik. Herausgegeben von Hubert Hermanns. Heft 18.) Med. 8vo. Pp. viii + 155, with 87 illustrations. 1933. Halle (Saale): Wilhelm Knapp. (Br., R.M. 8.80; geb., R.M. 10.)

This book is divided into two main sections. The first one deals with natural sand, the second with foundry sand. The former comprises a general discussion of the structure of sands and sandstones, the manner in which sands are derived from earlier rock formations, the investigations of sands from the chemical and physical points of view, and their classification into groups according to composition and utility. The special characteristics which are discussed are: (1) refractoriness; (2) clay content; (3) grain-size; (4) percentages of iron; calcium, and the alkalis; (5) binding power; (6) gas permeability. The greater portion of the book deals with foundry sands, and the discussion is divided under seven headings as follows: general description; preparation, principles underlying the use of these sands in various forms; facing and parting media; examination in the laboratory; works' examination based on small scale tests; a list of German foundry sands. The preparation of the sand embraces such questions as the uses of new and old sand, sand mixing, core-making, binding materials. The various adaptations and uses of dry and green sand moulds in both non-ferrous and ferrous foundries are clearly defined. In addition to the determination of the properties already mentioned for natural sands, the chapter on laboratory investigation includes a discussion on such physical characteristics as tensile and compressive strength, shear strength, and also on the relationship of the results of the examination of sands to practice. Throughout, the book is commendably illustrated by diagrams and photographs, and the effects of varying conditions during both trials and ordinary employment are tabulated and also translated into graphs. Many of the forms of apparatus that are given are novel.—W. A. C. Newman.

Modern Materials Handling. By Simeon J. Koshkin. Med. 8vo. Pp. 488, with 174 illustrations. 1932. New York: John Wiley & Sons, Inc. ($6.00); London: Chapman and Hall, Ltd. (37*s.* 6*d.* net).

The general scope of this book is a detailed discussion of modern methods of handling various classes of materials that are met with in works' practice. The underlying principles that govern the choice of a particular type of plant and the considerations appropriate to a great number of illustrative examples are dealt with exhaustively. Data relating to the design and performance of standard equipment are next given to illustrate the main points which are considered. In brief, the contents include chapters on cranes of all types, general overhead transportation, trucks, conveyors, photo-electric control, hoists, elevators, coal and ash handling, and transport of foundry materials. Where it is necessary to introduce formulæ they are reduced to their simplest form and adequately explained. It will be gathered, however, that the book will be most useful to those who have industrial undertakings in their charge, and that it deals only lightly with the nature of the metals and alloys of which the plants described are made. One serious criticism is that the illustrations are too small; an attempt has been made to crowd too many on to a page, with the result that in some instances the details are very faint, and in others either obscured or missing. In affording a general insight into the problems that are studied the book probably fulfils its purpose.—W. A. C. Newman.

The Principles of Electric Welding. Metallic Arc Process. By R. C. Stockton. Cr. 8vo. Pp. vii + 184, with 73 illustrations. 1933. London: Sir Isaac Pitman and Sons, Ltd. (7*s.* 6*d.* net.)

This is an elementary text-book based on lectures given by the author to part-time students at the Manchester College of Technology. It will appeal mainly, therefore, to those who have little knowledge of metallurgy. It refers almost entirely to the welding of ferrous materials.
—H. W. G. H.

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

1933 DECEMBER Part 12

I.—PROPERTIES OF METALS

(Continued from pp. 609–616.)

On the Problem of the Reducibility of Beryllium Chloride with Aluminium. Walter Kangro (*Metall u. Erz*, 1933, 30, 389–390).—Theoretical. Deductions from Nernst's formula indicate that beryllium chloride should be quantitatively reduced to metal by aluminium at 200°–300° C., but that at 460° C. only 2·8% of the beryllium should be reduced.—A. R. P.

Researches on the Reducibility of Beryllium Chloride with Metallic Aluminium. Hellmut Fischer and Newton Peters (*Metall u. Erz*, 1933. 30, 390–391).—Kangro's theoretical deductions (cf. preceding abstract) have been confirmed experimentally. At 260° C. a mixture of beryllium chloride with a deficiency of powdered aluminium gives a yield of 12–17% of the theoretical amount of beryllium metal, and at 350° C. a yield of 30–40%, provided the reaction is carried out in an atmosphere of hydrogen. The aluminium chloride distils away during the reaction and the excess of beryllium chloride can be distilled away at 460° C. Complete absence of moisture is essential, but even then the beryllium produced is generally contaminated with oxide and frequently pyrophoric.—A. R. P.

The Effect of Tension on the Electrical Resistance of the Trigonal Crystals, Bismuth and Antimony. Mildred Allen (*Phys. Rev.*, 1933, [ii], 43, 502).—Abstract of a paper read before the American Physical Society. The compensated potentiometer method of measuring small changes in resistance developed by P. W. Bridgman has been used in the study of the effect of tension, applied parallel to the direction of current flow, on the resistance of the two trigonal crystals bismuth and antimony. The adiabatic tension coeff. of resistance at 30° C. of both has been found to depend on the orientations of the principal and secondary cleavage planes. For the limiting cases of the principal cleavage plane, perpendicular and parallel to the tension, the coeff. is found to be independent of the secondary orientation. The coeff. shows trigonal symmetry, as is to be expected. Bridgman has shown on the basis of symmetry considerations that 6 constants are sufficient entirely to define the change of resistance of trigonal crystals under deforming forces. These have been found for both bismuth and antimony; the constants for antimony are about one tenth those of bismuth. The changes in resistance resulting from the *deformation* due to tension have been computed and applied as corrections to the observed changes.—S. G.

The Saturation Magnetization of Pure Cubic Cobalt. F. W. Constant and R. J. Allen (*J. Elisha Mitchell Sci. Soc.*, 1933, 49, (1), 33–34).—Cf. *J.*, this volume, p. 609. Abstract of a paper read before the North Carolina Academy of Science. The magnetization at a given temperature of an ellipsoid of cobalt, so heat-treated as to be in the cubic state, was measured for increasing fields, and Weiss's formula was applied in calculating from this the magnetization for an infinite field. The influence of temperature was investigated, and the results were compared with those obtained with iron and nickel (cubic crystals) and with hexagonal cobalt and other non-cubic materials.—P. M. C. R.

Copper Embrittlement.—III. L. L. Wyman (*Amer. Inst. Min. Met. Eng. Tech. Publ.* No. 508, 1933, 1–11).—(*a*) Different qualities of copper were heated in air at varying temperatures and the depth of oxidation was estimated by subsequent heating in hydrogen, which reduced the oxide, and left an open-grain boundary structure which could be recognized microscopically, and which causes embrittlement. The three types of material selected were: two kinds of pure oxygen-free copper; "tough-pitch" coppers containing up to 0·06% oxygen, and "double deoxidized" copper containing 0·026% residual silicon. (*b*) Oxygen-bearing samples of copper were heated in hydrogen for varying periods at temperatures from 200° to 1000° C., and the depth of penetration of hydrogen was estimated in the same way. Neither pure copper when oxidized or deoxidized, nor the "tough-pitch" coppers, are embrittled by exposure to hydrogen for 4 hrs. at 400° C. or below. The double deoxidized copper, in agreement with previous work (Wyman, this *J.*, 1932, **50**, 722, and this volume, p. 65), is superior to the other varieties as regards resistance to the oxidation–reduction cycles. The embrittlement caused by hydrogen is of the same order as that produced by illuminating gas, and the rate of embrittlement due to hydrogen decreases with depth of penetration. The rate of oxygen penetration into "pure" copper decreases markedly below 800° C. and that of hydrogen penetration into oxygen-bearing copper decreases markedly below 700° C., so that up to 800° C. the oxygen-free coppers are more resistant to embrittlement than the "tough-pitch" coppers.—W. H.-R.

Atomic Heats, Heats of Fusion, and Heats of Transformation of Gallium, Indium, and Thallium. W. A. Roth, Ingrid Meyer, and Hans Zeumer (*Z. anorg. Chem.*, 1933, **214**, 309–320).—The heats of fusion of gallium, and of very pure indium and thallium as determined by measurements of the specific heats in the solid and liquid state are: 19·15 ± 0·02, $6{\cdot}80_7 \pm 0{\cdot}02_5$, and 5·041 ± 0·011 cal./grm., respectively. The heat of transformation of thallium is 0·361 ± 0·012 cal./grm.—M. H.

Diffusion of Mercury into Tin Foil. W. Gerlach [with E. Schweitzer] (*Sitzungsber. bayer. Akad. Wiss.*, **1930**, 223–224; *Chem. Zentr.*, 1931, **102**, II, 826; *Brit. Chem. Abs.*, **1932**, [B], 265).—The spectroscopic detection of mercury is facilitated by electrodeposition on a small electrode; the form and distribution of mercury in tin were studied. Mercury does not diffuse equally readily in all directions into rolled tin foil; diffusion ellipses were obtained owing to the effect of rolling on orientation. Similar ellipses were obtained with rolled lead.—S. G.

Rate of Vaporization of Molybdenum in Vacuo. Lawrence Norris and A. G. Worthing (*Phys. Rev.*, 1933, [ii], **44**, 323).—Abstract of a paper read before the American Physical Society. The changes in weight of various long filaments of molybdenum electrically heated *in vacuo* to various incandescent temperatures have been the basis of this study. In all cases two nearly identical filaments were mounted in a single bulb. Both filaments were heated to 2150° K. by the same current during a 20-minute ageing period. Thereafter only one of the two filaments was operated at the desired temperature until completion of the vaporizing period. To avoid the cooling effects of the supports only central portions of the filaments were used in determining weight losses. Contrary to what might normally be expected, but in agreement with what one of the authors had found for tungsten, operation at constant current resulted very closely in constant temperature. When plotted the results are represented very closely for the temperature range 1600° K. $< T <$ 2400° K., by an empirical equation of the form $\log m = A + B/T + C/T^2$. When m, the rate of vaporization, is expressed in grm./cm.^{2} sec., and T in ° K., A, B, and C have values 7·57, $-$ 33·25 × 10^3, and 5·50 × 10^6. The values reported here for m are greater than those reported by Jones, Langmuir, and Mackay by a factor of about 2·5 at 2400° K. and of about 11·5 at 1600° K.—S. G.

A New Method for Determining the Thermionic Work-Functions of Metals and Its Application to Nickel. Gerald W. Fox and Robert M. Bowie (*Phys. Rev.*, 1933, [ii], **44**, 345–348).—A method is described for determining the thermionic work-functions of metals which are too hard or too volatile for the ordinary methods. The specimen in the form of an approximate sphere is heated by electron bombardment from an auxiliary filament which is disconnected when the measurements are made. The electron emission from the cooling sample is made to charge a condenser which is discharged at intervals through a ballistic galvanometer. Application of the Richardson equation shows that the thermionic constants are given by the relation $\log_{10} (T^2/SQ) = \log_{10} (2{\cdot}3/aA) + \Phi/(1{\cdot}988 \times 10^{-4}T)$, where Q is the quantity of charge yet to flow on cooling the sample from temperature T to the absolute zero, $-S$ is the slope of the $\log Q$ *versus* time curve, and a is the area of the emitter. For outgassed nickel the values found are $\Phi = 5{\cdot}03 \pm 0{\cdot}05$ v., and $A = 1{\cdot}38 \times 10^3$ amp./cm.^{2} deg.^{2}.—W. H.-R.

Revision of the Atomic Weight of Tellurium. II.—Synthesis of Silver Telluride. O. Hönigschmid (*Z. anorg. Chem.*, 1933, **214**, 281–288).—Silver telluride Ag_2Te has been synthesized by heating a weighed quantity of silver in tellurium vapour. The ratio $Ag_2Te : 2Ag$ leads to an atomic weight for tellurium of 127·61.—M. H.

Superconductivity of Tin at Radio Frequencies. F. B. Silsbee, R. B. Scott, F. G. Brickwedde, and J. W. Cook (*Phys. Rev.*, 1933, [ii], **43**, 1050).—Abstract of a paper read before the American Physical Society. Calorimetric experiments on extruded tin wire carrying radio-frequency currents showed that the effective resistance at temperatures slightly below the transition temperature (3·7° K.) was less than 1% of that at temperatures slightly above. The transition temperatures corresponding with various definite values of current and of frequency were observed for (*a*) direct current; (*b*) for alternating currents of frequencies ranging from 200 to 1200 kilocycles/second; and (*c*) for combinations of d.c. and a.c. Changes in resistance were indicated (*a*) by the deflection of a galvanometer connected across the terminals of the specimen; (*b*) by the changes in the readings of a thermo-ammeter in series with the specimen, and (*c*) by the simultaneous use of both. For large currents the transition temperature decreased by substantially the same amount for equal increments of the crest value of the resultant current (d.c., a.c., or combined d.c. and a.c.). At low currents there appeared to be a small difference (about 0·01° C.) in the transition temperature for direct and for radio-frequency currents. This is being further investigated. Except for this, all the results, including those of combined d.c. and a.c., can be explained on the basis of the skin effect and the variation of the transition temperature with magnetic field, without additional hypotheses. A conductor can be normally resistant to a.c. and at the same time superconducting to d.c. flowing through the core inside the skin. This was observed.—S. G.

Thermionic and Adsorption Characteristics of Platinum on Tungsten. R. W. Sears and J. A. Becker (*Phys. Rev.*, 1933, [ii], **43**, 1058).—Abstract of a paper read before the American Physical Society. As the amount (A) of platinum adsorbed on a tungsten surface increases, the thermionic activity decreases rapidly up to one layer and then more slowly until at about ten layers it approaches platinum activity. There is no minimum analogous to the maximum observed for electropositive adatoms. The rate of evaporation E increases with both A and temperature T. For a fixed value of A, $\log E$ varies linearly with $1/T$. For T fixed, $\log E$ increases with A, rapidly at first and then more slowly until it reaches the value for bulk platinum at about 10 layers. In the region of 1 or 2 layers maxima have been found. When platinum is deposited on one side of a tungsten ribbon it migrates over the surface at temperatures at which evaporation is negligible. The rate of migration increases not only with temperature and concentration gradient but also with the concentration. Hence the mechanism of migration is not like that of ordinary diffusion, but is similar to the mechanism of evaporation.

Very probably migration results from adatoms which leave the surface at one point and return to it at another point.—S. G.

The Processing of Thoriated Tungsten Filaments. Milton A. Ausman (*Radio Eng.*, 1933, 13, (June), 15–17; *C. Abs.*, 1933, 27, 4444).—Tungsten filaments containing thoria when raised to 2600° K. showed the presence of a small percentage of metallic thorium and possessed a greater electronic activity. Carbon, boron, and tungsten carbide may be introduced in the metallic powder before being pressed into ingots, and thereby aid in the reduction of thoria to thorium when the film is flashed. Carbon may be introduced by burning the thoriated tungsten filament in a hydrocarbon gas or vapour. Carbonization is easily effected by the use of an inert gas such as hydrogen as a carrier for a volatile liquid rich in carbon. Such an apparatus is illustrated and its operation is outlined.—S. G.

Elastic Constants of Zinc. Alvin W. Hanson (*Phys. Rev.*, 1933, [ii], 44, 320).—Abstract of a paper read before the American Physical Society. The elastic constants of zinc have been determined by static torsion and bending experiments. The bending experiments were performed on single crystals of 0°, 45°, and 90° orientation, and the torsion experiments on crystals of 0°, 70°, and 90°. From these measurements three constants are directly determined and certain combinations among the constants are obtained from which the remaining two constants may be computed. The crystals used in the bending experiments were of square cross-section, about 7 mm. on a side. Those used in the torsion experiments were of circular cross-section, approximately 6 mm. in diameter. The crystals were grown in a horizontal electric furnace under conditions which would ensure the least possible strain. Strained crystals were found to give variable results.—S. G.

Spontaneous Oxidation of Zinc and the Nature of "Pyrophoric Zinc." W. S. Sebborn (*Met. Ind.* (*Lond.*), 1933, 42, 665).—Abstracted from *Trans. Faraday Soc.*, 1933, 29, 659–663. See *J.*, this volume, p. 339.—J. H. W.

Advances in the Field of the Free Alkali Metals. H. Alterthum and R. Rompe (*Angew. Chem.*, 1933, 46, 303–311, 545–551).—A review of recent work on the production and uses of the alkali metals.—A. R. P.

Little-Known Properties of Metals. E. Raub (*Mitt. Forschungsinst. Edelmetalle*, 1933, 7, 51).—Curves are given showing the solubility in tap-water at 18° C. of common metals used in making food utensils; in all cases the solubility decreases rapidly with time of contact to a practically negligible constant value. Owing to the oligodynamic action of metals, especially copper and silver, no bacteria can live in contact with them, hence silverware which is badly soiled with food residues cannot convey infection. The questions of the smell and taste of metallic articles, especially silver, and of the action of sulphur-containing foods on them are critically discussed.—A. P.

Nature of Polish Layers. J. A. Darbyshire and K. R. Dixit (*Phil. Mag.*, 1933, [vii], 16, 961–974).—Electron diffraction results suggest that the polished surfaces of the elements bismuth, antimony, zinc, tellurium, cadmium, gold, silver, lead, molybdenum, copper, chromium, selenium, and silicon are amorphous, resembling a supercooled liquid, as originally suggested by Beilby. It is found that in many cases the atoms in the polished surfaces do not retain their normal sizes as given by the atomic volume curve of the elements. In the case of conductors, the atoms appear to be stripped and to have atomic volumes corresponding more nearly with the minimum values of the atomic volume curve. In the case of non-conductors (selenium and silicon) the normal interatomic distances are preserved.—J. S. G. T.

Gases in Metals. Earle E. Schumacher (*Bell Laboratories Record*, 1933, 12, 17–20).—Short illustrated descriptions are given of apparatus developed for removing gases from metals and for measuring their gas content. Metal which is to be made gas-free is melted by high-frequency currents in an

Alundum boat sealed in a Pyrex tube. Gases are pumped out of the system by a 4-stage Gaede mercury diffusion pump backed by an oil pump. Alternate melting and partial solidification may be employed to remove the last traces of gas. When the gas content is to be measured, a graphite boat is used, the evolved gases passed over heated copper oxide, and the water and carbon dioxide collected in absorbents contained in light glass baskets suspended from quartz springs. The residual gas is determined volumetrically.—J. C. C.

Some Theoretical and Practical Aspects of Gases in Metals. J. H. Scaff and E. E. Schumacher (*Bell System Tech. J.*, 1933, **12**, 178–196).—Reprinted from *Metals and Alloys*, 1933, **4**, 7–12. See *J.*, this volume, p. 228.—S. V. W.

Thermal Conductivity of Metals in the Range 0° to 600° C. M. S. Van Dusen and S. M. Shelton (*Phys. Rev.*, 1933, [ii], **43**, 1052).—Abstract of a paper read before the American Physical Society. The thermal conductivities [illegible] method used gives directly the variation of conductivity with temperature, but absolute values are obtained by comparison with pure lead, the conductivity of which at ordinary temperature is fairly well established. If later considered necessary an absolute determination of the conductivity of the lead used as the standard can be made at one temperature under conditions most conducive to accuracy, and all results reduced to this basis. The change of conductivity with temperature is determined by measuring the temperature distribution along a cylindrical bar, one end of which is heated and the other cooled. Heat loss from the convex surface is minimized by a surrounding guard tube. For the comparative measurements, the bar is soldered end to end with a standard bar of the same diameter, and similar measurements made. Data have thus far been obtained on a number of technically important metals, principally ferrous alloys and nickel–chromium alloys. Some investigation has been made of the use of thermal conductivity measurements as a tool in metallurgical research.—S. G.

Note on Contact Potential Difference. A. T. Waterman (*Phys. Rev.*, 1933, [ii], **43**, 1048).—Abstract of a paper read before the American Physical Society. Assuming Fermi distribution among the conduction electrons in a metal the condition for equilibrium between 2 metals in contact at the same temperature is: $A_1 = A_2 \exp. (V_1 - V_2)\varepsilon/kT$, where A, the Fermi constant, is given here by $\log A = \xi/kT$, ξ being the thermodynamic potential (Sommerfeld's W_i), and V is the average potential within the metal. Thus $\xi_1 - \xi_2 = (V_1 - V_2)\varepsilon$ (the Volta or junction potential difference). If the work-functions of the metals are different electrons will be displaced across the boundary. Let $V = w + v\varepsilon$, where w/ε = intrinsic potential (Sommerfeld's W_a) and v = potential due to loss or gain of electrons. Then $(v_1 - v_2)\varepsilon = \phi_2 - \phi_1$, where $\phi = w - \xi$, the thermionic work-function. If $v_1 - v_2$ is taken to be the contact potential difference it has the corrected value and sign, and is interpreted as the potential difference *between the metals themselves* (in the ordinary sense), in a manner similar to the potential difference of a charged condenser. On examination this interpretation appears to be consistent with the facts. This potential difference is shown to exist between any metals the thermionic atmospheres of which are in communication, is strictly independent of the distance between them, and independent of temperature in so far as are ξ and w.—S. G.

Diamagnetism and Paramagnetism in Intense Fields. D. H. Moore and F. W. Constant (*J. Elisha Mitchell Sci. Soc.*, 1933, **49**, 34).—Abstract of a paper read before the North Carolina Academy of Science. Measurements of the dia- and para-magnetism of copper, silver, bismuth, and platinum have been carried out by the Gouy method, using a Weiss electromagnet giving over 30,000 gauss. The susceptibility of all 4 materials is constant for the fields investigated. The influence of a ferro-magnetic impurity in the copper is discussed.—P. M. C. R.

New Work on the Physics of Metals. J. Dorfman (*Metallwirtschaft*, 1933, **12**, 221–223, 235–237).—A summary of recent work of the Physico-Technical Institute of the Urals concerning superconductivity, electromagnetic phenomena in liquid metals, and the relation between ferromagnetism and valency forces in alloys.—v. G.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 616–628.)

Influence of Heavy Metals on Aluminium Alloys. I.—The Formation of Solid Solutions in Aluminium Alloys. P. Röntgen and W. Koch (*Z. Metallkunde*, 1933, **25**, 182–185).—By microscopic investigation the solubility of nickel, chromium, and molybdenum in aluminium (containing 0·04% silicon + iron + copper) at 560° C. has been determined to be 0·01–0·02% in each case. Ternary alloys with 2% copper and either 0·05% chromium, 0·05% molybdenum, or 0·1% nickel are heterogeneous after annealing and quenching at 560° C. From this the authors conclude [*Note by Abstractor*: without any justification] that copper has no appreciable effect on the solubility of these metals in aluminium.—M. H.

On the Conductivity of Aluminium Solid Solutions. W. Fraenkel. W. Bosshard (*Metallwirtschaft*, 1933, **12**, 159–161; and (translation) *Light Metals Research*, 1933, **2**, (32), 15–22).—The increase in electrical resistance of pure (99·97%) aluminium caused by the presence in solid solution of each 1 atomic-% of a second metal is as follows (in $\Omega \times 10^{-7}$): indium 0·6, gallium 2·4, zinc 2·4, magnesium 5·0, copper 8·0, silicon 8·6, germanium 9·4, lithium 9·4, silver 11·2, manganese 49·0. Norbury's rule is only approximately valid. W. Bosshard (*ibid.*, p. 358) directs attention to his earlier work on this subject (see this *J.*, 1928, **39**, 608; **40**, 449–450).—v. G.

On the Mechanical and Chemical Properties of Alloys of Aluminium with Chromium, Iron, Magnesium, Manganese, Titanium, and Vanadium. H. Bohner (*Metallwirtschaft*, 1933, **12**, 251–255, 265–267; and *Alluminio*, 1933, **2**, 193–208).—The effect of small additions (0·06–1·5%) of the above-named metals on the mechanical properties and recrystallization of hard-drawn aluminium wire has been determined. Additions of 1–1·5% of chromium or manganese or of about 0·5% of titanium or vanadium produced the best properties in binary alloys. No temper-hardening effects can be obtained in ternary or quaternary alloys. Certain of the polynary alloys tested, especially a chromium–magnesium–titanium–aluminium alloy, possessed a high resistance to corrosion and a high tensile strength combined with high softening and recrystallization points. Additions of titanium invariably produced a fine-grained structure.—v. G.

The Tempering Effect in Quenched Copper–Aluminium Alloys. W. Stenzel and J. Weerts (*Metallwirtschaft*, 1933, **12**, 353–356, 369–374).—The solubility of copper in aluminium as determined by X-ray methods agrees with the results of Dix and Richardson above 350° C.; at 300° C. it is, however, only 0·35%, and at 225° C. less than 0·1%. On tempering quenched alloys at a constant temperature the rate of separation of $CuAl_2$ is greater the higher the copper content, *i.e.* the more supersaturated is the solid solution. After tempering at 100° C. for one week no precipitation can be detected, and yet there is a considerable change in the mechanical properties. Hence a great part of the ageing effects is to be attributed to changes in the solid-solution structure preparatory to precipitation of the $CuAl_2$.—v. G.

On the Behaviour of "Graphitic Silicon" in Aluminium at Higher Temperatures. C. Schaarwächter (*Z. Metallkunde*, 1933, **25**, 250–251; discussion, 251).—The crystals of "graphitic silicon" which separate on cooling a supersaturated aluminium solid solution do not appreciably redissolve on annealing at 540° C.; only at 577° C. (eutectic temperature) is the rate of diffusion high enough to complete the dissolution within a short time.—M. H.

The Influence of the Pre-Treatment on the Mechanical Properties and the Electrical Conductivity of Aluminium Containing Magnesium Silicide. G. Grube and F. Vaupel (*Light Metals Research*, 1933, 2, (34), 1–10).—Translated from *Z. Metallkunde*, 1933, 25, 84–88; see *J.*, this volume, p. 294.—J. C. C.

On the So-Called Period of Incubation in the Age-Hardening of Duralumin. W. Fraenkel and R. Hahn (*Z. Metallkunde*, 1933, 25, 185–188).—The conditions under which a period of incubation appears in the age-hardening of Duralumin have been investigated, the process being followed by measurements of the Brinell hardness, tensile strength, and electrical conductivity of sheets and wires. The effects of the following factors have been determined: origin of the alloy, composition (iron, silicon, copper, and magnesium contents), size of sample (*e.g.*, diameter of wires), preliminary heat-treatment (period of annealing at 500° C. before quenching, and quenching temperature), and preliminary mechanical treatment (percentage reduction by cold-rolling before annealing at 500° C. which corresponds with a variation of the grain-size). It was impossible to prove conclusively why one material shows incubation, whilst another does not. Evidently, incubation is the result of several causes, because samples having the same composition behave quite differently. On the other hand, it seems clear that very pure material does not show an incubation period, whereas this phenomenon is produced by an iron content, by long annealing before quenching, and by a coarse structure.—M. H.

Experiments on the Repeated Age-Hardening of Duralumin Rivets and on the Influence of the Ageing Temperature. Martin Abraham (*Z. Metallkunde*, 1933, 25, 203–206).—Rivet wire of Duralumin "681 A" has been subjected to repeated quenching (at 500° C.) followed by age-hardening at room temperature (*a*) after having reached the maximum attainable hardness (about 5 days), (*b*) after premature interruption of the age-hardening process and the shear strength determined at intervals. With (*a*) the rate of hardening is unaffected by the number of quenchings, with (*b*), however, a slightly higher rate occurs in the second ageing process. The changes in the shear strength of quenched Duralumin "681 A" rivets and Duralumin "681 A" and "681 ZB" rivet wire on ageing for 8 hrs. at 0°, 15°, 22°, 28°, and 35° C. are shown in graphs. Rivets of Duralumin "681 ZB" wire can be readily worked until the shear strength reaches 25–25·5 kg./mm.^{2}; this value is obtained after 10 hrs. at 8° C., hence it is unnecessary to store a day's supply of rivets at a lower temperature.—M. H.

A Critical Study of the Hardness Behaviour of Duralumin. Hugh O'Neill, J. F. B. Jackson, and G. S. Farnham (*Phil. Mag.*, 1933, [vii], 16, 913–929).—The results of "Meyer" analysis indicate that the normal age-hardening of quenched Duralumin, or its accelerated ageing at temperatures below 150°–200° C., are not "precipitation" treatments. The age-hardening process has effects somewhat similar to those obtained when a metal is slightly cold-worked. "Precipitation" can be induced in either freshly-quenched or fully-aged Duralumin by sufficiently severe heat-treatment. It has not been found, in general, to give hardness values, (P_m), superior to those obtained from normal ageing treatment at room temperature.—J. S. G. T.

Formation of Blisters During Heat-Treatment of the Heat-Treatable Aluminium Alloys. P. Brenner, F. Sauerwald, and W. Gatzek (*Light Metals Research*, 1933, 2, (28), 2–7).—Translated in full from *Z. Metallkunde*, 1933, 25, 77–80: see *J.*, this volume, p. 329.—J. C. C.

The "Y"-Alloy. —— Try-Chalons (*Fonderie moderne*, 1932, 26, 430–431).—Based on figures given in *Z. ges. Giesserei-Praxis: Das Metall*, 1932, 53, 282–283; see this *J.*, 1932, 50, 535.—J. H. W.

Hydronalium, a Light Alloy of High Resistance to Corrosion. W. Schultze (*Werft, Reederei, Hafen*, 1933, 14, (19), 280).—See *J.*, this vol., p. 616.—P. R.

Notes on the Cadmium–Nickel System. Carl E. Swartz and Albert J. Phillips (*Amer. Inst. Min. Met. Eng. Contribution* No. **55**, 1933, 1–4).—The cadmium–nickel system from 0 to 7·5% of nickel has been examined by thermal and microscopic analysis. From the melting point of cadmium the liquidus falls to a eutectic at 318° C. and 0·25% nickel, the constituents of the eutectic being cadmium and a compound which, if simple in composition, has the formula $NiCd_7$. The liquidus then rises steeply to 490° C., at which temperature the compound $NiCd_7$ is probably formed by a peritectic reaction. —W. H.-R.

An X-Ray Study of the Diffusion of Chromium into Iron. Laurence C. Hicks (*Amer. Inst. Min. Met. Eng. Contribution* No. **58**, 1933, 1–10).—A piece of pure electrolytic iron was packed in powdered electrolytic chromium, and heated for 96 hrs. at 1200° C. The variation of the chromium concentration was then determined by grinding the specimen to successive depths, and measuring the lattice constants, the data of Preston (this *J.*, 1932, **50**, 164) being used to deduce the composition from the lattice constant. The chromium concentration decreases gradually for a considerable distance (of the order 36×10^{-3} in.), and then decreases abruptly to a very small value which gradually approaches zero. This confirms the theory of Bannister and Jones (this *J.*, 1932, **50**, 22, 352) that diffusion above the Ac_3 transformation proceeds without re-orientation of lattice up to the extent necessary to inhibit the γ phase, and that further diffusion produces a new phase (α solid solution), the nuclei of which are immediately absorbed by the growing crystals; the theories of Grube (this *J.*, 1928, **39**, 530) and Kelley (this *J.*, 1928, **39**, 533) are not confirmed. Etching experiments are also described.—W. H.-R.

Diffusion of Copper in Iron in Connection with the Manufacture of Bimetals. M. Zakharova (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1932**, 542–550; *C. Abs.*, 1933, 27, 4508).—[In Russian.] The diffusion of copper (solution) in iron and the formation of a zone of iron–copper solid solution between the copper and the iron are too slow to be economically utilized in the commercial manufacture of copper-clad iron or steel wire.—S. G.

Beryllium–Copper Alloys. H. J. Noble (*Found. Trade J.*, 1933, 48, 401). —A short abstract of a paper read before the Hartford Chapter of the American Society for Steel Treating. See *J.*, this volume, p. 344.—J. H. W.

Transformation and Change of Properties of Gold–Copper Alloy. E. Schuch (*Metallwirtschaft*, 1933, **12**, 145–147).—The changes which occur in the tensile curve, hardness, electrical conductivity, and X-ray pattern of quenched 50 atomic-% copper–gold alloy during transformation into CuAu have been measured; they show that the transition from cubic solid solution to tetragonal compound proceeds without the formation of intermediate phases, but that severe lattice disturbances occur. No completely satisfactory explanation of the change can, however, be advanced as yet.—v. G.

On the Behaviour of Phosphorus to Copper and Silver.—II. K. W. Fröhlich (*Mitt. Forschungsinst. Edelmetalle*, 1933, 7, 75–80).—See *J.*, this volume, p. 237. To determine whether silver or copper–silver alloys are completely deoxidized, the best commercial procedure consists in annealing a portion of the rolled sheet in hydrogen at 520° C. for 1–2 hrs. and determining the Erichsen value; completely deoxidized sheet should give a depth of more than 10 mm. without fracture. This method is more delicate than metallographic examination and more rapid than chemical analysis. Experiments have shown that phosphorus is the best deoxidizer for standard silver alloys (925 or 835 fine), but that 2–5 minutes, according to the oxygen content, should be allowed to elapse after addition of the phosphor–copper before casting, to allow the reaction to complete itself. For new metal only 1 grm. of 10%

phosphor-copper per kg. of alloy is necessary. The oxygen is removed in the form of copper metaphosphate, which rises to the surface of the molten metal as a brown very fluid slag. Excess of deoxidizer should be avoided, since it may lead to trouble in subsequent plating of the article (cf. Moser, Fröhlich, and Raub, *J.*, this volume, p. 708).—A. R. P.

Age-Hardening Processes in Silver-Copper Single Crystals. P. Wiest (*Z. Metallkunde*, 1933, **25**, 238–240; discussion, 240–241).—The changes in hardness and lattice parameter of single crystals of an Ag-Cu alloy containing 5% Ag quenched from 780° C. have been determined during ageing at 350°, 375°, 400°, 420°, 445°, and 470° C. The results indicate that the supersaturated solid solution passes through three stages during ageing in all of which there is an increase in hardness followed by a decrease. In the first stage no change in the lattice parameter can be detected and in the second a slight broadening of the interference points has been observed; hence the increase in hardness in both cases is due to changes within the lattice caused by atomic movements preparatory to precipitation. In the third stage the increase in hardness is accompanied by a large decrease in the lattice parameter due to the precipitation of the dissolved atoms with the formation of its own lattice.—M. H.

Industrial Brasses. M. Lencauchez (*Cuivre et Laiton*, 1933, **6**, 343–350).—From *Rev. Fond. mod.*, 1933, **27**, 81–88; see *J.*, this volume, p. 378.—W. N.

The Solid Diffusion of the Pairs of Metals, Gold–Nickel, Gold–Palladium, and Gold–Platinum. A. Jedele (*Z. Elektrochem.*, 1933, **39**, 691–695).—The diffusion in the solid state of the pairs of metals gold–nickel, gold–palladium, and gold–platinum were measured in both directions, and it is shown that the rate of diffusion is different for each metal and that it is greater the nearer the temperature of diffusion is to the freezing point of the alloy. The rate of diffusion of gold in platinum is smaller than that of platinum in gold. At 900° C., the rate of diffusion of the platinum-rich solid solutions is about $0{\cdot}1 \times 10^{-5}$ cm.^{2}/day, and increases steadily to $0{\cdot}5 \times 10^{-5}$ cm.^{2}/day for the gold-rich alloys. The diffusion rate of the gold–palladium system increases from about $0{\cdot}2 \times 10^{-5}$ cm.^{2}/day for the palladium-rich alloys to $2{\cdot}0 \times 10^{-5}$ cm.^{2}/day for the gold-rich alloys; that of the gold–nickel system ranged from about $0{\cdot}3 \times 10^{-5}$ cm.^{2}/day for the nickel-rich to $5{\cdot}0 \times 10^{-5}$ cm.^{2}/day for the gold-rich alloys. The order of the depth of penetration of the metals platinum, palladium, and nickel in gold is the same as that of gold in these metals.
—J. H. W.

The Atomic Resistance Increase in Dilute Gold, Silver, and Copper Alloys. J. O. Linde (*Metallwirtschaft*, 1933, **12**, 173–175).—A summary of L.'s work published in other journals (see this *J.*, 1932, **50**, 15; and this volume, p. 15).
—v. G.

Nickel–Chromium Resistance Alloys and Their Life. W. Hessenbruch and W. Rohn (*Metallurgia*, 1933, **8**, 181–188).—An abridgment of an article on "High-Grade Chromium–Nickel Alloys and Life Tests Thereon," *Heraeus Vacuum-Schmelze* [*10th Anniv. Volume*], **1933**, p. 247. See *J.*, this volume, pp. 624–625.—J. W. D.

Influence of Small Amounts of Impurities on the Mechanical and Chemical (Corrosion) Properties of Zinc. A. Burkhardt and G. Sachs (*Metallwirtschaft*, 1933, **12**, 325–329, 339–342).—The tensile strength, elongation, bending strength, fatigue limit, and resistance to corrosion (Cohen test in dilute sulphuric acid) have been determined for rolled and annealed alloys of zinc (99·97%) containing (0·001–1%) of one of the following metals: aluminium, arsenic, silver, bismuth, calcium, cadmium, copper, iron, mercury, lithium, magnesium, nickel, lead, antimony, thallium. All the alloys are more difficult to roll than is pure zinc, the tin alloy being the worst, and the lead and cadmium alloys and those with not more than 0·01% lithium or magnesium, the best in this respect. Bismuth, mercury, antimony, and thallium have a particularly deleterious effect on the tensile properties, but all additions improve the bending properties. Iron, nickel, and antimony have by far the worst effect on the resistance to corrosion, arsenic, bismuth, aluminium, silver, and copper are also injurious in this respect, whereas cadmium, lead, mercury, lithium, and not more than 0·01% magnesium increase the resistance to corrosion. Attempts to overcome the accelerating action of iron on the corrosion of zinc by adding a third metal failed.—v. G.

The Interconversion of Atomic, Weight, and Volume Percentages in Binary and Ternary Systems. Cyril Stanley Smith (*Amer. Inst. Min. Met. Eng. Contribution* No. 60, 1933, 1–13).—In binary systems calculations for the interconversion of atomic and weight percentage compositions involve terms of the form $\frac{x}{100-x}$, where x is the percentage composition, and $\frac{A}{B}$ where A and B are the atomic weights of the two elements. Tables are given showing the values of $\log \frac{x}{100-x}$ for values of x in steps of 0·1% from 0·1 to 99·9, and by interpolation calculations accurate to 0·01% of the whole are readily obtained. A second table gives the values of the logarithms of the atomic weight ratios $\left(\text{i.e.} \log \frac{A}{B}\right)$ for most pairs of elements. The use of these tables greatly reduces the time spent in calculation, and their extension to conversions involving volume percentage is discussed. A graphical system based on the intercept theorem of Menelaos is described for the interconversion of atomic and weight percentages in ternary systems where the composition is represented in an equilateral triangle; the method involves only the use of a ruler.—W. H.-R.

Special Alloys. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, (i), 349; (ii) 369–370; (iii) 391–392).—See *J*., this volume, p. 552. The composition and, in some cases, the mechanical properties and applications of the following alloys are given: (i) Carbon bronze, Cufenium, Cunilov, Cupranium, Cussans' bearing metal, Cymric and Tudric pewter, Daimler bearing bronze, Damascene bronze, D'Arcet's free-melting alloys, Dandelion metal, Daws metal, and Dawson bronze; (ii) D'Arcet's golden bronze, Delator bronze, Delta metal, Dewrance bearing metals, Diamond bronze, "German" alloy and "Third Silver" (Drittel Silber, ⅓ silver : ⅔ aluminium). (iii) Dick's bearing bronze, Dirigold (Oranien bronze), Dow metal, Dudley's bearing metal and anti-friction metal, Dunlevie bearing, Duralium, and Duralumin.—J. H. W.

Investigations on Segregation (Liquation). G. Masing and E. Scheuer (*Z. Metallkunde*, 1933, **25**, 173–179).—Theoretical considerations indicate that the so-called inverse segregation of ingots should normally be expected. The results of recent investigations on inverse segregation are discussed from the point of view of the various existing theories. It is concluded that the relative displacement of the residual melt and the primary crystals which produces the inverse segregation is not the result of a single cause. The sucking effect (capillary effect, pipe effect) which takes place during solidification by contraction of the dendrites forming the marginal zone is chiefly effective with rapid solidification. The pressure of the gases liberated during the freezing of the residual melt is chiefly effective with slow solidification. In certain cases, however, the "crystallization pressure" (theory of Bauer and Arndt) seems to be an additional cause. 50 references are given.—M. H.

Effect of Temperature on the Elastic Properties of Metals Used for Aircraft Instruments. G. H. Keulegan and M. R. Houseman (*J. Franklin Inst.*, 1933, **215**, 478–480).—Abstract from *U.S. Bur. Stand. J. Research*, 1933, **10**, 289. See *J*., this volume, p. 302.—S. V. W.

The Superconductivity of Alloys from the Phase-Theory Point of View. C. Benedicks (*Z. Metallkunde*, 1933, 25, 197–202).—The relations which should exist between Roozeboom's 5 types of equilibrium diagrams of binary systems and the curve obtained by plotting the spring points (*i.e.* the temperatures at which metals and alloys become superconducting) against the concentration are explained. The results of Meissner, Franz, and Westerhoff for the spring points in the indium–lead, mercury–lead, bismuth–lead, tin–thallium, indium–thallium, and lead–thallium systems (cf. this *J.*, 1932, 50, 604, 607–608) are essentially in accordance with the equilibrium diagrams, but indicate that a modification is required in the equilibrium diagram of the tin–thallium system. The superconductivity is highly sensitive for the detection of heterogeneity (coring) in solid solutions. The phenomena of superconductivity can be qualitatively explained by the phoretic theory of metallic conduction.—M. H.

The Supraconductivity of Alloy Systems. J. F. Allen (*Phil. Mag.*, 1933, [vii], 16, 1005–1044).—The supraconductivity of seven alloy systems, *viz.* gold–tin, gold–lead, silver–tin, silver–lead, copper–tin, copper–lead, and thallium–tin, has been examined. Different supraconductive characteristics were found for each of three structural types. Simple eutectic mixtures showed a constant supraconductivity temperature except in the neighbourhood of the boundaries. Simple solid solutions or solubility phases showed a continuously varying supraconducting temperature and transition interval. This latter was least at the phase boundaries and greatest in the middle of the phase. The third type, composed of what may be termed a double series of solid solutions, showed supraconductive characteristics similar to the second type. X-ray examination of this type as found in the thallium–tin series showed that the transition temperature varied inversely with the magnitude of the lattice constants. In all types, the supraconductivity curve is a continuous function of the concentration. Hence, supraconductivity is a property of the complete homogeneous structure, and not merely a property of any one of its components. Residual resistance was found to be a structure-sensitive phenomenon exhibiting great variations throughout alloy systems, especially in solubility phases. It is impossible, from the results, to state definitely whether gold, silver, and copper are supraconductive or not at temperatures below 1° K.—J. S. G. T.

Materials for Electrical Resistances. Georg Keinath (*Arch. tech. Messen*, 1932, 2, T110–T111).—Alloys intended for resistance coils should possess a low-temperature coeff., reasonable constancy of resistance within the working temperature range, a low thermo-electric effect in contact with copper, high ductility, and minimum liability to oxidation. Alloys specially described are the now obsolete Neusilber (copper 60, nickel 17, zinc 23%), Nickelin (copper 67, nickel 31, manganese 2%), Manganin (copper 84, nickel 4, manganese 12%), Constantan (copper 54, nickel 45, manganese 1%), nickel–chrome containing iron (nickel 60, chromium 15, iron 23, manganese 2%) iron-free nickel–chrome (nickel 80, chromium 20%). Their principal properties are tabulated. A diagram shows the resistance per metre of wires of different diameters for the alloys in question and for certain pure metals.—P. M. C. R.

On the Influence of Strong Magnetic Fields on the Hardening of Metals and Alloys. Hans Esser and Heinz Cornelius (*Metallwirtschaft*, 1933, 12, 210–213; and (summary) *Metallurgist* (Suppt. to *Engineer*), 1933, 9, 62–63).—No effect of magnetic fields on the course of the hardening of steels could be detected, but the possibility that fields of different strengths or frequencies have an effect is not excluded. The hardness figures obtained by the Herbert pendulum tester are strongly affected by the room temperature. —v. G.

Highly Magnetic Alloys. Georg Keinath (*Arch. tech. Messen*, 1932, 2, T173).—A summary of recently available information as to the magnetic properties of the binary nickel–iron alloys, of certain of their ternary derivatives, and of the Perminvar alloys. Magnetization curves are given for the binary series, for which a specific resistance graph is also shown; on the latter the values for Megaperm and Mumetal are indicated. For the Hipernik alloys, a table shows the initial and maximum permeability, strength of magnetic field, saturation value, coercivity, and specific resistance; the compositions stated being nickel 41, 45, and 50%, respectively, remainder iron. Their permeability is compared graphically with that of iron. Among ternary alloys, Permalloy and its derivatives with additions of chromium and molybdenum are especially considered. Recent applications of Perminvar are reviewed.—P. M. C. R.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 628–631.)

Structure and Origin of the Copper–Cuprous Oxide Eutectic. L. W. Eastwood (*Amer. Inst. Min. Met. Eng. Contribution* No. **59**, 1933, 1–8).—The structure of the copper-cuprous oxide eutectic has been examined in detail for an alloy containing 0·48% oxygen. The eutectic as a whole solidifies in grains by the growth of main axes which branch off to form secondary and tertiary axes in the same way as the growing dendrites of a pure metal. Macro-etching reveals grains in each of which the copper has the same orientation. The "complex grains" described by Portevin (this *J.*, 1923, **29**, 239) are not really analogous to the crystal grains of a pure metal, but are the intersections of the polished surface with the branches of the eutectic dendrites, and are termed "intersections." The oxide is present as either spheroids or rods, the former being favoured by rapid solidification. The structure coarsens in the part last to solidify, and comparatively large spheroids are found both at the junction of (*a*) adjacent grains, and (*b*) adjacent intersections. These may be distinguished by the fact that only (*a*) shows a true grain boundary line on etching, since the copper orientation is the same in different intersections of the same dendrite. The growth and orientation of the cuprous oxide particles are discussed.—W. H.-R.

Addendum to: New Additions to the Recrystallization Theory. U. Dehlinger (*Metallwirtschaft*, 1933, **12**, 298–299).—Cf. *J.*, this volume, p. 189. Aluminium single crystals behave differently according to their method of preparation; those obtained by recrystallization show a well-defined point of inflection in the tensile curve corresponding with a yield-point, whereas those obtained directly from liquid aluminium show no such point and even, with a very small stress, undergo a permanent deformation.—v. G.

Laws of Transformation in the Solid State of Metals. U. Dehlinger (*Metallwirtschaft*, 1933, **12**, 207–210).—A systematic review of the mechanism of solid transformations in metals and the application thereto of thermodynamic laws.—v. G.

X-Ray Analysis of Iron–Tin Alloys. W. F. Ehret and A. F. Westgren (*Met. Ind.* (*Lond.*), 1933, **42**, 611–613).—Abstract from *J. Amer. Chem. Soc.*, 1933, **55**, 1339–1351. See *J.*, this volume, p. 306.—J. H. W.

The Structure of Nickel–Zinc Alloys.—II. W. Heike, J. Schramm, and O. Vaupel (*Metallwirtschaft*, 1933, **12**, 115–120).—This second part (for Part I, see *J.*, this volume, p. 17) deals with alloys containing 56–100% Zn and gives the complete equilibrium diagram of the system. The γ-phase shows a maximum melting point at 881° C. with 23% nickel and exists in alloys containing 23·8–13·8% nickel at room temperature; it has a γ-brass type of lattice. Alloys with 10·7% nickel consist of the hexagonal ε-compound, Ni_2Zn_{15}. Zinc dissolves only 0·05% nickel (η-phase).—v. G.

Electron Diffraction Patterns from Platinized Asbestos. D. A. Richards (*Phil. Mag.*, 1933, [vii], **16**, 778–787).—Electron diffraction analysis of platinized asbestos suggests that platinization effects a splitting of the asbestos fibre, so that the platinum diffraction pattern is observed only after a comparatively high degree of platinization of the fibre has been effected.—J. S. G. T.

The Constitution of Metallic Sodium. E. Wigner and F. Seitz (*Phys. Rev.*, 1933, [ii], **43**, 1048).—Abstract of a paper read before the American Physical Society. The free-electron picture of metals is employed in an investigation of the binding properties of metallic sodium, such as heat of evaporation, lattice constant, and compressibility, under the assumption that the forms of the closed shells are not altered by metallic binding. The boundary conditions to be satisfied by the wave-functions of the outer electrons are derived from consideration of crystal symmetry and the work of Bloch. The Schroedinger equation for each electron is approximated by a spherically symmetric one about each atom which is solved using the field of Prokofiew. The extent to which interactions of electrons are contained in the picture is discussed. It is found that to each value of the lattice constant, d, there corresponds a definite energy that is to be associated with the electron in the lowest state. This energy is determined as a function of d. Because of the Pauli principle, only two electrons will possess this energy and the mean energy of all of the electrons is obtained by adding an appropriate correction. The resulting curve possesses a minimum below the energy of the free atom, and from its characteristics the binding properties are determined with favourable agreement.—S. G.

The Crystal Structure of Tantalum Carbide. M. von Schwarz and O. Summa (*Metallwirtschaft*, 1933, **12**, 298).—Pure tantalum carbide, TaC, has a cubic lattice of the sodium chloride type, $a = 4{\cdot}4460 \pm 0{\cdot}0005$ A.—v. G.

The Unit Cell of Uranium Calculated from X-Ray Powder Method Data. Thomas A. Wilson (*Phys. Rev.*, 1933, [ii], **43**, 781).—Abstract of a paper read before the American Physical Society. Photographs were supplied by W. P. Jesse which had been obtained by allowing unfiltered iron X-radiation to graze the surface of a block of uranium which had been rendered plane by filing in hydrogen. The uranium was of the highest purity obtainable. The block was rotated by hand in the X-ray camera. Exposure lasted for 2¾ hrs. The photographs showed 13 different plane reflections. By a mathematical analysis based on vectors, the equation for the interplanar spacings of the parallelogram containing one uranium atom was found to be: $2{\cdot}535^2/d^2 = h^2 + k^2 + l^2 - 0{\cdot}878hk - 0{\cdot}758(h + k)l$. The unit cell of uranium accordingly has equal face perpendiculars of 2·535 A.U. in length, arranged in space at angles of 64°, 67° 45′, and 67° 45′, respectively. The volume of the cell is 20·26 cubic A.U., which gives uranium an X-ray density of 19·32, as against 18·68 reported previously, a difference of 3·3%.—S. C.

Does the Change in Lattice Constants in Solid Solution Formation Depend on the Grain-Size? Arthur Phillips and R. M. Brick (*Metallwirtschaft*, 1933, **12**, 161–162).—The lattice parameter of a fine-grained polycrystalline wire of aluminium containing 4·0% copper is the same as that of a coarse-grained wire containing 4·8% copper and of that of a single crystal containing 5·6% copper. These results have been confirmed by careful density measurements.
—v. G.

Concerning W. T. Sproull's Article on "Diffraction of Low-Speed Electrons by a Tungsten Single Crystal." H. E. Farnsworth. G. P. Thompson (*Phys. Rev.*, 1933, [ii], **44**, 417–418).—Notes. H. E. F. suggests that the effects observed by Sproull (*J.*, this volume, p. 306) for a tungsten crystal cut parallel to a (112) plane, are due to the fact that the heat-treatment caused evaporation which etched the surface so as to expose the more densely populated (011) planes. Under these conditions lines which Sproull took to be due to the volume condition would be due to the surface condition, and *vice versa*. Sproull's criticisms of F.'s work (*J. Opt. Soc. Amer.*, 1927, **15**, 290) are answered. G. P. T. also suggests that, owing to the method of preparation, the surface of Sproull's tungsten crystal contained etch pits and pyramids with the (101) plane exposed. This would also account for the low value found for the inner potential, since, if the effects were due to the surface effect of (101) planes, the full inner potential, which would only be reached at a finite distance inside the crystal, would not come into play.—W. H.-R.

Diffraction of Low-Speed Electrons. H. E. Farnsworth (*Phys. Rev.*, 1933, [ii], **43**, 778).—Abstract of a paper read before the American Physical Society. Experiments with low-speed electrons have shown many deviations from the results to be expected on the basis of de Broglie's original relation. These deviations exist for normal incidence as well as for glancing angles of incidence used in the Bragg method, and may appear as a secondary or fine structure of the main diffraction beams. The relative intensities of the various components are extremely sensitive to small changes in the angle of incidence. This results in large variations of the relative integrated intensities of the main diffraction beams with small changes in angle of incidence. It thus appears that an understanding of the phenomenon should contain information on still obscure points in the present view of the solid state, such as the concept of an average inner potential, deviations from such an average value, and interaction between electrons in crystals. The following further experiments have been undertaken to determine possible surface effects, and in particular the "surface action" considered by v. Laue: (1) a study of the characteristics of a thin film of one metal deposited by evaporation on a single crystal of another metal; (2) investigation of reflection from opposite sides of a given set of atomic planes when using primary electrons which enter different faces of the same crystal in the two cases. The first experiment shows that the fine structure characteristics for the film are essentially the same as those for a massive crystal of the same metal, and thus eliminates surface irregularities as a possible cause of fine structure differences. The second experiment indicates that there is an unsymmetrical reflection from opposite sides of an atomic plane, and appears to have a significant bearing on the interpretation of the fine structure.—S. G.

On the Precision Determination of Lattice Constants by the Reflection Method. Franz Wever and Hermann Müller (*Mitt. K.-W. Inst. Eisenforschung*, 1933, **15**, 59–69).—The accuracy of the determination of lattice constants by the X-ray reflection method on plane films has been theoretically and experimentally investigated. The effect of errors in measuring (*a*) the interference lines and (*b*) the distance between specimen and film is discussed and shown graphically. The errors in (*a*) can be determined only indirectly either by Sachs and Weerts' extrapolation method (see *J.*, 1930, **43**, 528, and *Z. Krist.*, 1932, **84**, 20) or by comparison with a standard material. The latter method is illustrated in detail for the case in which a thin film of the standard is applied to the specimen, the thickness of the film serving to correct (*a*). The intensity distribution over the width of the interference lines is derived geometrically: it is roughly symmetrical to the position of the line with an infinitely thin primary ray. The deviations from Bragg's reflection law caused by diffraction of the X-rays do not produce displacement, but only broadening of the interference lines with sufficiently fine-grained specimens, since the deviations of the rays on entering and leaving compensate one another.—J. W.

A New Type of Crystal Structure Model. George Glockler (*Rev. Sci. Instruments*, 1933, [N.S.], **4**, 529).—A cellophane model, which is collapsible and fits into a storage box of dimensions about 12 × 7½ × 1½ in. is illustrated. —J. S. G. T.

IV.—CORROSION

(Continued from pp. 631–635.)

On the Action of Cupriferous Tap-Water on Aluminium. L. W. Haase (*Metallwirtschaft*, 1933, 12, 137; and (translation) *Light Metals Research*, 1933, 2, (24), 10–12).—Copper can be deposited in a metallic form from water only when the water contains sulphuric acid; since this is never the case with tap-water, corrosion pits in aluminium which are surrounded by cupriferous corrosion products can be explained only on the assumption that, during the fabrication of the aluminium, small specks of copper have been introduced, *e.g.* during rolling, and that these have given rise to the corrosion.—v. G.

Composition of the Patina on a Modern Bronze Statue. Rutherford J. Gettens (*Tech. Studies Field Fine Arts*, 1933, 2, (1), 31–33; *C. Abs.*, 1933, 27, 4514).—Examination of the surface of the bronze statue of Nathan Hale, erected about 1895, showed the presence of an inner, very thin layer of red Cu_2O or cuprite, a middle green layer (constituting the patina) consisting mostly of basic copper sulphate (corresponding approximately to $3CuO{\cdot}SO_3{\cdot}2H_2O$, or antlerite) and containing a considerable amount of tin oxide, and an outside layer consisting of a mixture of soot and finely-divided SiO_2 (derived from wind-borne material).—S. G.

Some Observations on the Corrosion of Lead. A. H. Loveless, T. A. S. Davies, and W. Wright (*Met. Ind.* (*Lond.*), 1933, 42, 614–616).—Abstract from *J. Roy. Tech. Coll.* (*Glasgow*), 1933, 3, (1), 57–64. See *J.*, this volume, p. 308.—J. H. W.

The Atmospheric Corrosion of Magnesium. L. Whitby (*Trans. Faraday Soc.*, 1933, 29, 844–853).—Weight increment/time curves have been obtained for magnesium (99·9%) exposed to outdoor atmospheres for 217 days and to indoor atmospheres for 412 days. In the latter case the rate of corrosion depends on the relative humidity, and with constant relative humidity the weight increment is probably a linear function of the time. The film of corrosion products, however, slowly becomes protective owing to the closing of the pores by secondary reactions. The primary film consists of magnesium hydroxide which subsequently becomes converted into hydrated carbonate and sulphate; in both stages a critical relative humidity is necessary to promote the reaction. After 412 days the film contained 46·5% magnesium carbonate, 9·8% magnesium sulphate, 16·3% magnesium hydroxide, and 27·4% water. Film formation in the open air follows a similar course to that indoors, except that there is an intermittent leaching out of soluble sulphate by the rain; during ensuing dry periods the film again thickens but no protective film is ever obtained. After 217 days' outdoor exposure the film consisted of 61·5% magnesium carbonate trihydrate, 26·7% magnesium sulphate heptahydrate, 6·4% magnesium hydroxide, 2·5% carbonaceous matter, and 2·9% ferric oxide + alumina.—A. R. P.

The Dissolution of Magnesium in Aqueous Salt Solutions.—II. L. Whitby (*Trans. Faraday Soc.*, 1933, 29, 853).—Cf. *J.*, this volume, p. 356. No evidence could be found to support the theory that nitride and oxide inclusions in magnesium act as cathodes or as nuclei for anodic attack in sodium chloride solutions. Analysis of a dissolution–time curve of a sample of magnesium which gave accelerated attack with time in 0·1*N*-sodium chloride solution indicates that the acceleration was caused by progressive redeposition of the more noble impurities in the metal (chiefly copper and iron). Impurities have a marked effect on the rate of dissolution of magnesium in 0·1*N*-sodium chloride solution, but very little effect in 0·002*N*-sodium chloride or in 0·1*N*-sodium sulphate solution; the initial rate of dissolution is practically independent of the nature of the impurities and of the concentration of the corrosive solution.—A. R. P.

Zinc in Dry Batteries. E. Schrader (*Met. Ind.* (*Lond.*), 1933, **42**, 659–662, 667).—Abstracted from *Z. Metallkunde*, 1931, **23**, 301. See this *J.*, 1932, **50**, 435.—J. H. W.

Corrosion of Light Metals. Freeman Horn (*Mech. World*, 1933, **93**, 75–76). **Duralumin** (*ibid.*, 99). **Corrosion of Magnesium** (*ibid.*, 100). **Corrosion Testing of Light Metals** (*ibid.*, 126–127). **Corrosion-Fatigue of Light Metals** (*ibid.*, 167). **Prevention of Corrosion in Light Metals** (*ibid.*, 242–243).—Abstracts of a paper read before the Chemical Engineering Group of the Society of Chemical Industry. See *J.*, this volume, p. 307.—F. J.

Corrosion of Metals in Salt Solutions and Sea-Water. G. D. Bengough (*Chem. and Ind.*, 1933, **52**, 195–210, 228–239).—The paper is a series of four lectures, which give a comprehensive survey of a wide range of work, much of which has been published in the Proceedings of the Royal Society during recent years. A large part of the work refers to ferrous materials, but an account is also given of the corrosion of zinc in very dilute solutions of potassium chloride and potassium sulphate. Factors influencing general corrosion in salt solutions are discussed, and the experimental method of attack, using apparently stagnant solutions, is described in detail. It is shown that under such conditions corrosion is controlled by two simultaneous mechanisms, (1) displacement of hydrogen gas, (2) absorption of oxygen. Corrosion curves given for zinc in very dilute solutions of potassium chloride are said to be of historical interest as being the first complete set ever published for any of the metals which corrode both by oxygen absorption and hydrogen evolution. Spectroscopically pure zinc gives much less hydrogen evolution than ordinary commercially pure zinc, but the oxygen absorption rate is quite similar, making allowance for the effect of the hydrogen. The distribution of corrosion over the surface of specimens has also been studied and is illustrated with respect to zinc by means of a series of photomicrographs. The reactions occurring at cathodic and anodic regions and the factors controlling distribution of corrosion are discussed.—E. S. H.

Deterioration and Restoration, with Especial Reference to Metallic Exhibits. Alexander Scott (*Museums J.*, 1933, **33**, 4–8; *Tech. Studies Field Fine Arts*, 1933, **2**, (1), 53; *C. Abs.*, 1933, **27**, 4505).—Salts in the soil that are particularly destructive of metallic objects are sodium and calcium chlorides and nitrates and calcium sulphate, sodium chloride being the most active. It does not affect gold, but silver is rapidly changed to silver chloride or to a "horn silver" with a large chlorine content. With copper, iron, and bronze, a relatively small amount of sodium chloride acting in the presence of air and water may start a cycle of chloride, oxychloride, oxide or carbonate which will reduce the metal to a mass of these compounds. Treatment of corroded silver and copper must begin with complete removal of all traces of chlorine, which in many cases can be effected by soaking for several days in strong sodium sesquicarbonate solution, followed by thorough washing. $HCOOH$ is indicated as the best for cleaning, because the $HCOOAg$ can be easily decomposed into carbon dioxide and silver. Sulphuric or hydrochloric acids should not be used in the treatment of copper and bronze, but 3% aqueous citric acid is safe and effective. Application of granulated zinc in a dilute sodium hydroxide solution is preferable to actual electrolysis. Comparatively little can be done for iron objects when they carry a heavy crust of black iron oxide. Presence of active corrosion is usually shown by the appearance on the surface of brown liquid drops giving tests for chlorine, and the pieces may be immersed in or boiled with sodium hydroxide solution and granulated zinc. A test of the effectiveness of the treatment is exposure in a very moist atmosphere for 4–5 weeks; if freed of chlorine it will not show pinhead drops in this time.—S. G.

Some Comparative Corrosion-Fatigue Tests Employing Two Types of Stressing Action. H. J. Gough and D. G. Sopwith (*Engineering*, 1933, **135**, 75–78).—An abridged account of a paper read before the Iron and Steel Institute. See *J.*, this volume, p. 309.—W. P. R.

V.—PROTECTION

(Other than Electrodeposition.)

(Continued from pp. 636–639.)

The Electrolytic Oxidation of Aluminium. Anon. (*Oberflächentechnik*, 1933, **10**, 175–178).—A review of modern procedures of producing protective and decorative films on aluminium.—A. R. P.

The Electrolytic Oxidation Process [for the Protection of Aluminium and Its Alloys.] Hans Schmitt (*Oberflächentechnik*, 1933, **10**, 217–219).—The merits of various anodic oxidation processes are discussed.—A. R. P.

Anodic Polarization of Aluminium and Its Alloys as a Protection Against Corrosion. V. Kroenig and I. Kazakov (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1932**, 505–512; *C. Abs.*, 1933, **27**, 4516).—[In Russian.] A description is given of the anodic polarization methods used in the Central Aero-Hydrodynamical Institute, Moscow. Anodic polarization increases considerably the resistance of aluminium and Duralumin to corrosion by sea-water.—S. G.

Coating and Colouring Aluminium by Alumilite Process. H. Bengston and R. E. Pettit (*Chem. and Met. Eng.*, 1933, **40**, 135).—Abstracted from *Machinist* (*Eur. Edn.*), 1933, **77**, 76–79; see *J.*, this vol., pp. 245, 310.—F. J.

Testing the Thickness of Zinc on Galvanized Wire. Z. Dyakonova (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1932**, 550–552; *C. Abs.*, 1933, **27**, 4514).—[In Russian.] By the use of a solution of As_2O_3 in sulphuric acid, zinc oxide and zinc can be uniformly dissolved. By dipping a wire, previously cleaned in benzene or ether, into such a solution and holding for 15 seconds from the moment of the appearance of the first bubbles, a layer of zinc 0·0001 cm. thick is dissolved off. The wire is then washed in water and quickly dipped into a concentrated solution of ammonium sulphide. If any bare iron is present, black spots due to the formation of FeS will appear on the portions of the wire unprotected by zinc. To ascertain the presence of ferrous sulphide the wire is placed for a short time in strong acetic acid (3 c.c.), removed, and 2–3 drops of potassium ferricyanide are added to the solution. The change in the colour of the solution indicates the presence of iron.—S. G.

Artificial Production of Natural Protective Coatings [on Metals]. Anon. (*Chem.-Zeit.*, 1933, **57**, 662–663).—Modern methods of producing protective films on aluminium, copper, and zinc are briefly outlined.—A. R. P.

Metal Spraying: A Review of the Process. W. E. Ballard (*Indust. Gases*, 1932, **13**, 203–209).—After a historical survey of the process, the Schoop pistol is described. It is supplied with air at 50 lb. pressure, cylinder oxygen, and fuel gas. The air drives a turbine which is geared to rolls gripping the wire of metal to be sprayed. About 15 ft.^{3} of air is used per minute, and the consumption of fuel gas and oxygen varies according to the metal, lead requiring 1½ ft.^{3} of oxygen and 4 ft.^{3} of hydrogen, whilst stainless steel requires 40 ft.^{3} of oxygen and 100 ft.^{3} of hydrogen per 1 lb. sprayed. The usual metal loss is about 15%. The approximate consumption of metal per hr. in the pistol is for lead, 15 lb.; tin, 7 lb.; zinc, 5 lb.; aluminium and copper, 1½ lb. By means of special nozzles, long tubes and orifices of small diameter can be sprayed. The surface of the article to be sprayed must be roughened. This can be done, in the case of metals, by sand-blasting, but acid etching is useless. Porosity of the coatings can be overcome by chemical doping, heat-treatment, or mechanical battering. The applications of sprayed coatings of zinc, lead, tin, aluminium, and nickel are described.—H. W. G. H.

Protective Painting of Metal Work. S. C. Britton and U. R. Evans (*Iron Age*, 1933, **132**, 23 and 68).—Abstract of a paper read before the Electrochemical Society. See *J.*, this volume, p. 556.—J. H. W.

VI.—ELECTRODEPOSITION

(Continued from pp. 639–642.)

Technique of Electrodeposition of Cadmium. F. Pietrafesa and E. Lotti (*Galvano*, **1933**, (16), 23–26; (17), 24–26).—Translated from *Metallurgia italiana*, 1933, **25**, 167–173. See *J.*, this volume, p. 445.—E. S. H.

Porosity in Cadmium Coatings on Steel. S. G. Clarke (*Met. Ind.* (*N.Y.*), 1933, **31**, 307).—Abstract of a paper read before the Electrodepositors' Technical Society. See *J.*, this volume, p. 506.—I. M.

Discussion on Electrodeposited Cadmium. —— (*Met. Ind.* (*Lond.*), 1933, **43**, 331–333).—Summary of the discussion of a paper presented by S. G. Clarke to the Electrodepositors' Technical Society. See *J.*, this volume, p. 506.—J. H. W.

Prevention of Discoloration of Cadmium Plate. Gustaf Soderberg (*Metal Cleaning and Finishing*, 1932, **4**, 561–562).—Cf. *J.*, this volume, p. 27.—S. G.

The Electrodeposition of Ternary Alloys of Cadmium, Zinc, and Antimony. Lawrence E. Stout and Leonard Goldstein (*Trans. Electrochem. Soc.*, 1933, **63**, 99–119; and *Metal Cleaning and Finishing*, 1933, **5**, 257–260.—See *J.*, this volume, p. 249.—S. G.

Advances in Chromium Plating. Anon. (*Oberflächentechnik*, 1933, **10**, 219–221).—A review.—A. R. P.

Shaped Anodes in Chromium Plating. R. J. Piersol (*Metal Cleaning and Finishing*, 1933, **5**, 235–238; *C. Abs.*, 1933, **27**, 4485).—Special designs of anodes required for the various shapes of inside surface for securing uniform current density in chromium plating are discussed.—S. G.

Replating Hard Chromium. R. J. Piersol (*Metal Cleaning and Finishing*, 1933, **5**, 279–282; *C. Abs.*, 1933, **27**, 4485).—A method for chromium replating is described (U.S. Patent 1,774,901) with which successive layers of chromium have been deposited to a total thinness of 0·5 in.—S. G.

Shading in Chromium Plating. R. J. Piersol (*Metal Cleaning and Finishing*, 1933, **5**, 207–210; *C. Abs.*, 1933, **27**, 4485).—P. discusses the principles of calculating the current density to be employed in the chromium plating of irregularly-shaped articles so as to avoid "shading."—S. G.

Chromium Plating of Considerable Thickness. R. J. Piersol (*Galvano*, **1933**, (9), 25–27, (10), 23–25).—Translated from *Chem. and Met. Eng.*, 1931, **38**, 445–448. See this *J.*, 1932, **50**, 46.—E. S. H.

The Determination of the Sulphate Content of Chromium-Plating Baths. K. W. Fröhlich (*Mitt. Forschungsinst. Edelmetalle*, 1933, **7**, 64–65).—Removal of the chromium and other metals from the plating solution prior to determination of the sulphate content by the barium chloride method is unnecessary for technical purposes.—A. R. P.

Note on the Electrodeposition of Copper. E. Vuigner (*J. Four élect.*, 1933, **42**, 363–367).—As a result of a series of experiments, it is concluded that a superior quality of copper deposits with the minimum expenditure of current can be obtained by the following means: using anodes of well-refined copper; using cores prepared in a pure electrolyte with a moderate current; maintaining the baths at a sufficiently constant temperature and avoiding any addition of chlorine or of glue.—J. H. W.

The Electrodeposition of Magnesium. D. M. Overcash and F. C. Mathers (*Met. Ind.* (*Lond.*), 1933, **43**, 473–474).—Abstract of a paper read before the Electrochemical Society. See *J.*, this volume, p. 558.—J. H. W.

The Influence of the Composition and Acidity of the Electrolyte on the Characteristics of Nickel Deposits. D. J. Macnaughtan, G. E. Gardam, and R. A. F. Hammond (*Trans. Faraday Soc.*, 1933, **29**, 729–754).—The surface appearance and Brinell hardness of nickel deposited from sulphate solutions of different p_H containing one or more of the following: boric acid, potassium sulphate, potassium chloride, nickel chloride, have been examined and the results are shown in photographs and curves; the cathode efficiencies of the various electrolytes have also been determined. In all cases solutions of high p_H give the hardest deposits, reduction in p_H rapidly producing reduction in hardness until a critical p_H is reached. In solutions containing chlorides little change in hardness occurs below the critical p_H; the deposit from such solutions containing potassium is harder than that from solutions free from this metal. In chloride-free solutions, however, the hardness of the deposits rises with reduction in p_H below the critical value, and eventually reaches a well-defined maximum, after which further reduction in p_H produces softer plates especially when potassium is present. That the great hardness of deposits from high p_H solutions is due to the occlusion of basic material has been confirmed, but no direct relation can be found between the hardness and the amount of hydrogen discharged. It is suggested that the basic material is first formed in the colloidal state by depletion of hydrogen ions from the liquid around the cathode and is positively charged so that it migrates towards the cathode and is deposited on the crystal faces, thereby restraining grain growth, and thus causing a hard fine-grained deposit to be formed. Negatively charged anions tend to flocculate the basic material, and the resulting neutral precipitate is either swept into the body of the solution and there dissolved, or remains as an obstructive or semi-permeable membrane in the neighbourhood of the cathode. Chloride ions have a greater flocculating effect than sulphate ions, whilst potassium ions tend to oppose flocculation. In the absence of chloride ions the flocculated precipitate appears to hinder the free movement of the solution, and thus promotes formation of more colloid; this effect is less when potassium is present. The action of these phenomena in determining the hardness of the deposits at various p_H values is critically discussed. Pitting appears to be associated with the absence of potassium and the presence of chloride, and to depend on the p_H of the solution, never appearing when the p_H is less than 2·6; it reaches a maximum in the p_H range in which the greatest quantity of flocculated matter is produced. The influence of chloride in stimulating, and potassium ions in inhibiting, pitting is thus clearly associated with their respective actions in flocculating and stabilizing the basic material.—A. R. P.

Scientific Control of Electro-Deposits of Nickel and Chromium in Industry. M. Ballay (*Chim. et Ind.*, **1930**, Special No. (March), 253–262).—See abstract from another source, this *J.*, 1931, **47**, 41.—S. G.

Practical Plating. The Deposition of Nickel-Solutions. E. A. Ollard (*Met. Ind.* (*Lond.*), 1933, **43**, 377–378).—The use of a knowledge of the p_H value and the nickel ion concentration in the control of nickel plating solutions is explained. See *J.*, this volume, p. 558.—J. H. W.

Deposition of Nickel-Cobalt Alloys. S. A. Pletenew and W. W. Kuznetzova (*Met. Ind.* (*Lond.*), 1933, **42**, 598).—Short abstract from *Z. Elektrochem.*, 1933, **39**, 201–204. See *J.*, this volume, p. 312.—J. H. W.

Discussion on the Electrodeposition of Palladium. —— (*Met. Ind.* (*Lond.*), 1933, **43**, 203–204).—Summary of the discussion of a paper by R. H. Atkinson and A. R. Raper, read before the Electrodepositors' Technical Society. See *J.*, this volume, p. 509.—J. H. W.

Recent Advances in the Electrolytic Deposition of the Platinum Metals. Anon. (*Oberflächentechnik*, 1933, 10, 201–202).—A review of recent German, American, and British patents dealing with platinum-, palladium-, and rhodium-plating.—A. R. P.

A New Method of Testing Plating Baths and Its Application to Silver- and Copper-Plating. K. W. Fröhlich (*Mitt. Forschungsinst. Edelmetalle*, 1933, 7, 37–44).—The wearing qualities of electrolytic deposits may be determined by measuring the quantity of sand which, when allowed to fall in a thin stream on a flat plate, just causes the base metal to be exposed. The sand, which should pass a 30 mesh but be retained on a 50 mesh, is placed in a funnel provided with a long tube terminating just above the plate, which is inclined at an angle of 45°. Tests on silver-plates produced from baths of varying composition under various conditions have shown that the proportion of free cyanide and alkali carbonate, and considerable variations in the temperature have practically no effect on the rate of wear of the plate; high current density gives a slightly harder plate, but substitution of sodium salts for potassium salts is without effect. With a current density of 2 amp./dm.^{2} increase in the free acidity of sulphate copper-plating baths from 0 to 30 grm./litre decreases the rate of wear by about 30%; reduction of the current density, however, reduces the resistance to wear.—A. R. P.

Silver Plating of Alloys Containing Phosphorus. A Contribution to the Question of Electrolytic Degreasing. —— Moser, K. W. Fröhlich, and E. Raub (*Metall u. Erz*, 1933, 46, 562–565).—In melting 830-fine silver alloys in Germany phosphor–copper is almost invariably used as deoxidizer, and frequently as much as 0·1% phosphorus is left in the alloy. When examined under the microscope, this phosphorus is seen to be present as the ternary silver–copper–copper phosphide eutectic regularly distributed as minute particles along the grain boundaries. After fabrication of the metal into articles, the general practice is to silver-plate to produce a high-quality finish; frequently this plate is exceedingly porous and badly adherent. The cause of this trouble has been traced to the action of nascent hydrogen, produced in the electrolytic degreasing vat, on the phosphide eutectic; hydrogen phosphide is evolved and the surface becomes pitted, and these pits entrap gas which produces the pores in the plate. Satisfactory plating can be obtained if the articles are degreased by boiling in an alkali cleaner or brushed with an alkaline solution without the use of a current.—A. R. P.

New Facts in the Field of Silver-Plating. Anon. (*Oberflächentechnik*, 1933, 10, 165–167).—A review of recent work.—A. R. P.

The Nature of Spongy Zinc Deposits Obtained by the Electrolysis of Aqueous Solutions of Zinc Sulphate. W. S. Sebborn (*Trans. Faraday Soc.*, 1933, 29, 825–829).—The formation of spongy zinc deposits during the deposition of zinc from sulphate solutions is connected with the production of zinc hydroxide at the cathode. Thus under conditions which produce a spongy deposit on a vertical cathode coherent deposits are obtained on a horizontal cathode in a still solution, since any zinc hydroxide formed is then kept from contact with the metal by the surface effect of hydrogen bubbles. Analysis of the spongy metal showed it to contain about 80% of zinc metal, the remainder being zinc oxide, hydroxide, basic carbonate, and basic sulphate. These facts support the theory of Förster and Günther that sponge formation is due to formation of zinc hydroxide by reaction of zinc ions with hydroxyl ions at the cathode, and the subsequent occlusion of the hydroxide in the deposit whereby crystal growth is retarded. The production of spongy deposits is favoured by a high current density and by a low metal concentration.—A. R. P.

Zinc or Cadmium Plating. S. Wernick (*Galvano*, 1932, (3), 19–25).—Translated from *J. Electroplaters' and Depositors' Tech. Soc.*, 1931, 6, 129–152. See this *J.*, 1931, 47, 357.—E. S. H.

New Electrolytic Deposits. H. Krause (*Feinmechanik u. Präzision*, 1933, **41**, 106–108; *C. Abs.*, 1933, **27**, 4486).—A review. Platinum, palladium, gold, silver, rhodium, indium, molybdenum, tungsten, &c., are used. Rhodium deposits are recommended where hardness is of importance. It is best deposited from a sulphate bath containing 1 grm. rhodium per litre, and requiring 4–6 v.; it develops a noxious mist. Molybdenum is deposited from a solution of 10 grm. ammonium molybdate and 10–20 grm. ammonium nitrate in 1 litre of water, with 0·2–0·3 amp./dm.^{2} at about 2 v.; a fine black deposit is obtained.—S. G.

Specifications for Electrodeposits. Marcel Ballay (*Aciers spéciaux*, 1933, **8**, 240–257).—The specifications of electrodeposits which may be required by a user are considered, and in particular: the quality of the deposits, their adherence, their thickness, methods of solution of copper, nickel, chromium, silver, zinc, and cadmium deposits, porosity, corrosion resistance, their hardness and fragility, and standard commercial specifications.—J. H. W.

On the Measurement of the Throwing Power of Plating Baths. A. Onitchenko (*Z. Elektrochem.*, 1933, **39**, 815–818).—The efficiency of plating baths as regards throwing power and ability to fill cavities and produce an adherent metal deposit is discussed. A simple method of accurately and quickly determining these properties and the factors governing throwing power are described.—J. H. W.

Cleaning in Acids before Electrodeposition. [Clayton M. Hoff] (*Galvano*, **1932**, (5), 23–27).—Translated from *Brass World*, 1931, **27**, 129–131. See this *J.*, 1931, **47**, 496.—E. S. H.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-Refining.)

(Continued from p. 642.)

The Electro-Deposition of Beryllium. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 50–52).—A review of the methods of production of beryllium by fusion electrolysis above 500° C. from a bath of beryllium and sodium fluorides, on to a copper cathode. Heat-treatment leads to the gradual diffusion of the beryllium throughout the mass with the formation of a homogeneous alloy.—R. G.

The Deposition of Beryllium on Copper and Other Metals in Fused Electrolytes. H. Fischer and W. Schwan (*Metallwirtschaft*, 1933, **12**, 187–189).—An adherent film of beryllium can be deposited on copper by electrolysis at 800° C. of a 3 : 1 molecular mixture of beryllium and sodium fluorides. Ammonium fluoride is added to the bath during melting to ensure expulsion of the last traces of water. The current yield falls if the temperature is raised or lowered or if the current density is above 1000 amp./dm.^{2}. The deposited film first consists of a copper–beryllium alloy but the copper content decreases as the film thickens, until, when pure beryllium begins to be deposited, the film no longer is adherent but becomes powdery.—v. G.

Production of Oxygen-Free Electrolytic Copper. Anon. (*Met. Ind.* (*Lond.*), 1932, **40**, 617).—Abstracted from *Metallwirtschaft*, 1932, **11**, 68. Cf. *Met. Ind.* (*Lond.*), 1932, **40**, 637).—J. H. W.

Faraday and His Electrochemical Researches. R. S. Hutton (*Met. Ind.* (*Lond.*), 1933, **43**, 329–330, 379–380).—See *J.*, this volume, p. 561.—J. H. W.

VIII.—REFINING

(Continued from p. 643.)

The Electrolytic Refining of Mercury. E. Newbery and S. M. Naude (*Met. Ind.* (*Lond.*), 1933, **43**, 415–418).—Summary of a paper read before the Electrochemical Society. See *J.*, this volume, p. 562.—J. H. W.

IX.—ANALYSIS

(Continued from pp. 644–649.)

The Most Important Advances in Analytical Chemistry in the Past Year. R. Fresenius (*Angew. Chem.*, 1933, **46**, 615–618).—A review with especial reference to new methods of detecting and determining the metals.—A. R. P.

New List of Standard Samples. Anon. (*J. Franklin Inst.*, 1933, **215**, 486). —A supplement to the *U.S. Bur. Stand. Circ.* No. 25, contains a new list of standard samples for use in chemical analyses. A number of non-ferrous alloys is included.—S. V. W.

Some Practical Applications of X-Ray Analysis. V. E. Pullin (*Met. Ind.* (*Lond.*), 1933, **43**, 393; discussion, 393–394).—Abstract of a paper read before the Midland Metallurgical Society. The principles underlying X-ray analysis and the practical applications of this method to the analysis of metals and alloys are briefly described.—J. H. W.

Spectrographic Recognition of Small Quantities, "Traces" [of Impurities in Metals]. Walther Gerlach (*Angew. Chem.*, 1933, **46**, 557–562).—The use of the spectrograph in detecting traces of impurities in "commercially pure" metals is described with reference to specific examples. The purest platinum obtainable shows two very faint copper lines, but ordinary chemically pure platinum shows the lines of copper, silver, palladium, rhodium, nickel, and, if it has been melted on lime, calcium. All commercial qualities of pure aluminium contain silver, cadmium, copper, chromium, iron, gallium, manganese, nickel, lead, silicon, titanium, vanadium, and zinc; German aluminium is particularly rich in gallium, Italian in titanium, and American frequently contains scandium.—A. R. P.

Quantitative X-Ray Analysis of Iron Alloys. S. Shimur and M. Takasu (*J. Iron Steel Inst. Japan*, 1930, **16**, 961–970; *Brit. Chem. Abs.*, **1932**, [B], 26).—[In Japanese.] With Fe–Mn–Ni alloys the results were largely in error (Mn 0–25%, Ni 0·5–15%).—S. G.

Studies on Eliminating the Effects of PO_4-Radical in Qualitative Analysis. —I. Saburo Ishimaru (*Kinzoku no Kenkyu*, 1933, **10**, 423–430).—[In Japanese, with English abstract.] The precipitation of PO_4''' with $Fe^{\cdot\cdot\cdot}$ salt is preferred to precipitation with $Pb^{\cdot\cdot}$ salt.—A. R. P.

Analysis of Tin, Antimony, Lead, Bismuth Alloy. Gordon Abbey (*Chemist-Analyst*, 1933, 22, (4), 14–15).—For alloys containing 10–30% Sn, 30–40% Pb, and 30-40% Bi the Sn is determined by titration with $NaIO_3$, and the Sb with $KMnO_4$. The Pb is determined gravimetrically as sulphate, and the Bi in the filtrate from the $PbSO_4$.—A. R. P.

Method for the Determination of Bismuth in Refined Lead. J. E. Hendrick (*Chemist-Analyst*, 1933, **22**, (4), 15).—Double precipitation of BiOCl is recommended using a 25 grm. sample of Pb.—A. R. P.

Determination of Calcium in Lead-Calcium Alloys of Low Calcium Content. Beverly L. Clarke and Leland A. Wooten (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1933, **5**, 313–315).—The Pb (20 grm.) is dissolved in 100 c.c. of 1 : 3 HNO_3 and the Pb precipitated with 20 c.c. of 1 : 1 H_2SO_4. The filtrate (150–175 c.c.) is neutralized with NH_4OH, and 15 c.c. excess of NH_4OH are added, followed, after filtration, by 30 c.c. of 95% C_2H_5OH and 2 grm. of $(NH_4)_2C_2O_4$; after boiling for **3** minutes and cooling to 45°–55° C., the CaC_2O_4 is collected in a porous glass crucible, washed first with 1% $(NH_4)_2C_2O_4$, then with NH_4OH, and dissolved in H_2SO_4 for titration with $KMnO_4$.—A. R. P.

Determination of Lead, Copper, and Manganese in Manganese Bronze. James Brinn (*Chemist-Analyst*, 1933, **22**, (2), 14–15).—Pb is determined as $PbSO_4$, Mn by precipitation with $(NH_4)_2S_2O_8$ and conversion into $Mn_2P_2O_7$, and Cu by electrolysis.—A. R. P.

Detection and Determination of Lead in [Tinplate] Preserving Cans. —— Cheftel (*Ann. Falsif.*, 1932, **25**, 156–157; *Brit. Chem. Abs.*, 1932, [B], 606).—In testing for Pb in tinplate, C. emphasizes the great importance of ensuring that very minute droplets of Pb solder, sometimes far removed from the seams, are not included in the test-sample. It is recommended first to search the selected surface with a lens, then to heat the tinplate over a small flame, and scrape with a nickel knife. For analysis, 20 mg. of such metallic dust are evaporated with 2 c.c. of concentrated HNO_3. The process is thrice repeated and the residue taken up with H_2O, filtered from metastannic acid, and the Pb in the filtrate determined in the usual way.—S. G.

Tantalum and Columbium [Niobium] Cathodes vs. Platinum Cathodes for Electro-Analysis. D. F. Calhane and C. Malcolm Alber (*Trans. Electrochem. Soc.*, 1933, **63**, 173–179).—See this *J.*, 1933, **53**, 316.—S. G.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

(See also "Testing" and "Pyrometry.")

(Continued from pp. 649–650.)

A Thermocouple Potentiometer. A. Egerton and A. R. Ubbelohde (*J. Sci. Instruments*, 1933, **10**, (10), 310–311).—This instrument is of the type in which the greater part of the e.m.f. of the thermocouple is balanced against a known p.d. which can be varied in steps, and the small residual e.m.f. read on a sensitive millivoltmeter. The known p.d. are obtained by mounting twelve or more copper–Constantan thermo-couples in series, with the hot and cold junctions in two accurately controlled thermostats. The temperature difference of the thermostats is adjusted so that the e.m.f. of each copper–Constantan element corresponds with 100° C. of the main couple. In order to keep the resistance in the circuit constant, copper resistances equal to those of the Constantan elements are automatically cut out as the latter are inserted. —W. H.-R.

Temperature Measuring and Regulating Instruments. A. Grunwald (*Siemens Rev.*, 1933, **9**, (2), 32–37).—Reviews the Siemens instruments for temperature measurement and regulation. Mention is made of "Sinterkorund," (sintered corundum), a pure aluminium oxide, fired at 1800° C. by a special process and used for thermocouple protective tubes. See *J.*, this volume, p. 656.—R. Gr.

Universal Chamber for X-Ray Photographs. K. V. Vasil'ev (*Trans. Inst. Econ. Mineral* (*U.S.S.R.*), No. **55**, 1932, 20–31; *C. Abs.*, 1933, **27**, 4444).—[In Russian.] The tube of the Debye–Scherrer type is adopted for taking exposure by different methods. The Debye chamber is enlarged to permit exposures by the Laue method, while the insertion of a watch mechanism permits rotation of the crystal during the exposure. All diaphragms are demountable and the object might be located at any desired position. It is possible to use either the transmitted or reflected rays.—S. G.

XI.—PHYSICAL AND MECHANICAL TESTING AND RADIOLOGY

(Continued from pp. 651–656.)

Energy Loss Testing of Magnetic Materials Utilizing a Single Strip Specimen. C. Dannatt (*J. Sci. Instruments*, 1933, **10**, 276–285).—Describes a method for measuring the energy loss in magnetic materials under alternating magnetization. The tester takes a specimen 12 in. long with a maximum of 4 in. wide.

The chief advantage compared with other methods is that the actual quality of a single piece is obtained, instead of the average quality of a number of pieces in parallel, so that studies of the effect of direction of rolling, variation in properties with sheet position, &c., may be rapidly and accurately made. The small size of the specimen makes the method useful in metallurgical research. The theory of the method is given in the appendices.—W. H.-R.

On the Problem of the Fatigue Limit with Polyaxial Stresses. K. Hohenemser and W. Prager (*Metallwirtschaft*, 1933, **12**, 342–343).—Fatigue tests are described with a machine by means of which thin-walled tubes can be submitted simultaneously to (*a*) alternating and static tensile or compression stresses, or (*b*) alternating and static torsional stresses and static internal pressure.—v. G.

The Deep-Drawing Test. A. Krecek (*Metallwirtschaft*, 1933, **12**, 189–192). —A modification of the Erichsen test is described, and the influence of the width of the test-piece on the values obtained has been determined.—v. G.

A New Method for the Measurement of the Modulus of Elasticity. P. Le Rolland and P. Sorin (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 63–64).— A summary of a paper by Le R. and S. (*Rev. Mét.*, 1933, **30**, 112–116). See *J.*, this volume, p. 518.—R. G.

Hardness Testing of Metallic Structural Materials. Johann Gieth (*Werkstatt u. Betrieb*, 1933, **66**, 316–321).—Existing methods of hardness testing are classified as follows: static and dynamic impression methods, impact and rebound tests, and scratch-hardness testing. A description is given of the best-known processes, with some remarks as to the special applicability of each. Brinell hardnesses for a 3000-kg. load and 10 mm. diam. ball are tabulated for a variety of ferrous and non-ferrous materials; a series of scratch-hardness values on the Mohs and Martens scales is also given.—P. R.

Hardness Values for Electrochemical Products. Raymond R. Ridgway, Archibald H. Ballard, and Bruce L. Bailey (*Trans. Electrochem. Soc.*, 1933, **63**, 369–392; discussion, 392–393).—See this *J.*, 1933, **53**, 375.—S. G.

Simplified Hardness Tester. Anon. (*Canad. Mach.*, 1933, **44**, (10), 36).— See *J.*, this volume, pp. 568, 569.—P. M. C. R.

RADIOLOGY

Radium in Engineering Practice. V. E. Pullin (*Proc. Inst. Mech. Eng.*, 1933, **124**, 305–322; and (summaries) *Engineer*, 1933, **155**, 304–306; *Engineering*, 1933, **135**, 340–342: *Met. Ind.* (*Lond.*), 1933, **42**, 320; *Machinery* (*Lond.*), 1933, **41**, 763–766; *Mech. World*, 1933, **93**, 340–344; *S. African Eng.*, 1933, **44**, 87).—The use of γ-rays from radium for the detection of flaws in castings is described, and the apparatus is illustrated together with typical photographs. With specimens up to about 3 in. in thickness, X-ray radiology is much more suitable than radium except where the specimen must be radiographed *in situ*, and is mounted in an inaccessible position. For thick specimens radium has many advantages, especially where the thickness of the sample varies greatly.—W. H.-R.

The Physics of Röntgen Rays as the Basis of X-Ray Testing. W. E. Schmid (*Arch. tech. Messen*, 1932, **2**, 116).—A summary of the source and properties of X-rays, their detection, and their applications to the testing of materials o the investigation of crystal structure, and to spectroscopic analysis.—P. R.

X-Ray Testing of Castings in Dock. —— Schatzmann (*Werft, Reederei, Hafen*, 1933, **14**, 207–209).—An illustrated account of the work of an X-ray testing installation at Wilhelmshaven.—P. M. C. R.

Radiographic Examination of Pressure Vessels. R. E. Hiller (*Indust. Gases*, 1933, **14**, 102–106).—From *Iron Age*, 1933, **131**, 736–739; see *J.*, this volume, p. 375.—H. W. G. H.

XII.—PYROMETRY

(Continued from p. 656.)

Thermo-Elements. Georg Keinath (*Arch. tech. Messen*, 1932, 2, T156).—A summary of the principle of the thermo-couple is followed by a discussion of the factors influencing the selection of an element. Comparative curves show the influence of temperature on e.m.f. in elements composed of platinum with Constantan, Kahlbaum nickel, steel, iron, copper, carbon, and chrome-nickel. A thermoelectric table of metals in relation to platinum is given, and suitable couples are recommended for temperatures ranging from below 800° C. to about 2400° C. The merits of thermocouples are summarized.—P. M. C. R.

Partial Radiation Pyrometers. Anon. (*Arch. tech. Messen*, 1932, 2, (15), F20).—Four types of proprietary pyrometer of the "glowing wire" type, and one of the cross-wire type, are described, with an account of their special uses and adaptations.—P. M. C. R.

The Ardometer. Anon. (*Arch. tech. Messen*, 1932, 2, (16), F22).—See this *J.*, 1932, **50**, 492, 757.—P. M. C. R.

Tube Protectors for Pyrometers. Georg Keinath (*Arch. tech. Messen*, 1932, 2, (18), T185).—Pyrometer protectors should themselves evolve no harmful gases on heating. They should be gas-tight, good conductors of heat, be of sufficient mechanical strength, be unaffected by rapid changes of temperature, and be stable at high temperatures. K. considers that no protective material is perfectly satisfactory above 1200° C., the necessary combination of qualities being achieved by the concentric use of 2 or more protectors. Among metallic protectors, K. considers copper, bronze, Monel metal, cast iron, Armco, enamelled iron, Calorized and "Alitized" iron, ferro-chromium alloys, nickel, nickel-chromium, and nickel-chromium-iron alloys; for inner tubing, the properties of quartz, porcelain, alundum, and sinter-corundum, are considered. Ceramic materials for outer tubes are carborundum, graphite, and fireclay. Appropriate temperature ranges are indicated.—P. M. C. R.

Tube-Protectors for Pyrometers: Measurement of Penetrability by Gases. Georg Keinath (*Arch. tech. Messen*, 1932, 2, (15), T138).—Adapted from a contribution by W. F. Roeser to the *U.S. Bur. Stand. J. Research*, 1931, 7, 485–494. See this *J.*, 1931, **47**, 587.—P. M. C. R.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 657–660.)

Non-Ferrous Metals in the Foundry. C. Edward Williams (*Met. Ind.* (*Lond.*), 1933, 42, 664–665).—Summary of the Presidential Address to the Institute of British Foundrymen.—J. H. W.

Graphical Solution of Technical Melting Calculations. Alfred Koster (*Metall u. Erz*, 1933, 30, 406–408).—Graphical methods are given for making up binary or ternary alloys of a predetermined composition from mixtures of similar alloys of different compositions.—A. R. P.

Metals Melted in a Vacuum. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1933, 9, 62).—A review of a commemorative volume "Heraeus Vacuumschmelze" (published by the German firm Heraeus Vacuumschmelze A.G.), referring particularly to the contribution by W. Rohn on the development of vacuum melting on a commercial scale, and those describing the properties of the materials produced. [Abstracts of the papers published in this volume have already been published in this *J.*]—R. G.

Runners and Risers. T. R. Harris (*Found. Trade J.*, 1933, **49**, 151–152). —The functions of runners and risers are discussed and typical examples from practice are described.—J. H. W.

Porosity. Thomas E. Green (*World Power*, 1933, **19**, 114–115).—A short general article on the subject which on the whole tends to present an exaggerated view of the troubles caused by porous castings.—S. V. W.

Principal Factors in the Castability of Metals. A. Portevin and P. Bastien (*Usine*, 1932, **41**, (11), 29).—Summary of a paper read before the Académie des Sciences. See this *J.*, 1932, **50**, 329.—R. B. D.

Castability of Alloys. Relation to the Freezing Range. A. Portevin and P. Bastien (*Usine*, 1932, **41**, (13), 27).—Abstract of a paper read before the Académie des Sciences. See this *J.*, 1932, **50**, 329, 708.—R. B. D.

Precautions to be Observed in the Design of Sand-Cast and Machined Components. A. F. C. Pollard (*J. Sci. Instruments*, 1933, **10**, 265-272).—The design of apparatus and instruments is discussed to show how difficulties in casting and machining may be overcome, and labour costs lowered. The importance of avoiding complicated shapes in castings is emphasized; two or three simple forms to be bolted together are preferable to one complicated casting. The relative thicknesses of different parts of the casting and their effect on internal strains set up in cooling are discussed. In the design of machined components, complicated shapes should again be avoided if they imply difficulty in holding the work in the machine tool, inaccessibility of machined faces, a number of parallel machined faces at different levels, &c. A common fault is that of not allowing sufficient " landing space " for tools. Examples of bad design are given.—W. H.-R.

Removal of Gases and Other Impurities from Aluminium and Its Alloys with the Aid of Aluminium Chloride in Combination with Other Salts. —— Steinhäuser (*Metallwirtschaft*, 1933, **12**, 284–285).—Technical aluminium can be freed from gases and slag by stirring the molten metal with a small quantity (about $1^\circ/_{\circ\circ}$) of mixture of 2 parts of aluminium chloride and 1 part of sodium chloride, provided that the crucible is completely dry. The process is effective only with charges not exceeding 150 kg.—v. G.

Small Aluminium Hand Wheels Cast in Chill Moulds. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 368–369).—The casting of aluminium hand wheels in chill moulds is described. The moulds are made of nickel grey cast iron and are preheated to 120°–180° C. The aluminium alloy is made up of 85% aluminium (99·6% fine) and 15% of a 50 : 50 copper–aluminium alloy, and is melted in a crucible furnace, the pouring temperature being 720°–760° C. Silumin (Alpax) can also be used for this purpose, but the casting temperature is then higher (about 780°–840° C.).—J. H. W.

A New Casting Process for Aluminium. K. Thomas (*Stahl u. Eisen*, 1933, **53**, (28), 741).—An abstract of a paper by Kessner, *Metallwirtschaft*, 1932, **11**, 583–584. See *J.*, this volume, p. 40.—J. W.

Gases and Cast Aluminium Alloys. H. Nipper (*Met. Ind.* (*Lond.*), 1933, **42**, 618).—Abstract of a paper in *Z. Metallkunde*, 1933, **25**, 65–67; see *J.*, this volume, p. 326.—J. H. W.

Process for Producing High-Quality Large Castings of Aluminium Light Alloys. W. Claus (*Found. Trade J.*, 1933, **48**, 378).—Reproduction of an abstract in *Light Metal Research*, 1933, **2**, (24), 8. See *J.*, this volume, p. 377. —J. H. W.

Casting of Aluminium Billets for Rolling. P. Pontremoli (*Usine*, 1931, **40**, (43), 31–33).—Long abstract of a paper presented to the 6e. Congrès International de Fonderie. See this *J.*, 1932, **50**, 195.—H. W. G. H.

Properties of Aluminium Castings as a Function of Casting Temperature. Cooling Conditions, and Dissolved Gas. M. Barbero (*Usine*, 1931, **40**, (43), 31). —Long abstract of a paper presented to the 6e. Congrès International de Fonderie. See this *J.*, 1932, **50**, 195.—H. W. G. H.

Effect of Melting Loss on the Cost of Copper Alloys. G. d'Ardigny (*Rev. Fonderie moderne*, 1933, **27**, 231–232).—The cost of copper alloy ingots can be calculated from the formula:

$$p = c \, . \, \frac{(1 - l) + f\left(l + \frac{M}{Pn}\right)}{(1 - l)(1 - f)}$$

where l = coefficient of sound ingots, n = number of ingots, P = weight of an ingot, c = mean price of unit weight of material charged in, f = melting loss per cent. of the metal charged, M = weight of the feeding head, &c., and p = the cost of a good ingot.—J. H. W.

A New Casting Machine for the Manufacture of Copper Anode Plates and Copper Bars. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 367–369).—Abstracted from *Demag-Nachrichten*, **1933**, July. The casting machine consists of horizontal moulds of the required shape arranged on the circumference of a turn-table. The moulds are brought under the casting ladle as desired. The various devices connected with the machine are described. —J. H. W.

Aluminium Bronze Parts Cast in Permanent Moulds. E. Griffith (*Machinist* (*Eur. Edn.*), 1933, **77**, 616–617).—The mechanical properties of aluminium bronze and details of casting the alloy in permanent moulds are described with examples.—J. H. W.

Melting and Casting of Lead-Rich Copper Alloys. Werner Fröhlich (*Chem. Zeit.*, 1933, **57**, 741–742).—The composition and various methods of producing homogeneous castings of lead bearing bronzes are discussed.—A. R. P.

Some Notes on Phosphor–Bronze. R. C. Stockton (*Met. Ind.* (*Lond.*), 1933, **43**, 391–392).—Some difficulty may be experienced in producing sound castings in phosphor–bronze owing to incorrect casting temperature, bad arrangement and shape of runners and risers, bad moulding and melting practice, and to poor design of castings. These result in porosity, drawn parts, gas holes, and included oxides. The precautions for obviating each of these defects are given.—J. H. W.

Phosphorus Bronze. Alfred Hopwood (*Met. Ind.* (*Lond.*), 1933, **43**, 449).—A letter criticizing statements in R. C. Stockton's paper (preceding abstract). Low tin and phosphorus bronzes are easier to handle than those of higher tin and phosphorus content, and porosity cannot readily be overcome by control of casting temperature. The difficulty of founding these alloys lies in their exceptionally long freezing range and their type of structure. The practice of raising the casting temperature for a mould containing chills is deprecated. An initial minimum temperature of 150° C. for the chills is considered too high. Precautions to prevent dross formation are not required, and centrifugal casting is recommended to solve the problem of porous heavy castings, especially in high phosphorus bronze.—J. H. W.

Manufacture of Propellers. Wesley Lambert (*Syren and Shipping*, 1933, **146**, 332).—Abbreviated from a paper read before the Institute of Engineering Inspection. See *J.*, this volume, p. 378.—P. M. C. R.

Casting a Bronze Rod, 90 mm. Diameter and 3000 mm. Long. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, **54**, 391).—The moulding, gating, and casting of a long bronze rod in a vertical dry-sand mould are described. The rod was very porous for a depth of 3 mm. over half its length, but the centre was quite free from pores.—J. H. W.

New Demands on the Bronze Foundry. J. Arnott (*Rev. Fonderie moderne*, 1933, **27**, 225–227).—Abstracted from *Found. Trade J.*, 1933, **48**, 27–28. See *J.*, this volume, p. 378.—J. H. W.

A Cost Analysis of Zinc-Base Die-Castings vs. Machined Castings. L. H. Morin (*Met. Ind.* (*N.Y.*), 1933, **31**, 168–169); **Size Limits of Brass and Other Die-Castings.** L. H. Morin (*Iron Age*, 1932, **130**, 803–804).—From a paper read before the American Society of Mechanical Engineers. Comparative cost data are given. See *J.*, this volume, p. 381.—A. R. P.

Composition of Typical Die-Casting Alloys. Physical Properties and Applications of Die-Casting Alloys. Anon. (*Machinery* (*N.Y.*), 1933, 39, 440A).—Tabulated data based on paper by Louis H. Morin read before the American Society of Mechanical Engineers. See *J.*, this volume, p. 381, and preceding abstract.—J. C. C.

Successful Finishing of Die-Castings. Edgar Parkinson and Frank V. Faulhaber (*Found. Trade J.*, 1933, 48, 412, 418).—Abstract from *Iron Age*, 1933, **131**, 783; see *J.*, this volume, p. 393.—J. H. W.

Shockless Jolt Moulding Machine with Pneumatic Pressing Device and for High Lift Stroke. —— Weil (*Met. Ind.* (*Lond.*), 1933, 43, 242).—See *J.*, this volume, p. 573.—J. H. W.

Some Properties of Oil-Sand Cores. C. Hansen (*Bull. Assoc. Tech. Fonderie*, 1932, **6**, 27–31).—Summary of an address published in *Trans. Amer. Found. Assoc.*, 1926, **34**, 577–607. See this *J.*, 1926, **36**, 631.—W. N.

XV.—FURNACES AND FUELS

(Continued from pp. 661–663.)

Some Factors Affecting Furnace Practice. R. J. Sargant (*Trans. Ceram. Soc.*, 1933, **32**, 113–140).—An account of the properties of heat-resisting steels suitable for use in the construction of furnaces for low, medium, and high temperatures. Also a note on the storage of heat in furnace walls.—S. V. W.

Description of Electric Furnace Installations in an Aluminium Plant. H. Nathusius (*Electrowärme*, 1933, 3, 149–156; *C. Abs.*, 1933, 27, 4483).—Melting, hardening, and tempering furnaces in the plants of Brown-Boveri are described in detail. The charge for the melting furnaces amounts to 500–2000 kg. and consists of 19% pig aluminium, 22% bars from scrap, 42·5% sheet scrap (baled) and 16·5% other scrap; energy consumption is 430–500 kw.hr. per ton of aluminium and 250 kw. for a 2000 kg. charge. Continuous furnaces are used for the heat-treatment and heating of ingots and slabs.
—S. G.

A Simple Induction Furnace for Melting Copper Alloys. E. Fr. Russ (*Metallwirtschaft*, 1933, **12**, 268).—A description is given of an induction furnace with iron core and a ring-shaped melting channel for melting 100 kg. of copper alloy using 35 kva. The current consumption in melting brass or bronze is about 25 kw.-hr./100 kg., and the loss of metal by burning is only 1–2·5%.
—v. G.

Operation and Temperature Regulation of Electric Furnaces with Current Rectifiers. —— Büchting and H. Klemperer (*Siemens Z.*, 1933, **13**, 300–303).—Description of the temperature regulator.—M. H.

Siemens Industrial Heating Exhibits at the Electric Heating Exhibition at Essen. Anon. (*Siemens Rev.*, 1933, 9, (2), 46–51).—Includes a description of furnaces for metallurgical work.—R. Gr.

The Construction and Application of Calrod Heating Units. I.—. II.—The Calrod Unit. K. M. Cherry and F. E. Finlayson (*Gen. Elect. Rev.*, 1933, 36, 354–360, 411–415).—(I.—) Details are given of a new form of heating element known as Calrod. It consists of a nickel-chromium resistor insulated from a tubular sheath by means of magnesium oxide. The sheath material used depends on the conditions under which the heater will operate. Steel, brass, nickel–brass, Calorized steel, and stainless steel have been used for this purpose. The rating and form of the units are also varied according to the application. A major application is the melting of soft metals such as tin, solder, type metal, and tin. For this purpose a cast in type of unit is used. For most of the cast in type of units grey iron is used as the casting materials, although in special cases aluminium or copper has been used. A number of the cast in types are illustrated, and a number of special applications are discussed. (II.—) Further particulars of the Calrod type of heating unit. Cartridge units and strip heaters such as are used mainly for domestic purposes are discussed.—S. V. W.

XVI.—REFRACTORIES AND FURNACE MATERIALS

(Continued from pp. 663–664.)

Refractory Linings for Coreless Induction Furnaces. H. Siegel (*Siemens Z.*, 1933, **13**, 147–150).—Some experiences in the manufacture of crucibles for high-frequency furnaces are described.—M. H.

The Testing of Refractory Materials. W. Steger (*Arch. tech. Messen*, 1932, **1**, (8), T20–T21).—A tabulated classification of refractories gives also the binding media usually employed with each. The following qualities are generally tested: chemical composition, resistance to heat (Seger cone method), porosity, sp. gr., shrinkage, growth, compressive strength at room and at elevated temperatures, effect of high temperatures on material under load, resistance to abrupt changes in temperature, resistance to slagging, microstructure, penetrability by gases, liability to crumble, thermal expansion, specific heat, thermal conductivity, radiating power, and electrical resistance. Methods are indicated in each case. A bibliography is appended.—P. M. C. R.

Some Notes on the Practice of Heat Insulation. A. Lindsay Forster (*J. Inst. Fuel*, 1933, **6**, 255–260; discussion, 261–265; and (abstract) *Mech. World*, 1933, **93**, 504–506).—Representative costs of thermal energy derived from various fuels are tabulated. There is considerable need for specifying the insulating material to be used on plant; large amounts of inferior materials are still used. The use of these makes it possible to increase rather than reduce heat losses. Apparatus for the practical testing of insulation is briefly described. The characteristic properties of the insulators "Alfol" (a form of thin aluminium foil) and "glass silk" are discussed. Mattresses of glass silk are robust and keep their shape. A form of calorimeter for determining heat losses from insulation *in situ* is described.—J. S. G. T.

XVII.—HEAT-TREATMENT

(Continued from pp. 664–665.)

On the Heat-Treatment of Metal Strip in the Continuous Annealing Furnace. O. Junker (*Z. Metallkunde*, 1933, **25**, 45–49).—See *J.*, this volume, p. 276. The effects of variation of the furnace temperature, time of annealing, and rate of passage of the metal through an electric continuous annealing furnace and a laboratory furnace on the Erichsen number, elongation, tensile strength, and structure of 63 : 37 brass strip (0·4 mm. in thickness) have been determined. To obtain the highest Erichsen number the annealing temperature should be below the $\alpha - (\alpha + \beta)$-phase boundary (about 640 ± 20° C.), and the time of annealing should not be prolonged, otherwise a coarse-grained structure is formed. A number of works' experiences are described.—M. H.

Heat-Treatment of Beryllium–Copper. Edwin F. Cone (*Machinist* (*Eur. Edn.*), 1933, **77**, 620–622).—Precipitation-hardening is particularly effective for the beryllium–copper alloys. The cast alloys are held for at least 2 hrs. at a maximum temperature of 1475°–1500° F. (800°–815° C.), which results in the complete solution of the precipitated beryllides. After soaking, the casting is quenched in cold water as soon as possible, and will then have its maximum softness and elongation and minimum tensile strength. Precipitation-hardening which follows consists in heating the material to 525°–575° F. (275°–300° C.), but no higher, for various periods of time. The precautions to overcome distortion in thin or complicated sections, the physical properties of the cast, annealed, precipitation-hardened and rolled alloys containing 1·5–2·5% beryllium and the applications of the alloys, are given.
—J. H. W.

XVIII.—WORKING

(Continued from pp. 665–668.)

On a New Method for the Technical Working of Nickel. G. Hamprecht and L. Schlecht (*Metallwirtschaft*, 1933, 12, 281–284).—A very pure nickel powder free from all traces of copper, arsenic, sulphur, and silicon, and containing less than 0·05% oxygen and carbon (which later are almost completely expelled as oxides of carbon) can be obtained by the thermal dissociation of nickel carbonyl. The grain-size of this powder is 0·0005–0·005 mm. Compact bodies can be made from it by sintering at 1200° C. for 2 hrs. in a closed container or by pressing and subsequent sintering in a protective atmosphere; these rods or sheets have a density of 6·5–7·5, and can be further consolidated by hot pressing, forging, or rolling. Annealed nickel made in this way has a yield-point of 12 kg./mm.^{2}, a tensile strength of 40 kg./mm.^{2}, elongation of 50%, reduction in area 80%, and Brinell hardness 90 kg./mm.^{2}. Alloys with manganese, iron, and other metals can be prepared by addition of powders of these metals to the nickel prior to pressing. Owing to the absence of all impurities iron–nickel alloys prepared in this way have a high permeability and magnetic saturation. They can be accurately reproduced, which is important where a constant coefficient of expansion is required. Bimetals can be produced by using powders of two different metals in the pressing, and the process can also be adapted to welding.—v. G.

Manufacture of Non-Ferrous Seamless Tubes by Piercing and Extrusion Methods. Gilbert Evans (*Metallurgia*, 1933, 8, 167–170).—See *J.*, this volume, p. 389. The rotary piercer and the extrusion press are essential in the modern manufacture of seamless tubes, the first named for the production of tubes of large size, and the latter for tubes of smaller diameter. The practical phases of rotary piercing and of the extruding method of tube manufacture are reviewed, and include the Serck extrusion press, the Krupp vertical hydraulic extrusion press, and the movable container type of press. The extrusion of tubes by use of a movable mandrel and by use of a fixed mandrel are also discussed in detail. Brief reference is also made to pure technical phases of the methods adopted such as temperatures and velocities of extrusion.

—J. W. D.

Modern Plants for Wire Drawing.—I. K. Bernhoeft (*Z. Metallkunde*, 1933, 25, 125–127).—B. gives detailed directions for the establishment of plants and the construction of machines for the manufacture of rolled or extruded wire. The power requirements and drawing speeds (minimum and optimum) for the drawing of copper wire in different dimensions and reductions are tabulated.—M. H.

Stress Distribution and Material Flow in the Roll-Gap. Werner Lueg (*Stahl u. Eisen*, 1933, 53, 346–352).—Abstract of a paper by E. Siebel and W. Lueg, *Mitt. K.-W. Inst. Eisenforschung*, 1933, 15, 1–14. See *J.*, this volume, p. 276.—J. W.

Cold Pressing of Screw Bolts. W. Aumann (*Met. Ind.* (*Lond.*), 1933, 43, 135).—Short abstract from *Z. Metallkunde*, 1932, 24, 200. See *J.*, this volume, p. 50.—J. H. W.

Diamond as a Tool Material. P. Grodzinski (*Arch. tech. Messen*, 1932, 1, (11), T79).—The varieties of diamond in use as tool materials are described; specific gravities are given, with hardness values on the Mohs and absolute scales. The applications of diamond in hardness testing are enumerated; it is employed in the Shore, Martens, Brinell (high values), Rockwell, and Herbert methods. A bibliography is given.—P. M. C. R.

The Economic Uses of Cemented Carbide and Other High-Duty Alloy Tools. J. H. Garnett and E. W. Field (*Machinery* (*Lond.*), 1932, 41, 61–65, 97–100;

correspondence, 133).—An abstract of a paper to the Birmingham Branch of the Institution of Production Engineers. See *J.*, this volume, p. 668.—J. C. C.

Free-Cutting [Brass]. Alan Morris (*Automotive Ind.*, 1933, 68, (13), 398). —Abbreviated from a paper, "Machinability of Free-Cutting Brass Rod," published in *Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99** (Inst. Metals Div.), 323–330. See this *J.*, 1932, **50**, 260, and this volume, p. 215.—P. M. C. R.

XIX.—CLEANING AND FINISHING

(Continued from pp. 668–669.)

Cleaning Metal Parts for Finishing. Wm. J. Miskella (*Metal Cleaning and Finishing*, 1933, **5**, 289–290, 298; *C. Abs.*, 1933, **27**, 4514).—A general discussion of the open-tank method for cleaning metal products.—S. G.

Methods of Cleaning Metals. Joseph Geschelin (*Automobiltech. Z.*, 1933, **36**, 383).—An abstract of two articles in *Automotive Ind.*, 1933, **68**, 466–470, and 522–526; see *J.*, this volume, p. 584.—P. M. C. R.

Finishing Aluminium. Henry R. Power (*Metal Cleaning and Finishing*, 1933, **5**, 301–302; *C. Abs.*, 1933, **27**, 4510).—Blasting and finishing methods employed on aluminium are described in detail.—S. G.

Coppering of Aluminium. Anon. (*Cuivre et Laiton*, 1933, **6**, 281).—From *Illustrierte Zeitung für Blechindustrie*, April 24, 1931. The piece is washed in luke-warm 20% caustic soda solution, then in water, and afterwards in a large bulk of sulphuric acid, followed by a further rinsing in water. The specimen is then immersed immediately in a solution of one part of copper chloride dissolved in 8 to 12 parts of water and heated to 50° C. An addition of 2 parts of potassium chloride favours the deposition of the copper. Plunging into an alcoholic solution of copper chloride tends to give greater adherence.
—W. A. C. N.

Researches on Chlorate Colouring Baths. H. Krause (*Mitt. Forschungsinst. Edelmetalle*, 1933, **7**, 66–70).—In continuation of earlier work (see *J.*, this volume, p. 527) the effect on the colouring action of chlorate baths on copper and its alloys of additions of various metal sulphates has been determined.—A. R. P.

Colouration of Metals by Sea-Water. E. Beutel and A. Kutzelnigg (*Galvano*, 1932, (8), 26).—Translated abstract from *Inst. Technol.* See *J.*, this volume, p. 53.—E. S. H.

XX.—JOINING

(Continued from pp. 669–675.)

The Assembly of Steel Stampings by Continuous Furnace Brazing. C. L. West (*Metal Stampings*, 1933, **6**, 173–176).—The bronzing is effected in electric furnaces with controlled reducing gas atmosphere at temperatures ranging from 1400°–2100° F. (760°–1150° C.). Silver solders are used where a low melting temperature, 1400°–1600° F. (760°–870° C.), is necessary, but they are expensive. Brass wire and powder are used where a very strong bond is the prime consideration. The former is worked at 1740° F. (950° C.), and the latter at nearly 2000° F. (1095° C.). Copper is the best brazing medium, used as wire ribbon or powder, but it requires a temperature of 2100° F. (1150° C.), which increases maintenance costs. The preparation of the work and particulars of the brazing operation are described.—J. H. W.

Soft Solder and Soldered Joints. [S. J. Nightingale] (*Usine*, 1931, **40**, (14), 33).—Long abstract from *Engineering*, 1930, **130**, 794–797, of the pamphlet published by the B.N.-F.M.R.A. in 1929. See this *J.*, 1930, **43**, 647, 738.—H. W. G. H.

On the Diffusion of Heavy Metals into One Another and of Aluminium into Zinc, Tin, and Their Alloys (a Contribution to the Kinetics of the Soldering Process). A. Merz and E. Imbusch (*Metallwirtschaft*, 1933, **12**, 295–297, 311–314).—The rate of diffusion of zinc and aluminium into liquid alloys has been measured with a view to elucidating the mechanism of soldering zinc and aluminium. The diffusion coeff. (K_D) for zinc from a lead–tin–zinc alloy into a lead–tin alloy at 370° C. is 2·6 cm.²/day for a lead : tin ratio of 2 : 1, 2·6 for a 1 : 1 ratio, 3·4 for a 1 : 3 ratio, and 4·1 for a 0 : 1 ratio. For the diffusion of lead from a lead–tin alloy into pure tin at 325° C. K_D decreases from 2·1 with a 10 : 90 alloy to 1·6 with a 90 : 10 alloy, hence the lead concentration has relatively little effect on the rate of diffusion. For the diffusion of aluminium from a 40 : 60 aluminium–zinc alloy into pure zinc K_D increases linearly with the temperature from 3·4 at 610° C. to 4·8 cm.²/day at 710° C. For the diffusion of aluminium from a 14·5% aluminium–tin alloy into pure tin K_D rises linearly from 4·3 at 560° C. to 5·4 cm.²/day at 660° C. The values of K_D for the diffusion of aluminium from a liquid aluminium–tin–zinc alloy into a tin–zinc alloy are intermediate between the values for the pure metals given above and lie on a slightly concave curve. Thermal and dilatometric measurements have confirmed the absence of a transformation point in pure zinc. —v. G.

Aluminium Flux. Anon. (*Metal Stampings*, 1933, **6**, 220).—Oxweld aluminium flux serves the purposes of the 2 fluxes at present used, the one for welding pure aluminium and the other for aluminium alloys.—J. H. W.

Some Economic Aspects of Welding Aluminium. D. E. Roberts (*J. Amer. Weld. Soc.*, 1933, **12**, (2), 18–20; also *Indust. Gases*, 1932, **13**, 218–220; 1933, **14**, 20; and *Welding Industry*, 1933, **1**, 61–62).—See *J.*, this volume, p. 586. —H. W. G. H.

Welding Aluminium and Alloys. J. R. Schmidgall (*J. Amer. Weld. Soc.*, 1933, **12**, (4), 22–24).—Brief instructions for welding by metallic arc, oxy-acetylene, and oxy-hydrogen.—H. W. G. H.

Repair of Aluminium Crankcases. A. F. Davis (*J. Amer. Weld. Soc.*, 1933, **12**, (3), 23).—A copper backing strip is clamped on the underside of the part to be welded.—H. W. G. H.

Repair by Welding of a Cast Aluminium Motor Crank-Case. J. Leemann (*Autogene Metallbearbeitung*, 1933, **26**, 166–169).—A detailed description of the practice adopted.—H. W. G. H.

The Repair of Aluminium Alloy Crank Cases. Anon. (*Soudure et Oxy-Coupage*, 1933, **10**, 173).—The particular technique necessary, useful hints, and the method of preheating are discussed.—H. W. G. H.

Electric Welding of Aluminium. [A. J. T. Eyles] (*Elektroschweissung*, 1933, **4**, (3), 58).—Abstract of an article in *Elect. Rev.*, 1932, **110**, 564, discussing arc, Arcatom, and resistance welding. See *J.*, this vol., p. 397.—H. H.

Resistance Welding of Aluminium and Its Alloys. D. I. Bohn and G. O. Hoglund (*Canad. Mach.*, 1933, **44**, (10), 40).—Abstract of a paper read before the American Society of Mechanical Engineers. See *J.*, this volume, p. 587. —P. M. C. R.

Selection and Application of Welding Rods. Stuart Plumley (*Welding*, 1933, **4**, 63–67).—See *J.*, this volume, p. 403.—H. W. G. H.

Belgian Welding Symbols. Anon. (*Welding Industry*, 1933, **1**, 107–108).—See *J.*, this volume, p. 675.—H. W. G. H.

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