

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

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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 $2\text{Al} + 3\text{H}_2\text{O} = \text{Al}_2\text{O}_3 + 3\text{H}_2$ 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 trichloroacetic 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. Brislée (*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 ($E_{\text{calc.}} = 0.95$) and 1.40 (maximum) in the rolling and transverse directions ($E_{\text{calc.}} = 1.58$) 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 1.45×10^{-11} and 4.78×10^{-5} cm.²/day, respectively, at 106° and 324°C . The effect of temperature on the diffusion constant is given by the expression: $D = 5.76 \times 10^5 \times e^{-14,025/T}$. 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*, 1931, 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 $\phi' + \Delta\phi = \phi_0 = 3.15$ v. Using this value of ϕ_0 and the measured current, the thermionic constant is $A = 59.0$. Measurements made with a thorium covering thicker than that required to give the maximum emission as above, gave $\phi' = 2.8$ v. with 3.5 v. accelerating potential, $\Delta\phi = 0.3$ v. and therefore $\phi_0 = 3.1$ v. and $A = 56.0$. 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 $4.53 - 1.46 = 3.07$ 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 Å. is transmitted. The reflecting power from 3000 Å. to 2700 Å. is about 75%, indicating that practically no energy is absorbed. Below 2700 Å. 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 crysolon 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. Ryūzaburō Taguti (*Rikugagaku Kenkyū-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., $f = (8.7 \times 10^6 / e^{0.00060})(\dot{\phi}/2)^{0.51}$, in which f is the shearing stress in lb./in.², $\dot{\phi}$ 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 (*Ingegneria*, 1932, (10), 702-705).—Formulae 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 Sūgaku-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. Daizō Nukiyama (*Proc. Phys.-Math. Soc. Japan (Nippon Sugaku-Buturigakwai 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. 294-303.)

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-Mg₃Sb₂ 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-Mg₃Sb₂ the miscibility gap extends from about 9% to about 98% Mg₃Sb₂ 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 Cu₂FeAl₃, which appears to form small range of solid solutions. This N-phase is formed by a peritectic reaction shown nearly by 2CuAl₂ (liquid) + FeAl₃ (solid) → Cu₂FeAl₃ (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 γ (MnSb), ϵ (Mn₂Sb₂), and δ (Mn₂Sb). The γ 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 + $\delta \rightleftharpoons \epsilon$, 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, β (Mn) $\rightleftharpoons \alpha$ (Mn) + δ .—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, euphriferous 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 microscopic 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 Togô (*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 1.92×10^{-5} to 2.135×10^{-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 thermoelectric 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 (*Rikugagaku Kenkyū-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. Tōhoku Imp. Univ.*, 1932, 21, 344; See *J.*, this volume, p. 15.—R. G.

The Alloys of Praseodymium and Aluminium. G. Ganneri (*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_3 , 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, Λ , 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. Kōtarō Honda and Yosomatsu Shimizu (*Rikugagaku Kenkyū-jō 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. Ichirō 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 (*Rikugaku Kenkyō-jo Iho (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 m μ 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 m μ , 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 m μ 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: $a = 2.999$ A. at -46° C., $d_{\text{calc.}} = 14.24$ at -46° C. The smallest atomic distances are $d = 2.999$ A., $e = 3.463$ A., $f = 4.581$ A. The atomic radius is $r = 1.500$ 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 $a = 2.716$ and $c = 4.331$ A.—S. G.

On the Constitution of Metallic Sodium. E. Wigner and F. Seitz (*Phys. Rev.*, 1933, [ii], 43, S04-S10).—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 (*Rikugaku 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 lamellae 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 $|E_{\pi}'| \geq |E_p|$ 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 volcanic 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. 1.—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 0.1N-, N-, and 3N-sodium chloride solutions and in 0.05N-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 0.5N-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 $V_1, V_2, V_3 \dots V_N$ respectively and that $V_1 < V_2 < V_3 \dots < V_N$, 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. Break-down 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 (*Rikugaku-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 (*Rikugaku-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. Bargesles (*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. (*Emailltech. 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. Wallson (*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. —Altmanberger (*Emaillwaren-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 Korpium, 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 (*Mct. 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. 314.)

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 Pb₃Sb, 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-H₂SO₄ 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 gm. of copper, 300 gm. 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 gm. 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 (*Kogyō 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 gm. Cu/kg. H₂O 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 gm. copper being obtained (except where lead was present as 11% of the weight of copper, when 48 hrs. electrolysis gave only 83.44 gm. 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 Å. 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. Tchecoslov.*, 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 $0.001N\text{-HCl}$ 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^{IV} salts produce an increase of current at -0.8 v. due to reduction to Ti^{III} , V_2O_5 is reduced to V_2O_4 at 0.0 v. and to V_2O_3 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. Tchecoslov.*, 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 $\text{CH}_3\text{-COOH}$ 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^{IV} 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^{III} 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 Covalt 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 0.05×10^{-5} gram. of Hg in 0.005 c.c.—A. R. P.

A New Microchemical Reaction for Molybdenum, Vanadium, and Tungsten. Ardoino Mertini (*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% $\text{CH}_3\text{-COOH}$ groups of crystals of compounds of the type $\text{H}_2[(\text{C}_6\text{H}_4\text{O})_2\text{OMOH}]\text{CH}_2\text{CO}_2\text{CH}_2\text{-C}_6\text{H}_5\text{-NH}_2$, where M is quinquivalent 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 0.3N-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 0.3N acid concentration when the solution contains NH_4Cl . When separate solutions of these 2 metals containing NH_4Cl are precipitated by H_2S at 0.3N-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 0.3N-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. Balaneseu and Maria D. Motzoc (*Z. anal. Chem.*, 1932, 91, 188-191).—The solution is treated with NaOH until the precipitate of $\text{Al}(\text{OH})_3$ 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 iodo-hexamethylenetetramine 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 $\text{C}_2\text{H}_5\text{OH}$ 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 $\text{Cu}(\text{NO}_3)_2$ solution obtained in the usual course of analysis is unnecessary to obtain accurate results; it suffices to add 5 c.c. of 8N-HCl, HNO_3 , and H_2SO_4 , and evaporate to 5 c.c., cool, add 5 c.c. of 8N- CH_3COOH and the necessary KI, and titrate as usual with $\text{Na}_2\text{S}_2\text{O}_3$.—A. R. P.

Short Contribution to the Analytical Behaviour of Gallium. Erich Schwarz von Bergkamp (*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. $\text{Ga}(\text{OH})_3$ 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 Å. is $4 \times 10^{-4}\%$ in carbon electrodes and 3×10^{-3} in electrodes containing AuCl_3 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 Å. 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 (*Uchenie 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 $\pm 2\%$.—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 $\text{K}_2\text{S}_2\text{O}_8$ - 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 0.1N 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. Stehlik (*Coll. Trav. chim. Tchecoslov.*, 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 $\text{Ce}(\text{SO}_4)_2$ 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 $(\text{NH}_4)_2\text{MoO}_4$ 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 $\text{K}_2\text{NaCo}(\text{NO}_2)_6$ 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_3COOH solution containing $\text{CH}_3\text{COONH}_4$ 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 perhenate 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 Szébellédy and Károly Schick (*Magyar gyógyszerésztudományi Társaság Értesítője*, 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 $(\text{C}_2\text{H}_5)_2\text{O}$ and isobutyl 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 $[\text{Cr}(\text{NH}_3)_6]_2(\text{H}_4\text{TeO}_6)_3$ by addition of a 40% solution of $[\text{Cr}(\text{NH}_3)_6](\text{NO}_3)_3$ to an ammoniacal solution of $\text{Na}_2\text{H}_4\text{TeO}_6$ 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 $(\text{TiO})\text{SO}_4$ in H_2SO_4 solution is shown to be due to $[\text{TiO}_2(\text{SO}_4)_2]_2$.—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 $\text{K}_2\text{Cr}_2\text{O}_7$ 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 $(C_{16}H_{25}O_7)_2Zn \cdot 2H_2O$. 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, (1), 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, (1), 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 $\frac{1}{2}$ in. thick the elongation is measured on a gauge length of 0.3 in. For thicknesses of more than $\frac{1}{2}$ 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, (1), 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. Germain (*Metalurgia 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. Bertelli 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, (1), 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.

Thermal 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, Al₂O₃, and MgO, by measuring the electrical conductivity on slow cooling. Most of the silicates investigated correspond with the formulæ 2RO·SiO₂, 4RO·3SiO₂, and RO·SiO₂. 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 SiO₂ 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 Convince 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.

Salvaging 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. Lencachez (*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 (Suppl. 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 Kawasaki (*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. Munday (*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. Sullioti 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: $\alpha = 0.038 (T_0/100)^3 + 10$, 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 electro-thermal 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. Liebalddt (*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. Stauffer 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, (1), 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 (*Nimash-Izvestia Nauchno-issledovatel'skogo Instituta Mashinostroeniia 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 Tinsplate 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 tinsplate 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 (*Rikugaku 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 (*Rikugaku 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, Ō. 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 (*Rikugaku 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. High-dueck (*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 Nitrallloy 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. (*Automobillech.-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 $\frac{1}{4}$ -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. Gossicaux (*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 $\frac{1}{4}$ -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 $1\frac{1}{2}$ 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 wagon 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 blow-pipe 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 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-*

préfabriques 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, Alscaloy, 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. Languépin (*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 Elkaly tips, is described and illustrated.—P. M. C. R.

Sifbronze. Anon. (*Mel. 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 Schmelzschweiserausbildung (*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-Int. 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 *Maribosa* with a view to minimize the risk of fire and allowing a saving in weight. The installation in the dining-saloon of 370 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. Wako (*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 Alpac (for castings), and Alfol as insulation; the latter material consists of crumpled aluminium foil, weighing approx. 0.188 lb./ft.², as against 9.3 lb./ft.² 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 Alpac; 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 Alpac Alloy. Anon. (*Tramway and Railway World*, 1932, 70, 91-92).—Alpac 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*: Alpac?], 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.

Alpac Doors in Railway Construction. M. Leroy (*Rev. Aluminium*, 1932, 9, 1893-1899).—The applications of Alpac 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. (*Aluminium*, 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 $\frac{1}{2}$ 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 *Zahnärztliche 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 Stellite'd 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, (1), 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, (1), 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, (1), 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, (1), 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. Formulae 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, (1), 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, (1), 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, (1), 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, (1), 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 Kisson (*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, (1), 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 fittings. 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 $92.5 \pm 0.5\%$ silver and $83.5 \pm 0.5\%$ 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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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. \times 8 $\frac{1}{2}$ 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. (63s. net.)

The present volume of Mellor's treatise deals with the metals uranium, manganese, massium, 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 massium, 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, Flat, Greene, Ludlum, Moore, Stoble, Webb, Glrod, and Nathusius; (iii) induction furnaces, where the low-frequency furnaces of Kjellen, Röchling-Rodenhauser, Frick and Ilorth, 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 susceptibilities 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 Vollständigkeit." 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. HIGGITT.

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 Schweissttechnik. 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. (5s. 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. HIGGSETT.

Encyclopædia of Oxy-Acetylene Welding. Volume I—Pipe Construction. Pp. 83. Volume II—Construction of Apparatus and Containers. Pp. 80. 8½ in. × 11½ in. 1932. Geneva: International Advisory Committee for Carbide and Welding Technique; London: Raggett and Co., 30 Red Lion Sq., W.C.1. (10s. per volume; 50s. 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. HIGGSETT.

Die Korrosionsschwingungsfestigkeit von Stählen und ihre Erhöhung durch Oberflächendrücken und 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. Svo. Pp. 90. 1932. London: Adam Hilger, Ltd., 98, King's Rd., Camden Rd., N.W.1. (11s. 6d. 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 Svo. Pp. 255, with 7 illustrations. London: E. Leitz, 20 Mortimer St. 10s.)

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 pH 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. (5s.)

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 shilling's worth, 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 trudge 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.

