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(GENERAL AND NON-FERROUS)

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NEW SERIES

Metallurgical Abstracts, published under this title since January 1931 and issued monthly as a supplement to the monthly *Journal of the Institute of Metals*, has been bound hitherto as a part of the *Journal* series.

The present issue of *Metallurgical Abstracts* commences Volume 1 of a New Series which will be bound annually as an entirely separate publication complete with its own index.

SYMBOLS

In order to facilitate the ready identification of abstracts of certain types of papers, the following two signs will be used in future and will appear immediately preceding certain of the titles of articles abstracted:

* Denotes abstract of a paper describing the results of an original investigation.

† Denotes a first-class critical review.

I.—PROPERTIES OF METALS

*On the Single Potential of Aluminium. Hikozi Endô and Shigenori Kanazawa (*Sci. Rep. Tôhoku Imp. Univ.*, 1933, [i], 22, 537-552; and (in Japanese) *Kinzoku no Kenkyu*, 1933, 10, 471-487).—[In English.] The single electrode potential of aluminium in normal potassium chloride solution depends on the nature of the gas which is passed over the surface of the solution. No effect is produced by hydrogen, nitrogen, or carbon dioxide, but the presence of oxygen produces a marked lowering of the absolute potential, due probably to the formation of an oxide film. The influence of impurities in the aluminium is marked; the addition of iron steadily lowers the electrode potential, but that of silicon does not. The most probable value for pure aluminium is -1.29 v.—E. S. H.

Characteristics and Uses of Beryllium. Anon. (*Canad. Mach.*, 1933, 44, (11), 16, 28).—A summary of the properties of beryllium, with some details as to its occurrence. Alloys briefly mentioned include beryllium-copper (beryllium up to 2.5%), 1% beryllium steel, and an aluminium-beryllium alloy.—P. M. C. R.

*On Structural Anomalies of Bismuth and Antimony. Alfred Schulze (*Z. physikal. Chem.*, 1933, [A], 165, 188-194).—Very pure polycrystalline antimony exhibits a reversible discontinuity on the temperature-electrical resistance curve at 105° - 110° C. even if tempered for several hours at 200° C.; the discontinuity is not observed in single crystals or after tempering at 600° C., and cannot therefore be due to a transformation. The effect is attributed to elastic displacements between neighbouring crystals and to the mechanical deformations thereby produced. The observations made by Drucker (*J. Inst. Metals*, 1933, 53, 113) on bismuth can be explained similarly.—B. Bl.

*On the Elastic Constants of Single Crystals of Copper. Ren'iti Kimura (*Sci. Rep. Tôhoku Imp. Univ.*, 1933, [i], 22, 553-564).—[In English.] Cf. *J. Inst. Metals*, 1933, 53, 177. The elastic constants have been determined by a static method at room temperature. The results are not in agreement with Cauchy's relation. The following values are given for Young's modulus E and for the modulus of torsion n in the directions of the principal crystallographic axes: $E_{[100]} 0.775 \times 10^{12}$, $E_{[110]} 1.261 \times 10^{12}$, $E_{[111]} 1.595 \times 10^{12}$, $n_{[100]} 0.611 \times 10^{12}$, $n_{[110]} 0.380 \times 10^{12}$, $n_{[111]} 0.337 \times 10^{12}$ dyne/cm.².—E. S. H.

Chemistry of Indium. Alfred W. Downes and Louis Kahlenberg (*Trans. Electrochem. Soc.*, 1933, 63, 155-158; discussion, 158-159).—For abstract of the paper see *J. Inst. Metals*, 1933, 53, 290. In the discussion U. C. Tainton stated that the recovery of indium from zinc ores was difficult, since most of it passed into the iron oxide residues together with germanium, arsenic, and antimony. Leon R. Westbrook gave details of the therapeutic uses of indium.—A. R. P.

*On the Question of the Anodic Passivity of Lead. P. Porfirov (*Zhurnal Obshchey Khimii (Journal of General Chemistry)*, 1933, [A], 3, 590-595).—[In Russian.] The anodic passivity of lead has been studied by measuring the changes which occur in the anode resistance when dilute sulphuric acid is electrolyzed with a lead anode. The results indicate that passivation occurs in two stages: first lead dissolves normally and the lead sulphate found is deposited on the anode, thus reducing the exposed area and increasing the effective current density, which, in turn, accelerates crystallization of the sulphate and causes colloid formation accompanied by a sharp increase in the film resistance and current density. The second stage of the process begins when the current density reaches a certain limiting value at which oxygen is evolved at the anode and the sulphate converted into peroxide,

thus rendering the anode insoluble. In the first stage the film resistance is high and the electrode potential constant, hence the passivity is mechanical; in the second stage the film resistance is small and the potential markedly different from the original, hence the passivity is chemical. In anhydrous sulphuric acid only mechanical passivation occurs.—M. Z.

American Cable Practice. [Failure of Lead Sheathing.] R. Spieser (*Bull. Assoc. Suisse Elect.*, 1933, 24, 544-545).—A summarized account of the 932 cases of failure in service submitted to the Testing Laboratory of the Electrical Supply Grid (U.S.A. and Canada) in 1931. Stress is laid on the comparatively frequent failures of lead sheathing; these are stated to be due mainly to variations in temperature or to too low a radius of curvature at bends.

—P. M. C. R.

***Oxidation-Reduction Equilibrium of Metallic Manganese.** Shin-Ichi Aoyama and Yoshinaga Oka (*Sci. Rep. Tôhoku Imp. Univ.*, 1933, [i], 22, 824-834).—[In English.] By heating manganese in an atmosphere of hydrogen and water vapour the existence of the reaction $Mn + H_2O = MnO + H_2$ was confirmed. A linear relation holds between $\log H_2/H_2O$ and $1/T$. The heat of formation and the free energy at 298° abs. in the reaction $Mn + \frac{1}{2}O_2 = MnO$ are given by $\Delta H_{298} = -96,680$ grm.-cal., $\Delta F_{298} = -96,240$ grm.-cal.—E. S. H.

***Effect of High Electrostatic Fields upon the Vaporization of Molybdenum.** G. B. Estabrook (*Univ. Pittsburgh Bull.*, 1933, (29), 65-77).—A paper read before the American Physical Society, of which only an abstract has previously appeared. See *J. Inst. Metals*, 1933, 53, 483.—S. G.

†**The Strength and Ductility of Nickel Wires of Small Diameter.** Edmund R. Thews (*Draht-Welt*, 1932, 25, 755-757).—Discusses investigations of the mechanical properties of nickel wires made in both England and America and cites the work of Ransley and Smithells (*J. Inst. Metals*, 1932, 49, 287-298) very largely. Tables of strengths and ductilities of commercial, pure, and alloyed nickel wires annealed at various temperatures are given.—A. B. W.

The Contamination of Nickel Crystals Grown in a Molybdenum Resistance Furnace. Andrew Dingwall, Jerrold Zacharias, and Sidney L. Siegel (*Trans. Electrochem. Soc.*, 1933, 63, 395-400).—See *J. Inst. Metals*, 1933, 53, 484.

—S. G.

The Relation of Hydrogen to Nickel with Special Reference to the Catalytic Power of the Latter. Harry N. Huntzicker and Louis Kahlenberg (*Trans. Electrochem. Soc.*, 1933, 63, 349-367).—See *J. Inst. Metals*, 1933, 53, 610.—S. G.

***The Electrical Resistance of Palladium Wires Charged with Hydrogen.—II.** Harro Hagen and Adolf Sieverts (*Z. physikal. Chem.*, 1933, [A], 165, 1-11).—*Cf. J. Inst. Metals*, 1933, 53, 290. The electrical resistance of palladium wires has been measured in a hydrogen atmosphere at temperatures up to 470° C. and pressures up to 140 kg./cm.².—B. Bl.

***Change of Magnetic Susceptibility of Platinum, Copper, and Silver Caused by Cold-Working.** Kotarô Honda and Yosomatsu Shimizu (*Nature*, 1933, 132, 565-566).—Eliminating effects due to ferromagnetic materials, the following magnetic susceptibilities have been determined: platinum 1.100×10^{-6} , copper -0.0848×10^{-6} , silver -0.185×10^{-6} . The susceptibility of cold-worked platinum is slightly less than that of annealed platinum, whilst in the case of copper and silver cold-working increases the susceptibility. Although the effect of the volume change is considered, the change in susceptibility appears to be real.—E. S. H.

***Inertia and Chemical Activity of Rare Gases—Action of Helium on Platinum under the Influence of Electric Discharge at Low Pressure and Determination of Helium in the Product Formed.** Horacio Damianovich (*Anales Inst. Investigaciones cient. tecnol.*, 1932, 1, 30-37; *C. Abs.*, 1933, 27, 4993).—An

electric discharge is formed with platinum electrodes in the presence of helium at low pressure. The product formed is decomposed by heat, leaving metallic platinum and dissolves in *aqua regia* more easily than platinum and than the products obtained under similar conditions with oxygen, nitrogen, and hydrogen. In the action of helium on platinum a new product is formed with properties differing from its components.—S. G.

***Properties of the Product Formed by the Combination of Helium with Platinum and an Excess of Platinum.—Comparison with the Properties of Products Obtained from the Action of Oxygen, Nitrogen, and Hydrogen on the Same Metals under Similar Conditions.** Horacio Damianovich (*Anales Inst. Investigaciones cient. tecnol.*, 1932, 1, 37-44).—Cf. preceding abstract.—S. G.

***Density of the Product Obtained from the Action of Helium on Platinum.** Horacio Damianovich and Jose Piazza (*Anales Inst. Investigaciones cient. tecnol.*, 1932, 1, 45-48; *C. Abs.*, 1933, 27, 49-93).—The density of the product obtained in the above experiments (cf. preceding abstracts) is considerably lower than that of ordinary platinum; it approaches the latter if the product is heated to 380° C. for 2 hrs., supporting the theory of the existence of chemical combinations with helium and platinum.—S. G.

***Action of Oxygen on Platinum under the Influence of Electric Discharge at Low Pressure.** Horacio Damianovich and Jose Piazza (*Anales Inst. Investigaciones cient. tecnol.*, 1932, 1, 49-53; *C. Abs.*, 1933, 27, 4993).—By the method previously described (cf. preceding abstracts) oxygen is made to combine with platinum under the influence of electric discharges at low pressure. The product obtained appears to be an oxide of the approximate formula Pt_2O_3 , which is very stable at ordinary temperatures and decomposes only under strong heat. Its density is much lower than that of platinum or platinum-helium product and it does not absorb air.—S. G.

***Action of Hydrogen on Platinum under the Influence of Electric Discharge at Low Pressure.** Horacio Damianovich and Carlos Christen (*Anales Inst. Investigaciones cient. tecnol.*, 1932, 1, 54-57; *C. Abs.*, 1933, 27, 4993).—In continuation of the above investigations (cf. preceding abstracts). A deposit is obtained from the action of hydrogen on platinum which is similar to finely powdered platinum; under these conditions hydrogen does not combine with platinum.—S. G.

***Action of Nitrogen on Platinum under the Influence of Electric Discharge at Low Pressure.** Horacio Damianovich and Guillermo Berraz (*Anales Inst. Investigaciones cient. tecnol.*, 1932, 1, 58-63; *C. Abs.*, 1933, 27, 4993).—By the use of a technique analogous to that of the previous experiments (cf. preceding abstracts), nitrogen was found to combine with platinum; the product is relatively stable, and its properties, in particular density and solubility in *aqua regia*, are decidedly different from those of platinum or of platinum combined with helium, oxygen, or hydrogen.—S. G.

***The Kongsberg Silver.** Einar Jensen (*Tids. Kjemi Bergvesen*, 1933, 13, 70-73; *C. Abs.*, 1933, 27, 5687).—The first results of an extensive analytical research are given. Six samples of native silver and argentite have been analyzed for silver, mercury, bismuth, lead, copper, arsenic, antimony, iron, nickel, cobalt, zinc, manganese, calcium, and sulphur.—S. G.

***Preparation of Macroscopic Thallium Crystals by Electrolysis.** A. Sprantsman (*Acta Commentationes Univ. Tartuensis*, 1933, A24, 3-5; *C. Abs.*, 1933, 27, 5650).—The crystals were prepared by electrolyzing aqueous Tl_2SO_4 by means of a platinum anode and a copper cathode covered with a film of paraffin. The form of the crystals depends on the concentration and temperature of the solution, and on the product of the free acid and applied p.d., but is independent of current density between 0.01 and 0.10 amp./dm.².

—S. G.

***The Transformation of Single Crystals of White Tin into Grey Tin.** A. Komar and B. Lasarev (*Physikal. Z. Sowjetunion*, 1933, 4, 130–131; *C. Abs.*, 1933, 27, 5600).—[In German.] The linear velocity of transformation can be increased 200–300-fold.—S. G.

Zinc as a Printing Surface. J. Bekk (*Deut. Druck.*, 1932, 39, 11–14; *Phot. Abs.*, 1933, 13, 178).—A study of the physical and chemical properties of zinc used in the production of relief and lithographic plates has particular reference to the influence of impurities on zinc etching.—S. G.

***The Evaporation of Atoms, Ions, and Electrons from Cæsium Films on Tungsten.** John Bradshaw Taylor and Irving Langmuir (*Phys. Rev.*, 1933, [ii], 44, 423–458).—Detailed experiments are described on the evaporation of neutral atoms, positive ions, and electrons from films of cæsium deposited on tungsten, and methods are given for determining θ , the fraction of the tungsten surface covered with cæsium. The results support the postulate that all properties of an adsorbed film on an underlying surface of given composition are uniquely determined by θ and T (the temperature). At low temperatures and high pressures of cæsium vapour, the adsorbed cæsium atoms first form a true monatomic layer, the formation of a second layer beginning only at filament temperatures corresponding with a nearly saturated cæsium vapour. A theory of the formation of further layers is discussed, the essential assumption being that an atom in the n th layer can exist only on a group of at least 4 atoms on the $(n - 1)$ th layer. The absorption coeff. of atoms striking the tungsten surface is shown experimentally to be unity from $\theta = 0$ to $\theta =$ nearly 1, and the bearing of this on the process of evaporation and condensation is discussed.—W. H.-R.

***Remarkable Optical Properties of the Alkali Metals.** R. W. Wood (*Phys. Rev.*, 1933, [ii], 44, 353–360).—Thin films of the alkali metals deposited on quartz are opaque to visible light, but highly transparent in the ultra-violet region. The point at which transparency begins moves towards shorter wavelengths with decreasing atomic number, the critical values being cæsium 4400, rubidium 3600, potassium 3150, sodium 2100, and lithium 2050 Å., the value for lithium being slightly uncertain. The transparency continues into the ultra-violet as far as the limits of the experiments (1860 Å.), and the effect of the thickness of the film has been studied for potassium. Plane polarization by reflection was observed, and the reflecting powers for different wavelengths were measured for all these metals except lithium. The refractive index of a potassium film varied from 0.90 at 2147 Å. to 0.50 at 3100 Å., and total reflection was observed although the critical angle was not very sharply defined. These properties are shown only by coherent films deposited at liquid air temperature under thoroughly outgassed conditions, and details of preparation are given. (See following abstract.)—W. H.-R.

Remarkable Optical Properties of the Alkali Metals. R. de L. Kronig (*Nature*, 1933, 132, 601).—K. applies his quantum theory of metallic dispersion to the phenomena described by Wood (preceding abstract).—E. S. H.

Optical Properties of the Alkali Metals. E. L. Hill (*Rev. Sci. Instruments*, 1933, [N.S.], 4, 525–526).—Wood's work on the optical properties of thin films of lithium, sodium, potassium, rubidium, and cæsium of thickness about 3000 Å., in the ultra-violet region between 3000 and 1860 Å. is briefly referred to. Cf. abstract above.—J. S. G. T.

A Method for the Production of Single Crystals. A. I. Froiman and P. A. Polibin (*Physikal. Z. Sowjetunion*, 1933, 3, 627–631; *C. Abs.*, 1933, 27, 4146).—[In German.] By using a modification of Bridgman's method, it is possible to determine in advance where the crystal axes of the sample will be after the crystal is grown. This is done by means of a special apparatus that allows only that crystal nucleus to grow further which has, at the start of crystallization, the desired orientation.—S. G.

The Behaviour of Metallic Materials under Static and Dynamic Deformation. P. Ludwik (*Z. Metallkunde*, 1933, 25, 221-228).—A lecture to the Deutsche Gesellschaft für Metallkunde. The phenomena of plasticity, strengthening by cold-deformation and age-hardening, recrystallization, crystal recovery, internal stress, damping capacity, and sensitivity to notch effect are discussed. Results are given of determinations (previously published) of the endurance strength of notched test-pieces in bending and torsion tests and of the corrosion fatigue of various ferrous and non-ferrous alloys. Recent work by Ludwik and Krystof (*Z. V.d.I.*, 1933, 77, 629) on the relation between the applied stress and the endurance strength under bending and torsional stress of polished, notched, and corroded specimens is reviewed (cf. *J. Inst. Metals*, 1933, 53, 487).—M. H.

***The Serrated Discontinuity on Load-Extension Diagram and Age-Hardening of Metals and Alloys.** Tadashi Kawai (*Sci. Rep. Tôhoku Imp. Univ.*, 1933, [i], 22, 354-374).—[In English.] A study of cold-drawn bars of copper, aluminium, nickel, 60 : 40 brass, 70 : 30 brass, 80 : 20 brass, 90 : 10 brass, phosphor-bronze, manganese-brass, copper-iron alloys (0.5 and 1% iron), Delta metal, and Duralumin, wires of nickel and Nichrome, as well as of many steels, shows that only metals which undergo age-hardening after stretching show a serrated discontinuity on the load-extension diagram, when they are tested at a temperature at which the age-hardening is significant. The phenomenon is explained by successive yielding and ageing.—E. S. H.

***X-Ray Investigations on the Thermal Expansion of Solids.—I.** Gunji Shinoda (*Mem. Coll. Sci. Kyoto Imp. Univ.*, 1933, [A], 16, 193-201).—[In English.] Determinations of thermal expansion coeff. and lattice constants of some metals by the X-ray method have yielded the following results: expansion coeff. $\times 10^{-6}$, aluminium α_{20} 2.9; tin α_{11} 45.8, α_{1} 25.7; indium α_{11} 45.0, α_{1} 11.7; zinc α_{11} 64.5, α_{1} 10.8; thallium α_{11} 72, α_{1} 9; lattice constant, tin a 5.824 Å., c/a 0.5415; indium a 4.581 Å., c/a 1.077.—E. S. H.

Some Notes on Fractures. J. Blundell (*J. Inst. Locomotive Eng.*, 1933, 23, 270-285).—Descriptions, with 46 photographs, are given of fractures in locomotive parts arising from unsuitable material, manufacturing faults, design faults, or improper use. The danger of having sudden changes in section and of sharp edges in general is shown in a number of instances.—J. C. C.

***Determination of Size of Particles in Metallic Powders.** N. M. Zarubin (*Zavodskaya Lab.*, 1933, (2), 29-34).—[In Russian.] The Stokes, the microscopic, and the chemical rate of solution methods were used to determine the size of particles in tungsten, molybdenum, cobalt, nickel, and other powders.—S. G.

Removal of Metallic Deposits by High-Frequency Currents. J. K. Robertson and C. W. Clapp (*Nature*, 1933, 132, 479-480).—A mirror deposit of metal (especially silver) in a tube is removed when a high-frequency luminous discharge is passed in air, oxygen, or hydrogen at a pressure of a few mm. Little effect is obtained in the presence of nitrogen.—E. S. H.

***The Effect of Heat-Treatment on the Production of Frictional Electric Charges on Metals.** P. A. Mainstone (*Phil. Mag.*, 1933, [vii], 16, 1083-1096).—Prolonged heating of aluminium and nickel at low pressures reduces considerably the normal negative frictional charge on the metal. A partial slow recovery of the charge occurs on re-cooling. A similar effect occurs with the metals in nitrogen at atmospheric pressure. Widely varying results are obtained if the metals are de-gassed and re-heated at about 300° C. in hydrogen or nitrogen. Re-polishing or etching restores the surface to its original state. The frictional charge on polished palladium changes sign from negative to positive when the metal is de-gassed and heated in hydrogen at about 250° C.

—J. S. G. T.

II.—PROPERTIES OF ALLOYS

***Dilatometric Study of an Aluminium Alloy.** Otakar Quadrát and Rudolf Pospíšil (*Chim. et Ind.*, 1933, Special No. (June), 620–622; *C. Abs.*, 1933, 27, 5703).—Analysis of 6 samples taken from different parts of a commercial aeroplane engine piston made of aluminium–copper–nickel–magnesium alloy showed segregation of up to nearly 10% of the added elements, the thinner portions of the casting having higher copper, nickel, and magnesium contents. Variations in the coeff. of expansion of test-pieces taken from the same places as the portions used for analysis were only about 1%, which is practically within the limit of experimental error.—S. G.

***On the Equilibrium Diagram of the Iron–Aluminium System.** Atomi Ōsawa (*Sci. Rep. Tôhoku Imp. Univ.*, 1933, [i], 22, 803–819).—[In English.] See abstract from the Japanese, *J. Inst. Metals*, 1933, 53, 616.—E. S. H.

On the Influence of Aluminium on Cast Iron. E. Piwowsky and E. Soehnchen (*Metallwirtschaft*, 1933, 12, 417–421).—Data are given on the castability, tensile properties, and corrosion-resistance of cast iron with up to 20% aluminium.—v. G.

***On the Compounds of Aluminium and Silver.** F. E. Tischchenko (*Zhurnal Obshchey Khimii (Journal of General Chemistry)*, 1933, 3, 549–557).—[In Russian.] Cf. Petrenko, *Z. anorg. Chem.*, 1905, 46, 49. The system has been re-examined by thermal analysis. The β -phase, Ag_3Al , is formed at 771° C. and undergoes a transformation at 606° C. into β' . Aluminium is insoluble in β ; but is soluble in β to a maximum of 10.22% at 722° C., the eutectic point between β and Ag_3Al_2 ; the latter is stable only between 752° C. and 711° C. Below 711° C. Ag_3Al_2 decomposes into γ'' , which is a solid solution of aluminium in Ag_2Al containing a maximum of 14.33% aluminium. Between 711° C. and 400° C. over a range of 13% there is a duplex field of $\beta + \gamma'$, and below 400° C. with 7.7–11.1% aluminium the structure consists of β' and γ . The results of Hoar and Rowntree (*J. Inst. Metals*, 1931, 45, 119) and Westgren and Bradley (*J. Inst. Metals*, 1928, 40, 576) are reviewed and compared with those of T. —M. Z.

***On the Eutectoidal Decomposition of Aluminium–Zinc Alloys.** V. Bugakov (*Physikal. Z. Sowjetunion*, 1933, 3, 632–652; *C. Abs.*, 1933, 27, 4512).—[In German.] A study was made of the β -phase of the zinc–aluminium system. Hardness, electrical conductivity, and specific volume were determined for samples subjected to a variety of heat-treatments at temperatures at which the β -phase is unstable (*i.e.* temperatures below 256° C.). Decomposition of the β -phase proceeds practically to completion at room temperature, but the process is accelerated by annealing at higher temperatures. When the rate of decomposition of the β -phase is decreased by additions of small amounts (less than 1%) of magnesium to the mixture, determinations of electrical conductivity indicate that the alloy passes through a metastable condition before the β -phase changes to a state stable at room temperature. Hardness tests, on the other hand, seem to show that, even after electrical conductivity has become constant and a stable state apparently reached, a slow ageing continues for some time.—S. G.

The Resistance of High-Strength Aluminium Alloys to Axial Loading. Anon. (*Alluminio*, 1933, 2, 221–223).—Some data are given on the buckling strength to axial loading of heat-treated aluminium alloys (and steel), and the mathematical means for calculating it. A diagram is appended.—G. G.

Non-Corroding Aluminium [N.C.A. Alloy]. Anon. (*Syren and Shipping*, 1933, 149, 244).—It is claimed that N.C.A. metal, an aluminium alloy, resists sea-water corrosion exceptionally well, as shown by Admiralty tests over a period of 6–7 years. Sand-cast bars possess the following properties: ultimate tensile stress 11–14 tons/in.², yield-point 6–7 tons/in.², elongation 5–7% on

2 in., scleroscope hardness 12, Brinell hardness 63. The alloy is also available in extruded bars, tubes and angles, and as rolled sheet.—P. M. C. R.

Hydrionalium. Anon. (*Met. Ind. (Lond.)*, 1933, 43, 85). **A New Aluminium Alloy—Hydrionalium.** Anon. (*Metallurgia*, 1933, 9, 31).—See *J. Inst. Metals*, 1933, 53, 490.—S. G.

A New Alloy for High-Speed Automobile and Aircraft Engines. Anon. (*Automobiltech. Z.*, 1933, 36, 517).—A piston alloy of aluminium, with 14% silicon and small additions of nickel, copper, and magnesium, remainder aluminium. It is claimed to have a sp. gr. nearly equal to that of aluminium, with a higher thermal conductivity and a thermal expansion 18% less than that of other piston alloys. It is especially recommended for aircraft and motor-boat engines. Details are given as to performance and working.—P. R.

The Future of Light Metals. W. Kollrepp (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 54, 348-349).—Gives a brief, general discussion of the mechanical properties and corrosion-resistance of light metal alloys and an indication as to how these will influence their application in the future.—J. H. W.

***Effect of Silicon on the Critical Points and the Constitution of Chromium Alloys.** E. Valenta and F. Pobořil (*Chim. et Ind.*, 1933, Special No. (June), 633-648; *C. Abs.*, 1933, 27, 5704).—The effect of silicon on the constitution of chromium alloys was studied on the 2 pseudo-binary sections of the ternary system: iron-carbon-chromium, the carbon content being 0.8% and the chromium content 25%, at the bases of the 2 sections of the quaternary system: iron-carbon-chromium-silicon with a constant silicon content of 2.5%, carbon 0.8%, and chromium 25%. Special study was made of the alloys having the characteristics of cast irons, which solidify as the eutectic forms. The methods of investigation were microscopic examination, thermal analysis, dilatometric analysis, and determination of the hardness after quenching. Silicon decreases the homogeneous zone of the γ -phase and widens the zone of primary separation of the α -phase. By considerably raising the critical points it increases the zone of the alloys having no critical points. Moreover, silicon considerably reduces the carbon content of the eutectic. In order to facilitate the visualization of the extent of the changes caused by the presence of silicon in the iron-carbon-chromium system, a diagram of the ternary crystallization was drawn which was made possible by using both the data in the literature, particularly those of Westgren, Phragmen, and Negresco, and the personal deductions of V. and P.—S. G.

***Copper-Lead Alloy System.** M. Nishikawa (*Suiyokai-shi*, 1933, 8, 239-243; *C. Abs.*, 1933, 27, 5702).—[In Japanese.] The constitution of the copper-lead system has been investigated by thermal and microscopic analyses, and the equilibrium diagram has been constructed. A monotectic reaction: liquid + Cu \rightleftharpoons liquid was found to occur at 957° C. and in 13-48% of copper.—S. G.

***The Electrical Conductivity of Cu₃Pd- and Cu₃Pt-Alloys with Disordered and Ordered Atomic Distributions at Low Temperatures.** H. J. Seemann (*Z. Physik*, 1933, 84, 557-564).—The specific electric resistance of Cu₃Pd- and Cu₃Pt-alloys with orderly atomic distribution at low temperatures, down to about - 253° C. is found to decrease with decrease of temperature, only a little more than is the case with a disorderly atomic distribution, and in this respect the results are in marked contrast with results obtained with Cu₃Au-alloys, where a marked difference in the two cases was found to occur. The difference is discussed with reference to the systems of valency electrons in the several cases.—J. S. G. T.

Silver-Copper Alloys Containing Phosphorus. H. Moser, E. Raub, and K. W. Fröhlich (*Metallwirtschaft*, 1933, 12, 497-501).—An account of work the results of which have already been published by K. W. F. in *Mitt. Forschungsinst. Edelmetalle*, 1933, 7, 75. See *J. Inst. Metals*, 1933, 53, 696.—V. G.

Tests Several Possibilities of Tin-Free Lead Bearing Bronzes. Anon. (*Automotive Ind.*, 1933, 69, 678).—A short account of recent researches carried out at the U.S. Bureau of Standards on copper-lead alloys containing small additions of other metals. See *J. Inst. Metals*, 1933, 53, 620.—P. M. C. R.

The Effect of the Addition of Lead on the Hardness of Certain Tin-Base Bearing Alloys at Elevated Temperatures. J. N. Kenyon (*Met. Ind. (Lond.)*, 1933, 43, 495-499).—Read before the American Society for Testing Materials. See *J. Inst. Metals*, 1933, 53, 495.—J. H. W.

The Mechanism of Inverse Segregation. Alloy Group 3.—Tin Bronzes, 89 : 11 Type. Owen W. Ellis (*Met. Ind. (Lond.)*, 1933, 43, 194-196, 225-226).—An introduction to the Symposium on Deoxidation and Degassing of Bronze Foundry Alloys held by the American Foundrymen's Association. —J. H. W.

Phosphor-Bronze. Anon. (*Automobile Eng.*, 1933, 23, 387).—A note on the analysis, characteristics, qualities, and applications of phosphor-bronzes, in which the alloy is divided into 3 groups: (a) phosphorus 0.05-0.10%; (b) phosphorus 0.35-0.5%; (c) phosphorus 0.5-1.25%, and where the tin content of (a) and (b) varies from 8 to 10%; (c) shows considerable hardness and much resistance to wear.—J. W. D.

Properties of Bronze Bearing Metals. Anon. (*Machinist (Eur. Edn.)*, 1933, 77, 597-598).—The mechanical properties of Admiralty bronze, and of 80 : 10 : 10 : 0, 83 : 7 : 7 : 3, 70 : 10 : 20 : 0, 85 : 5 : 9 : 1, and 70 : 5 : 25 : 0 copper-tin-lead-zinc bearing alloys are tabulated.—J. H. W.

The Effect of Cold-Working on the Strength of Bronze and the Possibility of Improvement by Suitable Heat-Treatment. F. Freude (*Metallborse*, 1932, 22, 225-227).—The danger of season-cracking after very hard cold-working, e.g. drawing, of 70 : 30-60 : 40 brass is illustrated, and the effect of low-temperature annealing in reducing internal stress is shown graphically. Annealing for 3 hrs. at 250° C. is sufficient to prevent all danger of season-cracking, but has no effect on the hardness or strength of the metal.—A. R. P.

***An Electrochemical Investigation of Brass.** Arne Ölander (*Z. physikal. Chem.*, 1933, [A], 164, 428-438).—The potential of the cell: zinc|lithium, rubidium, zinc chloride|copper, zinc_{solid}, and its temperature coeff. have been determined for 46 alloys between 333° and 626° C.; the results confirm Bauer and Hansen's equilibrium diagram except that the left-hand boundary of the γ -phase is more inclined to the left. The activity coeff. of zinc in the γ -phase is unity, the γ -phase has the ordered structure Cu_5Zn_9 , and the β and β' phases both have the ordered structure CuZn with a degree of disorder of 1%. The heat of transformation of β into β' is 87 gm.-cal./gm.-atom; apparently the transformation is not due to atomic changes, but to electronic movements which have no other action than to cause a slight lattice expansion, similar to that which occurs at the Curie point in iron. The heat of the transformation in the δ -phase is 195 gm.-cal./gm.-atom and the latent heat of fusion of zinc 28.4 gm.-cal./gm.—B. Bl.

***The Constitution of Magnesium-Rich Magnesium-Zinc-Silicon Alloys.** E. Elchardus and P. Lafite (*Compt. rend.*, 1933, 197, 1125-1127).—The magnesium-rich alloys of the system magnesium-zinc-silicon have been studied by thermal analysis. It is confirmed that a definite ternary compound does not exist. The following stages are observed at each point in the region of immiscibility, beginning with a liquid alloy: (1) separation of two liquid phases; (2) deposition of a solid phase; (3) disappearance of one of the liquid phases; (4) deposition of the binary eutectic; (5) deposition of the ternary eutectic, corresponding with the composition: magnesium 53.3, zinc 43.5, silicon 3.2%, at a constant temperature (335° C.). The limit of the ternary solid solution is at the approximate composition: zinc 5.25, silicon 0.25, magnesium 94.5%. The constitution of the different zones was determined microscopically.—J. H. W.

***The Determination of the Vapour Pressure of Amalgams by a Dynamic Method.** John S. Pedder and Sidney Barratt (*J. Chem. Soc.*, 1933, 537-546).—An apparatus for the measurement of the vapour pressures of amalgams or alloys by the dynamic gas-streaming method at temperatures between 250° and 400° C. is described. The partial pressures of mercury above cadmium, zinc, and potassium amalgams of various compositions and at different temperatures have been measured. From the measurements of the partial pressures of mercury and potassium above potassium-mercury amalgams, containing 41.1-72 mols.-% potassium at 387.5° C., it is deduced that a considerable amount of a compound, probably K₂Hg, is present in the vapour of these amalgams at that temperature.—S. V. W.

***Electron Emitting Alloys of Nickel and Barium.** D. W. Randolph, O. S. Duffendack, and R. A. Wolfe (*Electronics*, 1933, 6, 244-246).—The addition of up to 0.20% barium to nickel greatly increases the thermionic emission of the latter. Alloys containing up to 10% barium are being studied. Small quantities of other elements influence the emission of the low percentage barium alloys. The electron emission increases with the amount of chromium up to a maximum at 3.5% chromium and then decreases again. The addition of chromium has been found to be beneficial in other ways. The alloys containing chromium are more resistant to corrosion and have a greater tensile strength at 800°-900° C. The rate of evaporation is lower than for pure nickel, and when slightly oxidized they form a very suitable core metal for oxide-coated emitters.—S. V. W.

***On the Magnetostriction of Nickel-Cobalt Alloys.** Yosio Masiyama (*Sci. Rep. Tôhoku Imp. Univ.*, 1933, [i], 22, 338-353).—[In English.] The longitudinal and transverse effects are in different senses and the total volume change is a differential effect. A marked discontinuity in the concentration curve occurs at about 75% of cobalt, which corresponds with the change from a face-centred cubic lattice to a hexagonal, close-packed lattice.—E. S. H.

The Mechanical Properties of Certain Samples of Monel Metal. T. W. Hardy (*Canad. Dept. Mines, Mines Branch, Rep. No. 728*, 1932, 161-163; *C. Abs.*, 1932, 27, 4198).—Tensile properties, Izod impact tests, and Brinell hardness of 14 samples of Monel metal purchased in the open market agree with the trade data of the International Nickel Co.—S. G.

X-Ray Study of the Electrolytic Fe-Ni Alloys. Keizô Iwasé and Nobuyuki Nasu (*Sci. Rep. Tôhoku Imp. Univ.*, 1933, [i], 22, 328-337).—[In English.] See abstract from the Japanese, *J. Inst. Metals*, 1933, 53, 190.—E. S. H.

Magnetically Permeable Alloys. Anon. (*Arch. tech. Messen*, 1933, 3, (26), 22).—An account of 5 proprietary alloys of high permeability; their composition and magnetic properties are tabulated. The alloys are: "BR 50," and Hyperm 36, 50 A, 5 B, and 4.—P. M. C. R.

Anti-Friction Metals: Their Composition, Structure, &c. Anon. (*Commonwealth Eng.*, 1933, 20, 363-367).—The chief characteristic of tin-base and lead-base anti-friction alloys and their fundamental properties are described. The formulæ for friction at high speeds, at constant speed, and at constant load are given.—J. H. W.

***Electrical Conductivity Measurements of the Systems Zinc-Cadmium and Lead-Antimony with Reference to the Attainment of Stable Equilibrium.** M. le Blanc and H. Schöpel (*Z. Elektrochem.*, 1933, 39, 695-701).—The specific electrical conductivity of the zinc-cadmium and lead-antimony systems has been measured with reference to the attainment of stable equilibrium. In the zinc-cadmium system, the attainment of equilibrium occurs almost immediately in most alloys, except at the extremes of concentration (less than 10 atomic-%). In the lead-antimony system, the attainment of equilibrium is slower throughout the whole range. The limits of the single phase regions were determined by means of temperature-resistance curves. At

263° C., the saturation limit of zinc in cadmium occurs at 97.5 atomic-% of zinc (95.8% by weight), and that of cadmium in zinc at 6 atomic-% of zinc (3.6% by weight). In the lead-antimony system, the saturation limit of lead in antimony occurs at 94.2 atomic-% of lead (96.5% by weight) at 249° C., and that of antimony in lead at 1.5 atomic-% of lead (2.5% by weight). Micrographic examination confirmed these points in the case of the zinc-cadmium alloys and the point at 1.5 atomic-% of lead in the case of the lead-antimony alloys. On the other hand, the indication of the maximum electrical conductivity at 5 atomic-% of lead was not confirmed by micrographic examination. The lead side could not be determined more exactly.—J. H. W.

On the Solid Diffusion of Metallurgical Products. J. Laissus (*Chim. et Ind.*, 1933, 29, 515-526).—A study of cementation processes in which various pairs of metals are considered under different conditions of temperature and time. The results are considered from the theoretical and practical aspects. The effect of cementation in offering resistance to oxidation and general corrosion in certain instances is studied.—W. A. C. N.

***The Crystallization of Eutectic Mixtures.** G. Tammann (*Z. Metallkunde*, 1933, 25, 236-238).—The linear rate of crystallization of eutectic mixtures depends on undercooling in the same way as that of chemically homogeneous melts. In tubes the linear rate of crystallization of the latter is determined only by the flow of heat from the ends of the crystal filaments, whereas in the former case the separation of the constituents into individual crystal filaments is an additional process which is performed by diffusion. By increasing the rate of the eutectic crystallization the thickness of the crystal filaments may be decreased to submicroscopic proportions, hence, the relatively slow diffusion process is sufficient to produce separation of the constituents; this action is promoted by the close juxtaposition of the two kinds of crystal filament, as this causes more uniform diffusion. Since the separation of both constituents is necessary, the maximum linear rate of crystallization of binary eutectic mixtures is much less than that of either of the constituents. This has been verified by observations made on eutectic mixtures of organic compounds.—M. H.

***On Vapour Pressures and Activities of Some Binary Alloys.** Ernst Burmeister and Karl Jellinek (*Z. physikal. Chem.*, 1933, [A], 165, 121-132).—The activities of cadmium over cadmium-tin alloys at 540° C., of zinc over tin-zinc alloys at 684° C., and of cadmium and zinc over cadmium-zinc alloys at 682° C. have been determined by vapour pressure measurements by an improved method; the values obtained agree closely with those determined by Taylor's electromotive method.—B. Bl.

***Entropy in Intermediate Phases.** Arne Ölander (*Z. physikal. Chem.*, 1933, [A], 165, 65-78).—Intermediate phases which have an extended field of existence can have either a random or an ordered lattice orientation. In the latter case the variation in composition of the phase can occur either by substitution or by the introduction or removal of atoms from the lattice. To determine whether an intermediate phase is ordered or not a new method is given: the electrolytic dissolution potentials of the constituents of the compounds and their temperature coeff. are measured. Formulæ of the partial molar entropy are derived and the calculated figures are compared with the experimental results for β -CuZn, β' -AgCd, γ -Zn₁₆Cu₁₀, γ -Cd₁₆Ag₁₀, Au₃Cd, and AuCd₃.—B. Bl.

Methods of Graphic Representation of Four-Component Systems. Ya. E. Vilnyanskii and Z. S. Bannuih (*Kal'n*, 1933, (5), 23-35; *C. Abs.*, 1933, 27, 5625).—The construction of diagrams for the graphic representation of the system MgCl₂-KCl-NaCl-H₂O is discussed. Regular and right-angle tetrahedra are found best suited for the graphic solution of problems of a four-component system.—S. G.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

Organization of the Metallographic Section of the Trinec Steel Works. Bohuslav Otta (*Chim. et Ind.*, 1933, Special No. (June), 606-611; *C. Abs.*, 1933, 27, 5694).—Descriptive, with examples of the practical application of metallography to the control of operations in steel plants and to the discovery of the causes of failure of metal parts in service.—S. G.

***Synthetic Metal Bodies. VII.—Crystallization Between Surfaces in Structural Equilibrium.** F. Sauerwald and L. Holub (*Z. Elektrochem.*, 1933, 39, 750-753).—By pressing synthetic bodies, internal strains are produced which cause a fading of the K_{α} -doublets in the X-ray photograph. Between unpressed surfaces in structural equilibrium in copper single crystals, crystal growth from one crystal to another was observed at 900° C., but not at 500° C. Such crystal growth therefore occurs at higher temperatures than recrystallization of mechanically deformed crystals. It is probably not the result of nucleus formation, but of grain boundary displacement. Even at 900° C., recrystallization between crystals from the melt seldom occurs. This crystallization inertia is similar to that which occurs in ordinary polycrystalline metals obtained from the melt. From these results it is concluded that the crystallization tendency of such substances the single crystals of which are formed out of the melt is generally smaller than that of substances the single crystals of which are produced, for example, in the solid state by the reduction of oxides.—J. H. W.

***On the Recrystallization and Crystal Recovery of Pure Aluminium and of Several Al-Cu Basis Alloys Following Cold-Work.** H. Bohner and R. Vogel (*Kalt-Walz-Welt* (Monthly Suppt. to *Draht-Welt*), 1933, (3), 17-24).—A paper read before the Deutsche Gesellschaft für Metallkunde. See *J. Inst. Metals*, 1933, 53, 128.—A. B. W.

***Influence of the Initial Grain-Size on the Final Grain-Size of Crystals During Recrystallization.** R. Alexandru (*Bull. Sci. Polytech. Timisoara*, 1933, 4, 122-129; *C. Abs.*, 1933, 27, 5285).—Samples of electrolytic iron with grain-sizes between 200 and 24 grains per mm.² were deformed by rolling, and allowed to recrystallize at 650°-750° C. An initial grain-size of approximately 157 grains per mm.² gave a maximum grain-size in the product.—S. G.

†**Recrystallization of Metals.** M. I. Zakharova (*Zventye Metally (The Non-Ferrous Metals)*, 1932, 346-351; *C. Abs.*, 1933, 27, 4198).—[In Russian.] A review of the modern conceptions of recrystallization of metals. 12 references are given.—S. G.

***The Photographic Development of Slip Lines on Deformed Crystals of Silver Chloride.** G. Tammann and G. Bandel (*Z. anorg. Chem.*, 1933, 214, 403-406).—Treatment with a photographic developer of a bent cast plate of silver chloride reveals slip lines as darkened bands of metallic silver. These slip lines are not due to an increase in the reactivity of the silver chloride caused by the slip process but are produced by impurities with which the material is supersaturated, which accelerate the process of development. The separation of these impurities takes place preferably on the slip planes just as is the case with deformed supersaturated metallic solid solutions.—M. H.

***On the Relation Between the Crystal Orientation in Rolled Aluminium Sheet and the Thickness of the Sheet.** G. v. Vargha and G. Wassermann (*Metallwirtschaft*, 1933, 12, 511-513).—In the middle zones of rolled aluminium sheet the crystals are oriented with a [112] direction in the direction of rolling and a (110) plane parallel to the rolling plane. In the edge zones the orientation of the crystals is much more imperfect; with considerable dispersion a (100) plane lies in the rolling plane and a [110] direction in the direction of rolling. With

sheet 5 mm. thick the edge zones are about 1.3 mm. thick, and relatively well defined, but with thinner sheet the difference between the two zones is much less clearly marked. The middle of a sheet 5 mm. thick shows, despite the smaller deformation, a more perfect crystal orientation than is the case with the more strongly deformed, thinner sheet.—v. G.

***Precision Measurements of the Lattice Constants of Beryllium.** M. C. Neuberger (*Z. Krist.*, 1933, **85**, 325–329; *C. Abs.*, 1933, **27**, 5603).—The values are $a = 2.2679 \pm 0.0002$ A.; $c = 3.5942 \pm 0.0003$ A. The axial ratio $a/c = 1.5848$. The density as calculated is 1.857 at 20° C.—S. G.

***X-Ray Determination of the Phase Boundary Lines in the Copper-Zinc Diagram.** Axel Johansson and A. Westgren (*Metallwirtschaft*, 1933, **12**, 385–387).—X-ray examination of carefully prepared and homogenized copper-zinc alloys has confirmed the equilibrium diagram of Bauer and Hansen, except that the $\beta/(\alpha + \beta)$ phase boundary above 450° C. is placed about 1 atomic-% further towards the zinc side.—v. G.

***The Structure of the A Phase of the Ag-Li System.** Harald Perltz (*Z. Krist.*, 1933, **86**, 155–158; *C. Abs.*, 1933, **27**, 5604).—The A phase of the system silver-lithium has a simple cubic structure, with $a = 9.94$ A., containing 52 atoms per unit cube. Identical X-ray data were obtained through the range from 76.3 to 80.2 atoms-% lithium.—S. G.

***The Crystal Structure and Lattice Constants of α -(β -)Tungsten.** M. C. Neuberger (*Z. Krist.*, 1933, **85**, 232–238; *C. Abs.*, 1933, **27**, 5603).—The structure of a new form of tungsten has been determined by means of X-rays. In order to be conventional N. proposes to designate the α -form as the new modification of tungsten, and the β -form as the well-known body-centred cubic form. The α -form contains 8 atoms in the unit cell, arranged in a specific type of lattice with 2 tungsten atoms in the positions $[000]$ $[\frac{1}{2}, \frac{1}{2}, \frac{1}{2}]$ and 6 tungsten atoms in the positions $[\frac{1}{2}, 0, \frac{1}{2}]$ $[\frac{1}{2}, \frac{1}{2}, 0]$ $[0, \frac{1}{2}, \frac{1}{2}]$ $[\frac{1}{2}, 0, \frac{3}{2}]$ $[\frac{3}{2}, \frac{1}{2}, 0]$ $[0, \frac{3}{2}, \frac{1}{2}]$. The edge of the unit cell is 5.038 ± 0.003 A. The specific type of the cubic class is $T_{\frac{2}{2}}^4 O_2, O_3$.—S. G.

***The Solubility of Copper in Zinc.** M. Hansen and W. Stenzel (*Metallwirtschaft*, 1933, **12**, 539–542).—The lattice constants of pure zinc ($a = 2.6590$ A., $c = 4.9351$ A., $c/a = 1.8560$; $d_{\text{calc.}} = 7.140$) are changed by addition of 2.66% copper to $a = 2.6732$ A., $c = 4.8152$ A., $c/a = 1.8012$; $d_{\text{calc.}} = 7.236$. The reduction of almost 3% in the axial ratio is particularly noteworthy. X-ray determinations of the solid solubility of copper in zinc gave the following results: at the peritectic point (424° C.) 2.66%, at 400° C. 2.41%, 350° C. 1.95%, 300° C. 1.53%, 250° C. 1.12%, 200° C. 0.77%, and 150° C. 0.51%. These figures have been confirmed by density measurements and micrographic examination.—v. G.

***X-Ray Proof of the Compound ZrW_2 .** A. Classen and W. G. Burgers (*Z. Krist.*, 1933, **86**, 100–105; *C. Abs.*, 1933, **27**, 5600).—Powder photographs give evidence of a cubic compound of zirconium and tungsten. No analysis was made, but the data indicate a cell with $a = 7.61$ A., containing 8 molecules of ZrW_2 . The calculated density = 13.78.—S. G.

Binding Forces in the Alkali Metals According to the Free Electron Theory. O. K. Rice (*Phys. Rev.*, 1933, [ii], **44**, 318).—Abstract of a paper read before the American Physical Society. Although there have been a considerable number of attempts to work out in some detail the nature of the cohesive forces in the alkali metals, it seemed worth while to see how far one could go with the simplest possible hypothesis, according to which the metal consists of singly-charged positive ions imbedded in a sea of free electrons. Frenkel first showed that the fact that the electrons in the metal obey the Fermi statistics, results in an effective repulsive force which will be balanced by attractive electrical forces; but, as he pointed out, the finite size of the ions prevents this being more than a qualitative picture, and he suggested taking this into account by

including repulsive forces between electrons and ions. In the present work, R. has introduced an intrinsic ionic volume, into which the electrons are supposed to be unable to penetrate, this simply being subtracted from the atomic volume in the Fermi expression for the kinetic energy of the electrons. For the attractive potential an expression involving a Madelung constant of a size about equal to those occurring in cases of univalent crystals, and the same for all the alkali metals, is used. It is possible then to calculate the energy of the metals from the experimental value of the atomic volume, getting excellent agreement with experiment. The method is not so successful in calculating the compressibilities, but, apart from the fact that the compressibilities at absolute zero may only be inferred from measurements around room temperature, it appears that a relatively small correction to the Fermi energy expression can give the correct compressibility without greatly upsetting the calculation of the energy. The latter is, then, to be considered as significant.

—S. G.

Lattice Distortion and Fibre Structure in Metals. W. A. Wood (*Nature*, 1933, 132, 352).—As the temperature of a cold-worked metal is increased, removal of lattice distortion occurs before removal of fibre structure. This intermediate state persists as the metal is slowly cooled. The observation explains the inability to establish a relation between the changes in properties brought about by cold-working and the onset of the fibre structure. The fibrous state does not necessarily represent a state intermediate between that of the normal metal with grains oriented at random and that of the large metallic crystal.—E. S. H.

***Investigation of the Orientations in Thin Evaporated Metallic Films by the Method of Electron Diffraction.** K. R. Dixit (*Phil. Mag.*, 1933, [vii], 16, 1049–1064).—The effect of temperature on the orientations of the small crystals in thin metallic films is investigated. The films, of thickness 10^{-4} – 10^{-6} cm., of silver on molybdenum, quartz, and glass, of aluminium on molybdenum, and of zinc on molybdenum are studied at temperatures ranging from room temperature up to, in some cases, 950° C. Different orientations, not depending on the support, are observed. A theory, assuming that these thin deposits behave as a two-dimensional gas, is proposed.—J. S. G. T.

***Optical Method for the Determination of the Orientation of Single-Crystal Specimens.** E. Jakowlewa (*Physikal. Z. Sowjetunion*, 1933, 3, 429–438; *C. Abs.*, 1933, 27, 3879).—[In German.] A new optical method is described which simplifies and facilitates the determination of crystal orientation and indices. It is suitable for crystals of any symmetry. The crystal is suspended within a glass sphere. Diverging light rays pass into the sphere and strike the crystal as a parallel beam. They are diffracted from the crystal surfaces and emerge from the sphere, converging at twice their focal length. Apparatus and measurements are described. An accuracy of 1° to $30'$ is possible.—S. G.

The Determination of Crystal Orientation. J. Thewlis (*Z. Krist.*, 1933, 85, 74–88; *C. Abs.*, 1933, 27, 3879).—This new method involves the use of graphs obtained by plotting as ordinates and abscissæ the indices or the direction cosines of all directions in a crystal and on these curves are drawn curves of constant angle for different reflecting planes. By using measurements from X-ray photographs it is possible with these graphs to determine the orientation of the crystal. Formulæ for constructing the graphs and also for the determination of crystal orientation without the aid of the graphs are included.

—S. G.

IV.—CORROSION

***Relation Between the Constitution of Some Chromium Alloys and Their Rate of Solution in Hydrochloric Acid.** P. Herasymenko, J. Pech, and F. Pobořil (*Chim. et Ind.*, 1933, Special No. (June), 649-654; *C. Abs.*, 1933, 27, 5704).—The rate of solution of some chromium alloys in hydrochloric acid depends on their constitution and increases considerably in passing from the α -phase to the γ -phase. Measurement of the solution potential of these alloys showed that the differences in the rate of solution are due to variations in the difference of their potential and that of hydrogen.—S. G.

The Corrosion of Copper Rollers Used in Cloth Printing by Alkaline Printing Colours. Karl Reinking and Gustav Bernardy (*Melliand Textilber.*, 1931, 12, 328; *C. Abs.*, 1933, 27, 3826).—The observation of Runge (1842) that potassium hydroxide and potassium carbonate corrode copper and brass in the presence of air is correct; sodium carbonate acts in the same manner. The addition of mineral oils to the printing colours, as done in practice, is apparently intended to exclude air. The covering of the copper cylinder by a sulphide layer is said to have proved of advantage.—S. G.

Copper in Water Distributing Systems: Its Physical, Chemical, and Hygienic Aspects. L. W. Haase and O. Ulsamer (*Kleine Mitt. preuss. Land-, Wasser-, Boden-, u. Lufthygiene, Berlin-Dahlem*, VIII Beiheft, 1933, 3-47).—The time required for the formation of the protective oxide (chiefly cuprous oxide) film on the inner surface of copper water-pipes is dependent on the hardness of the water and its content of neutral salts and gases. In acidic, gassy waters the formation of the film is greatly retarded; in normal, soft surface and underground waters the film forms in about a year if the oxygen content of the water is sufficient, and in hard and medium-hard waters in a few weeks. During the formation of the film the copper content of the water is dependent on its chemical composition and is less the harder is the water. A distinction is drawn between copper compounds in true solution which impart taste to the water, and suspended tasteless copper compounds; the latter are formed in water of more than 4° of permanent hardness. When formation of the protective film is complete, the copper content of hot or cold water taken from the pipes never exceeds 0.1-0.3 mg./litre. Further growth of the film and consequent narrowing of the cross-section of the pipe does not occur under any conditions; iron pipes are much inferior to copper in this respect. Soluble copper salts in amounts sufficient to cause acute copper poisoning cannot pass unnoticed into the human organism, and chronic copper poisoning is unknown. The copper content of tap-water can in no case increase by more than a few % the amount of copper taken into the human body in the ordinary foodstuffs. Some other physiological aspects of the problem are discussed.—J. W.

Lead as a Construction Material—Its Contact with Plaster, Lime, and Cement. Jacques Mahul (*J. Usines Gaz*, 1933, 57, 243-245; *C. Abs.*, 1933, 27, 5039).—Plaster-of-Paris does not attack lead. In the presence of wet lime and air lead oxidizes to Pb_3O_4 . In saturated lime water up to 0.108 gm. of lead per 100 c.c. dissolves in 1 month (0.009 gm. in distilled water), whilst even more (0.183 gm. of lead per 100 c.c.) dissolves in a saturated solution of Portland cement. Any other cement which can liberate free lime is corrosive to lead, the lime dissolving the protective layer of lead suboxide and allowing air oxidation. Aluminous cements and old mortars without free lime are non-corrosive. It is suggested that lead in construction work be protected against these corrosive effects by either a previous bituminous coating or the use of plaster-of-Paris or aluminous cement.—S. G.

On the Question of Corrosion. IV.—Nickel, Tin, Zinc, and Alloys. E. Naumann (*Gas u. Wasserfach*, 1933, 76, 146–147).—Cf. *J. Inst. Metals*, 1933, 53, 193. The behaviour of nickel-plated materials, Monel metal, tinned lead tubes, bronze, red brass, galvanized iron pipes, and brass towards the corrosive action of water is briefly described.—B. Bl.

Corrosion Phenomena in Hot-Water Geysers. R. Scherrer (*Bull. Assoc. Suisse Elect.*, 1933, 24, 517–543).—Cases of rusting are frequent in the boilers of geysers where a galvanized iron vessel is employed, whether electrical or gas heating is used. The zinc coating becomes detached, and eventually forms a sediment of basic zinc carbonate. S. considers that attack is the result of the severe working conditions rather than of defective material or poor galvanizing. The hot-galvanizing process and the methods of testing galvanized material are described. The immunity of such boilers in certain neighbourhoods is explained by local differences in the feed-water. Severe attack is caused by the presence of much free oxygen and carbon dioxide in solution. Analyses of 6 typical samples of water are tabulated. The importance of p_H value and of temporary hardness is discussed, and certain methods of decalcifying water and of estimating its hardness are described. Illustrations show the special types of attack due to dissolved oxygen. The attack by carbon dioxide is held to be comparatively slight. In the case of galvanized heaters, the presence of chlorides is always harmful. The phenomena of passivation are briefly discussed, as are the factors influencing the corrosive power of a feed-water. An improved method for estimating corrosion attack is described, with comparative curves for waters of stated hardness. Among alternative materials to galvanized iron and steel, stainless steel and enamelled iron gave results much inferior to tinned copper, which is recommended for general use.—P. M. C. R.

Salt Effect in Metal Corrosion. R. Podhorsky (*Arhiv Hem. Farm.*, 1933, 7, 97–113 (113–114 in German); *C. Abs.*, 1933, 27, 5295).—It is concluded from experiments with zinc plates and iron wire in sodium chloride that the changes in metal potential are much more important in the establishment of salt effect than the changes in solution velocity for oxygen conforming to the Adeney convection currents. Visible protective layers of corrosion products have no influence on the velocity of corrosion of iron and zinc in sodium chloride solution. As the corrosion intensity is not directly proportional to the duration of action, the form of corrosion curve is dependent on the duration of the experiment.—S. G.

Relative Corrodibility of Some Common Metals and Alloys. Anon. (*Metal Progress*, 1933, 24, (5), 41).—A table of 43 ferrous and non-ferrous metals and alloys gives, in addition to their approximate compositions, the grade of corrosion-resistance of each to the following agencies: sea-shore and industrial atmospheres; domestic, mine and sea-water, saline water containing hydrogen sulphide, and wet steam; fruit and vegetable juices, dairy and other food products; hydrochloric, sulphuric, acetic, nitric, and phosphoric acids (moderate concentration — 5–15%); alkalis in 1–20% solution and fused; solutions of medium concentration containing ammonium chloride, magnesium chloride, magnesium sulphate; hot sulphite liquor, dye liquor, and crude refinery liquors. In addition the maximum safe temperature (in deg. Fahrenheit) is given for a number of the materials with respect to oxidizing, reducing, and sulphur-rich gases.—P. M. C. R.

***The Effect of Traces of other Metals on the Rate of Corrosion of Tin by Citric Acid.** J. M. Bryan (*Dept. Sci. Indust. Res., Rep. Food Investigation Board*, 1932, 163–165; *C. Abs.*, 1933, 27, 5296).—2 p.p.m. of iron in solution had no effect but 5 p.p.m. caused a marked increase in the rate of corrosion of tin by 0.5% citric acid. Copper had less effect than iron. The results show the importance of considering the rate of oxidation of stannous to stannic tin.—S. G.

***The Corrosion of Steel and Tinplate by Acids Other than Citric.** T. N. Morris (*Dept. Sci. Indust. Res., Rep. Food Investigation Board, 1932, 170-171; C. Abs., 1933, 27, 5295*).—Tartaric, malic, acetic, and hydrochloric acids, alone or buffered with their own sodium salts or with sodium citrate over the p_H range met with in canned fruits, were similar in action to citric acid. Oxalic acid behaved differently.—S. G.

***The Corrosion of Various Metals in a 1 Per Cent. Solution of Citric Acid at 25°.** Anon. (*Dept. Sci. Indust. Res., Rep. Food Investigation Board, 1932, 173-178; C. Abs., 1933, 27, 5295*).—Nickel, cobalt, tin, and Monel metal corrode very much more in the presence of air than in its absence. The effect of air is not noticeable with aluminium and its alloys. Most chromium-nickel alloys (stainless steel) are highly resistant, but, if not, the absence of air is no protection. Silver is not attacked, but silver and copper in contact accelerate the corrosion of the copper.—S. G.

Injurious Action of Fruit Acids on Metals. W. Lohmann (*Mineralwasser-Fabrikant, 1932, 36, 581-582; Chem. Zentr., 1932, 103, II, 2891; C. Abs., 1933, 27, 5835*).—The yellow coal-tar dye in lemonade is decolorized by contact with tin. Beverages containing lactic acid attack brass, especially in presence of sugar. In a 1% acid solution the metal losses in 10 days at room temperature (and at 30°-35°) are for lactic acid 0.52 (1.6), citric acid 0.87 (2.13), tartaric acid 0.86 (1.5), and for acetic acid 0.13 (1.9)%. Further data are given for 20-, 32-, and 40-day periods.—S. G.

The Chemistry of Cider. V. L. S. Charley (*Chem. and Ind., 1933, 52, 743-744*).—An abstract of a lecture to the Food Group of the Society of Chemical Industry. Apple juice and cider have slight action on tin or aluminium, but attack zinc, lead, and copper rapidly. Heavily-tinned copper is generally used for filters, &c., which come into contact with cider for prolonged periods.—E. S. H.

***Some Inhibitors of Acid Corrosion.** Emilio Jimeno and Isidro Grifoll (*Anales Soc. españ. Fis. Quím., 1933, 31, 582-593; C. Abs., 1933, 27, 5044*).—Both hydrogen formation and oxide solution contribute simultaneously to corrosion. Many inhibitors were tested. Their use reduces attack on metals to 0.1 of that without them. Inhibitors can be used hot or cold. Those which readily assume a colloidal, stable form are best. Oily substances are often effective inhibitors, but their aqueous dispersions are unstable.—S. G.

***Action of Sulphur on Certain Metals.** René Dubrisay (*Chim. et Ind., 1933, Special No. (June), 631-632; C. Abs., 1933, 27, 5705*).—From a study of the mechanism of the blackening of copper and silver under the effect of sulphur and its compounds, it is concluded that this phenomenon can be produced by elemental sulphur without the intervention of sulphides. Extremely small traces of sulphur (of the order of 0.001 mg.) can produce a marked effect on silver.—S. G.

Chemistry of the Corrosive Action of Ammonium Nitrate. V. Obornin (*Khimstroï, 1933, 5, 2316-2319; C. Abs., 1933, 27, 5705*).—[In Russian.] The corrosion of copper by weak solutions of equal concentrations of ammonia, nitric acid, and ammonium nitrate decreases in the order given.—S. G.

Power Alcohol and Petrol Mixture. Anon. (*Indust. Australian, 1933, 88, 271-272*).—Two types of corrosion by fuel are distinguished: (1) attack on the metal surfaces of the fuel system; (2) attack on cylinder and on exhaust by acid combustion products. The influence of moisture, of incomplete combustion, and of a change of fuel are briefly considered.—P. M. C. R.

On the Evolution and Present State of Microphonic Technique. P. Chauvasse (*Ann. Postes, Télég. et Téléph., 1933, 22, 9-57*).—(Section on secondary characteristics, p. 41; effects of moisture.) Moisture enters microphones by absorption from the atmosphere or by condensation from expired air. It causes deterioration in the properties of the carbon employed, and also attacks



the metallic parts. Aluminium, unless of extreme purity, is especially liable to such attack. Accelerated tests show that effective protection can be given by coating with cellulose varnish or by plating. Nickel-plated brass is found to be especially resistant to corrosion of this type.—P. M. C. R.

On the Limiting Current in Anodic Polarization of Metals in Aqueous Solutions.—III. Kurt Schwabe (*Z. Elektrochem.*, 1933, 39, 791-799).—The investigation of the anodic polarization of metals is continued. The behaviour of zinc in unsaturated solutions of zinc chloride, zinc perchlorate, and zinc nitrate, and of zinc in a saturated solution of zinc perchlorate and of silver in a solution of silver perchlorate in water-free propyl alcohol is discussed. (See *J. Inst. Metals*, 1932, 50, 610, and 1933, 53, 555.)—J. H. W.

Fatigue Failure Caused by Corrosion. P. Nettmann (*Automobiltech. Z.*, 1933, 36, 459-460).—The mechanism of lubrication is considered from a theoretical viewpoint. The effects of the viscosity of the lubricant, of its dilution with liquid fuel, and of its emulsification are discussed. The influence of temperature on cylinder wear is considered, and is illustrated by a diagram.—P. M. C. R.

V.—PROTECTION

(Other than Electrodeposition.)

†**Corrosion and Protection.** Ulick R. Evans (*Chem. and Ind.*, 1933, 52, 910-911).—A lecture to the Yorkshire Section of the Society of Chemical Industry. Deals in a general way with corrosion at high and low temperatures, and protection by the use of resistant materials, water treatment, metallic layers, and paint coats.—E. S. H.

The Protal Process for the Protection of Light Alloys. J. Cournot (*Chem. and Ind.*, 1933, 52, 891-892).—Protection of aluminium by "Protalizing" consists in immersing the object for about 40 minutes in a solution of certain salts at 100° C. The solution used contains an alkaline salt of a metal capable of forming two oxides, the higher oxide being soluble in alkali and the lower oxide insoluble. Reduction occurs and the lower, insoluble oxide becomes attached as a protective film to the aluminium. Liberation of gas occurs at the end of the process. It is usual to impregnate the film with an appropriate finish.—E. S. H.

***Anodic Films of Aluminium and Their Applications.** Shoji Setoh and Akira Miyata (*J. Electrochem. Assoc. (Japan)*, 1933, 1, 15-24; *C. Abs.*, 1933, 27, 4742).—[In Japanese.] Thick and tough films were obtained with an oxalic acid bath. The thickness of the active layer is proportional to the voltage. The layer is subjected to an electric stress of the order of 10^6 to 10^8 v./cm.² and to a pressure of 10^3 to 10^4 atm. A concentrated solution lowers the energy consumption 4-8%. Superposition of a.c. on d.c. prevents the aluminium from pitting during electrolysis. Thick, porous films are treated with high-pressure steam for a few minutes to make them waterproof and more corrosion-resistant than by ordinary impregnating or painting.—S. G.

The M.B.V. Surface Treatment for Aluminium and Its Alloys. G. Eckert (*Found. Trade J.*, 1933, 49, 281-282, and *Machinist (Eur. Edn.)*, 1933, 77, 553E).—Abstracts of a pamphlet published by the British Aluminium Co., Ltd., on the M.B.V. process for improving the corrosion-resistance of aluminium and its copper-free alloys, being a translation of a paper by E. See *J. Inst. Metals*, 1932, 50, 438, 481, and also 1933, 53, 84, 443.—J. H. W.

New English Galvanizing Process [Crapo]. — Bauer (*Draht-Welt*, 1933, 26, 211-212).—A recently patented development of the Crapo process of galvanizing

wires, &c., involves annealing and surface chemical treatment prior to galvanizing. Strong smooth uniform coatings are obtained with lower working costs than with the older methods. The wire is first drawn through a lead bath maintained at 800° C. and provided with a fused salt cover (10% sodium cyanide, 35% sodium carbonate, 55% sodium chloride), and then through hydrochloric acid, wash water, and neutralizing baths before it enters the zinc bath maintained at 450°–460° C. This process was developed by W. H. Potter, an Englishman. The process of the American Crapo which has also been patented is similar in general principle and in the claims made for it, but a bath of fused salts (60% NaCN, 20% Na₂CO₃, and 20% sodium chloride) maintained at 650°–700° C. and covered with a thin layer of coke, is used.—A. B. W.

Galvanizing of Small Iron Articles and the Like. — Beisel (*Draht-Welt*, 1933, 26, 19–21; and (in German, English, and French) *Draht-Welt Export Ausgabe*, 1933, (4), 25–31).—Describes in detail all the operations essential to the efficient hot-galvanizing of small articles—degreasing, descaling, fluxing, drying, preheating, and the final dip and drain. The use of a centrifugal machine to enable thorough removal of superfluous zinc is also explained. It is claimed that small articles can often be coated advantageously with a metal-spraying pistol operating in a rotating drum. Two examples of cementation processes are also given with all essential practical data.—A. B. W.

Testing Zinc Coatings on Galvanized Wires. Anon. (*Draht-Welt*, 1933, 26, 515–516).—The need for a simple, easily applied test of zinc coatings has led the British Non-Ferrous Metals Research Association to consider the whole problem. Complicated methods necessitating the resources of a laboratory or costly apparatus must be ruled out. Although the copper sulphate dip process has definite limitations, it is widely known amongst producers and users and has long been employed by them. There is also the bend test; for soft wires round an 8-diameters mandrel and for hard quality round a 4-diameters mandrel. The copper dip test may also be advantageously applied following a bending test to determine whether the coating has cracked or not. If these tests were standardized and recommended procedures defined the needs of the trade would be satisfactory met.—A. B. W.

The Electro Coppering of Galvanized Iron Sheets. A. Wogrinz (*Kalt-Walzwelt* (Monthly Suppt. to *Draht-Welt*), 1933, (5), 38–39).—A brief discussion of the technical and economic requirements for plating 2 m. × 1 m. galvanized iron sheets on one side only. The copper is deposited from a cyanide bath at 30° C. with a current density of 0.5 amp./dm.², 30 minutes' plating usually being sufficient.—A. B. W.

Metallizing Process. Anon. (*Indust. Finishing*, 1933, 9, 30–33).—A general review of the process, including a table showing standard wire size, pressures of acetylene, oxygen, and air, speed of wire, thickness of coat, and weight in lb. of metal sprayed per hr. for lead, tin, zinc, aluminium, copper, brass, phosphor-bronze, nickel-brass, and Monel metal.—E. S. H.

Application and Economics of the Process of Metal Spraying. Chas. Stipp (*Welding Eng.*, 1933, 18, (3), 12–14, and (abstract) *Indust. Gases*, 1933, 14, 82).—After a brief description of the process and its technique, various applications are discussed. These include the spraying of aluminium in combustion chambers of high-compression internal-combustion engines, corrosion protection in chemical, dairy and food-production plant, renewing the zinc coating on welded galvanized sheet, salvaging of castings, building-up worn parts, and ornamental work.—H. W. G. H.

The Protection of Aluminium and Its Alloys by Paints and Varnishes. H. Rabaté (*Rev. Aluminium*, 1933, 10, 2133–2148).—The protection of aluminium and its alloys by painting and varnishing is fully described as follows: (1) preparation of the metal surfaces before the application, (a) for electrolytic coating, (b) before painting; (2) different types of protective coatings, (a) oxidation,

including anodic oxidation, modification of anodic oxidation, chemical oxidation and bronzing, (b) electrolytic protection with cadmium, zinc, nickel, copper, chromium, or cobalt, (c) Schoop metallization; (3) types of varnish and paint protectors; (4) other types of coating, such as fats and phenol.—J. H. W.

Painting Galvanized Iron and Sheet Zinc. E. Perry (*Indust. Finishing*, 1933, 9, 11-12).—It is recommended to clean the surface with a solution containing 30 grm. of dry sodium phosphate and 4 grm. of sodium hydroxide in 200 grm. of water at 140°-176° F. (60°-147° C.) and then to etch by immersing for 30 seconds at room temperature in a solution of 20 grm. ammonium nitrate and 200 grm. commercial hydrochloric acid in 1000 grm. of water. Portland cement paint acts as a good primer, especially when the material has to undergo considerable temperature variations, as in the linings of refrigerators.—E. S. H.

VI.—ELECTRODEPOSITION

A New Stripping Test for Cadmium Coatings. Gustaf Soderberg (*Metal Cleaning and Finishing*, 1933, 5, 341-343; *C. Abs.*, 1933, 27, 5251).—A discussion of the factors affecting the distribution of electroplated cadmium and an outline of a new stripping method by which the minimum thickness as well as the actual thickness of the plate at any one point may be determined.—S. G.

Udylite Develops New Test Method for Cadmium. Anon. (*Platers Guide*, 1933, 29, (10), 11-12).—Briefly describes a new stripping test for determining the thickness of depleted cadmium coatings.—J. H. W.

Matt Chromium Plating. Herbert Kurrein (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, 31, 341-343).—A matt finish on chromium-plated brass or steel may be obtained by (a) treating in the usual way to obtain first a copper, then a nickel plate of high lustre, matting the latter plate by sand-blasting or pickling, and applying an outer coat of chromium; (b) sand-blasting the original material before any plating, or (c) roughening the original surface with emery before plating. Matt chromium finishes produced by method (a) are generally the best and most resistant to corrosion.—A. R. P.

The Production of Hard Chromium Plate. Arthur Willink (*Metal Cleaning and Finishing*, 1933, 5, 368-371; *C. Abs.*, 1933, 27, 5649).—Important factors which influence the wear-resistance of chromium plate are discussed.—S. G.

Chromium Plating in the Cold. L. Richard (*Galvano*, 1933, (19), 18-20).—Practical notes are given on chromium-plating baths maintained at 15° C., including a discussion of the composition of the bath, temperature, size, and disposition of anodes, regulation of current density, and mode of suspension, drying, and polishing of the objects.—E. S. H.

Some Notes on Chromium Plating. Lucien Richard (*Galvano*, 1933, (17), 22-23, (18), 21-22).—Practical notes, based on answers to correspondents, are discussed briefly.—E. S. H.

Chromium Plating on Zinc. M. de Kay Thompson and F. C. Jelen (*Trans. Electrochem. Soc.*, 1933, 63, 141-148; discussion, 148).—For abstract of the paper see *J. Inst. Metals*, 1933, 53, 27. In the discussion E. A. Anderson stated that outdoor exposure tests indicated that a single nickel coating was more protective than a composite copper-nickel coating.—A. R. P.

Utility of Chromium Plating in Calico Printing. John B. Dick (*Amer. Dyestuff Reporter*, 1933, 22, 305-309; *C. Abs.*, 1933, 27, 3826).—The advantages of chromium plating are enumerated. Means of plating copper rolls are described.—S. G.

Chromium Plating. A New Portable Equipment for the Electrodeposition of Metals. Anon. (*Chem. and Ind.*, 1933, 52, 837-838).—A portable plating apparatus, allowing metal parts to be electro-plated *in situ*, is described.—E. H.

Chromium Plating of Small Tools and Mandrels with a View to Increasing their Resistance to Wear. Anon. (*Galvano*, 1933, (18), 23-26, (19), 24-26).—Translated from *Machinery (Lond.)*, 1932, 40, 549-553. See *J. Inst. Metals*, 1933, 53, 88.—E. S. H.

A Cyanide-Free Bath for the Deposition of Copper on Steel. Colin G. Fink and Chaak Y. Wong (*Trans. Electrochem. Soc.*, 1933, 63, 65-72; discussion, 72-73; also (abstracts) *Met. Ind. (Lond.)*, 1933, 43, 110; and *Daily Metal Reporter*, 1933, 33, (92), 11).—For abstract of the paper, see *J. Inst. Metals*, 1933, 53, 252. In the discussion Raymond R. Rogers stated that chromium can be deposited on copper plated from oxalate baths without danger of peeling. Leonard Shepley stated that cyanide baths have certain advantages over oxalate baths, and considered that their toxicity and comparative instability are not serious drawbacks; in reply Colin G. Fink stated that cyanide baths are really suitable only for "flashing," and that oxalate baths have the advantage of being much cheaper, less toxic, and more stable than cyanide baths, have a throwing power equal to that of sulphate baths and require little attention in use.—A. R. P.

Nickel Plating of Fabricated Zinc in a Barrel. Albert Hirsch (*Trans. Electrochem. Soc.*, 1933, 63, 135-139; discussion, 139-140; also *Metal Cleaning and Finishing*, 1933, 5, 299-300; and *Iron Age*, 1933, 131, 991).—For abstract of the paper see *J. Inst. Metals*, 1933, 53, 312. In the discussion E. A. Anderson expressed the opinion that an intermediate copper coating is undesirable and that nickel plating from a solution of p_H 8 will give an extremely hard nickel deposit which will almost certainly contain numerous cracks if it is built up to any great thickness; he considered a minimum thickness of 0.0003 in. of nickel necessary, and this would require 2 hrs.' plating in H.'s solution. Charles H. Eldridge considered a minimum thickness of 0.0005 in. of nickel necessary in the absence of a copper intermediate coating.—A. R. P.

Nickel Plating in the Barrel and the Treatment of Small Parts. Anon. (*Galvano*, 1933, (19), 14-17).—A description of existing practice.—E. S. H.

Electrolytic Deposition of Platinum on Copper. Shao-Tze Leo and Tsing-Nang Shen (*Sci. Quart. Nat. Univ. Peking*, 1931, 3, 7-19; *C. Abs.*, 1933, 27, 5650).—Copper dishes are plated from a phosphate bath with a current density of 0.75 amp./dm.² at 45° C. They have been successfully used as a substitute for platinum ware in evaporating hydrofluoric acid mixtures. The platinum deposit loosened, however, on being heated to high temperatures.

—S. G.

Rhodium Plating. Colin G. Fink and George C. Lambros (*Trans. Electrochem. Soc.*, 1933, 63, 181-186; discussion, 186).—For abstract of the paper see *J. Inst. Metals*, 1933, 53, 447. In the discussion W. L. Mancher said that the reflectivity of rhodium in the range 4500-6500 Å. is 50-56%, C. G. F. said the U.S. Bureau of Standards figure for melted rhodium was 45%, and A. H. Taylor stated that 3 samples of rhodium plate from different baths gave reflectivities of 66, 70, and 78%, respectively; the best deposit consisting of 1 mg. of rhodium per in.² on an undercoat of nickel. C. G. F. stated that rhodium reflectors were used for searchlight and cinema mirrors in the U.S.A.

—A. R. P.

A Study of Cyanide Zinc Plating Baths Using the Aluminium-Mercury-Zinc Anode. A. Kenneth Graham (*Trans. Electrochem. Soc.*, 1933, 63, 121-132; discussion, 133).—For abstract of the paper see *J. Inst. Metals*, 1933, 53, 313. In the discussion U. C. Tainton suggested that the cause of the anodic sludge obtained by G. was the 0.07% of impurity in the zinc, and stated that zinc of 99.99% purity was now readily obtainable. In reply A. K. G. stated that the use of this latter type of zinc in the alloy anodes gave no better results than when 99.93% zinc was used.—A. R. P.

The Electrolytic Finishing of Die-Cast Metal. — Rössler (*Werkstatt u. Betrieb*, 1933, 66, 409-411).—The formation of a poorly adhesive or blistered coating is attributed to incorrect treatment rather than to the unsuitability for plating of zinc, tin, or aluminium die-castings. Tin, having little tendency to oxidize, presents the least difficulty, but efficient deoxidation and degreasing are necessary for all three materials. A coating of copper or brass is found to improve the quality of subsequent nickel-plating. Special precautions are indicated for each type of material.—P. M. C. K.

The Electroplating of Wires. H. Berlet (*Draht-Welt*, 1933, 26, 435-436).—A simple mathematical investigation of the relationships obtaining between the various factors involved in the continuous plating of wires.

If M = weight of wire plated in kg.; t = time of plating in hours; D = density of wire material; r = wire radius in mm.; L = length immersed in metres; v = wire velocity in metre/sec.; Q = weight of metal in gm. deposited per kg. of wire; A = electrochemical equivalent of metal deposited in gm./coulomb; B = current efficiency (fractional); J = current in amps.

$$\text{Then } M = 3.6t \cdot v \cdot r^2 \cdot \pi \cdot D,$$

$$L = \frac{5MQ}{B \cdot A \cdot t \cdot C \cdot \pi \cdot r},$$

$$\text{and } J = \frac{M \cdot Q}{B \cdot A \cdot t}.$$

Discretion must, of course, be exercised in subdividing the immersed length (L) found according to the ability of the wire to carry the current (J).

—A. B. W.

Electrodeposition of Metals and Alloys from Formamide Solutions. R. D. Blue and F. C. Mathers (*Trans. Electrochem. Soc.*, 1933, 63, 231-238).—See *J. Inst. Metals*, 1933, 53, 511.—S. G.

The Heating of Electrolytic Baths in Winter. Anon. (*Galvano*, 1933, (18), 15-16).—Electrical heating is recommended.—E. S. H.

The Application of X-Rays in the Field of Electrodeposition. N. Promisel (*Met. Ind. (Lond.)*, 1933, 43, 437-441).—The work of earlier experimenters on the X-ray analysis of electrodeposits is summarized and the reasons for the preferential orientation of the deposits normal to certain crystallographic planes, characteristic of the metal concerned, are discussed. These directions depend on the nature of the metal deposited and the nature of the plating solutions and conditions of deposition. The influence of the crystal arrangement on the reflectivity, and the work of Roux and Cournot and Stillwell and Stout on the deposition of alloys are discussed. X-ray analysis yields a large range of information on the nature of electrodeposits, and this information can be applied to studies of the adherence and physical properties of the deposits, of the effect of addition agents and of anions on their nature, and of the structure of dull, bright, and burnt deposits.—J. H. W.

The Removal of Cyanide from Plating-Room Wastes. E. F. Eldridge (*Mich. Eng. Exper. Sta. Bull.* No. 52, 1933, 1-20; *C. Abs.*, 1933, 27, 4741).—Dilute cyanide waste from plating rooms was treated by several methods in an effort to remove the toxicity. (1) KCN treated with Cl_2 yields CNCl , which appears to be nearly as toxic as the KCN. (2) Fe^{++} and Fe^{+++} salts were used in an effort to precipitate prussian blue. After precipitation the solution was toxic. (3) KCN was oxidized by KMnO_4 in alkali solution to KOCN with the precipitation of $\text{Mn}(\text{OH})_4$. After oxidation the clear supernatant liquid when diluted 1-1 with water was not toxic to fish. High concentration of $\text{Mn}(\text{OH})_4$ sludge was toxic. (4) KCN, on addition of acid, is converted to HCN which can be removed by aeration. When the p_{H} was maintained at about 5 in a solution containing initially 200-500 p.p.m. KCN, the HCN was completely removed in 8-16 hrs. The aerated liquid when diluted 1-1 was not toxic to the fish.—S. G.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-Refining.)

***Preparation and Electrolysis of Aluminium Sulphide.** Paul Roentgen and Heinz Borchers (*Metallwirtschaft*, 1933, 12, 431–434).—Crude aluminium reacts vigorously with iron sulphide forming aluminium sulphide containing only about 1.5% alumina, 0.2% silicon, and 0.01% iron, the greater part of the impurities in the aluminium being absorbed by the iron. Sodium chloride may be added to the reaction mixture to prevent oxidation. Aluminium sulphide can be electrolyzed at 700° C. in fused chloride or fluoride electrolytes without difficulty to give pure aluminium; the decomposition voltage is about 1 volt less than that of the alumina-cryolite bath, the current yield is very high, and the carbon anodes are unattacked by the sulphur.—V. G.

***Critical Voltage Phenomena at the Critical Current Density in the Deposition of Spongy Copper, and Microscopic Examination of these Deposits.** Keinosuke Hirakoso (*J. Electrochem. Soc. (Japan)*, 1933, 1, 61–68).—[In Japanese.]
—S. G.

Electrothermic Preparation of Cupro-Silicon. V. Verigin (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, 369–374; *C. Abs.*, 1933, 27, 4176).—[In Russian.] The alloy, prepared in the electric furnace, contained silicon 58, copper 40, and iron about 1%, and possessed good physical and chemical properties. The semi-commercial process was made continuous.—S. G.

***Electrolytic Production of Metallic Lithium.** N. A. Isgarishev and S. A. Pletnev (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, 536–542; *C. Abs.*, 1933, 27, 4175).—[In Russian.] Fused lithium chloride plus potassium chloride (1 : 1) was electrolyzed in a magnesium silicate-lined iron cell with graphite anode and iron cathode. The output of the cells was 1 kg./day lithium at 225 amp. and 17 v., or 75 kw.hr./kg. lithium. Efficiency was about 85%. The lithium analyzed potassium 0.23, magnesium 0.19, and sodium 0.5%. The sodium was an impurity in the potassium chloride used. The magnesium came from the lining.—S. G.

Choice of an Electrolytic Method for the Preparation of Metallic Magnesium. I. G. Scherbakov (*Tech. Urals*, 1931, 7, (5/6), 12–16; *Chem. Zentr.*, 1932, 103, I, 2075; *C. Abs.*, 1933, 27, 5649).—[In Russian.] The comparative advantages and disadvantages of the methods for the electrolytic preparation of magnesium are discussed: (1) magnesium oxide and fluoride; (2) magnesium chloride; (3) magnesium chloride and carnallite; (4) carnallite.
—S. G.

Electrolytic Parting of the Noble Metals. Fr. Vogel (*Russko-Germanski Vestnik Nauk i Tech.*, 1932, (11/12), 21–28; *Chem. Zentr.*, 1932, 103, II, 2519; *C. Abs.*, 1933, 27, 5649).—From a critical consideration of the methods of separation of gold and silver, V. concludes that the most satisfactory process is to fuse a poor gold-silver alloy with a rich silver alloy, i.e. increase the silver content. The Siemens and Halske process for electrolytic refining of silver is better than that of Dietzel.—S. G.

†**On the Theory of the Cathodic Evolution of Hydrogen.** J. Hoekstra. M. Volmer (*Z. physikal. Chem.*, 1933, [A], 166, 76–79, 80).—A critical discussion of Volmer's work on hydrogen overvoltage and V.'s reply to the criticisms.
—B. Bl.

Note on the Theory of Hydrogen Overvoltage. O. Essin (*Z. physikal. Chem.*, 1933, [A], 166, 270–272).—The theory of Erdey-Grúz and Volmer explains the effect of hydrogen-ion concentration on overvoltage if the rate of the opposed reaction is taken into consideration.—B. Bl.

The Theory of Passivity. XX.—The Passivity of Nickel. W. J. Müller and E. Löwe (*Z. Elektrochem.*, 1933, 39, 872-879).—Georgi's criticism (see *J. Inst. Metals*, 1933, 53, 338) of M.'s film theory (*Bedeckungstheorie*) of passivity is shown to rest on a misconception of that theory, and it is claimed that Georgi's experimental results can be completely explained by this theory. Von Foerster's explanation of passivity (see *J. Inst. Metals*, 1933, 53, 131), namely that the potential displacement of the nickel depends on the retardation of the solution of the nickel, is based on current density and strength curves without consideration of the time factor. His hypothesis is contrary to the fundamental law that the charged hydrogen ions on the anode are repelled according to Coulomb's law and therefore cannot come into the reaction zone of the anode. Experimental results showed, in conformity with M.'s theory, that a depression of the nickel potential is accompanied by an increase in porosity.—J. H. W.

The Theory of Passivity. XXI.—Film or Absorption Theory. W. J. Müller (*Z. Elektrochem.*, 1933, 39, 880-883).—M. replies to the criticisms of E. Müller and Kurt Schwabe. See *J. Inst. Metals*, 1933, 53, 555, and preceding and following abstracts.—J. H. W.

The Theory of Passivity. Erich Müller and Kurt Schwabe (*Z. Elektrochem.*, 1933, 39, 884).—Reply to W. J. Müller's criticism (preceding abstract).

—J. H. W.

***On the Potential Difference between Copper and Its Amalgam, and the Reproducibility of the Copper Electrode.** Mitzugu Oku (*Sci. Rep. Tōhoku Imp. Univ.*, 1933, [i], 22, 288-300).—[In English.] A standard copper electrode is prepared by electrolyzing a copper sulphate solution containing sulphuric acid, using a high current density and a platinum cathode. The deposited copper is preserved in the electrolyte, with occasional shaking to remove occluded hydrogen. Atmospheric oxidation should be avoided. Good results can be obtained with copper, reduced from cupric oxide by hydrogen at 500° C., which is stored in copper sulphate solution containing sulphuric acid. The p.d. between the standard copper electrode and the amalgam is given by $E_{298} = 0.00512 \pm 0.00004$, $dE/dT = -0.0000737$ volt/degree ($t = 0^{\circ}-35^{\circ}$ C.).

—E. S. H.

***On the Law of Mass Action with Concentrated Non-Ideal Solutions.** F. Sauerwald and F. Neubert (*Metallwirtschaft*, 1933, 12, 459-460).—Since the quotient of the activity coeff. is either equal to unity or a constant it can be concluded that the mass action law, referred to the concentration of the components, is apparently valid for concentrated solutions. Measurements of the equilibria in the reaction $PbCl_2 + Sn = Pb + SnCl_2$ are given as examples.

—v. G.

Cathodic Films in Electrolytic Condensers. Frank W. Godsey, Jr. (*Trans. Electrochem. Soc.*, 1933, 63, 223-229).—See *J. Inst. Metals*, 1933, 53, 256.—S. G.

VIII.—REFINING

(Including Electro-Refining.)

Refining Lead by Chlorination. F. M. Loskutov (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, (9), 87-98; *C. Abs.*, 1933, 27, 5693).—[In Russian.] Chlorination was compared with fire-refining of lead. In the conditions at the works where the experiments were carried out the chlorination process showed little superiority, but it is hoped that some improvements suggested will increase greatly the advantages of the chlorination process.—S. G.

IX.—ANALYSIS

Electrolytic Analysis of Bronze and Brass. W. J. Ugniatchev (*Zhurnal Obshchey Khimii (Journal of General Chemistry)*, 1933, 3, 500–504).—[In Russian.] Difficulties encountered in the electrolytic analysis of bronze and brass are reviewed and a combined electrolytic and chemical method of analysis is described in detail. Cu and Pb are first determined electrolytically in HNO_3 solution, the Ni is removed from the solution with dimethylglyoxime, and the filtrate used for the electrolytic determination of Zn. P is determined by the molybdate method as usual. Sn is determined by dissolving in $\text{H}_2\text{C}_2\text{O}_4$ the metastannic acid produced by treatment of the alloy with HNO_3 and electrolyzing the solution.—M. Z.

Assay of Refined Electrolytic Gold. I. A. Kadaner (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, 7, 137–138; *Chim. et Ind.*, 1933, 30, 101; *C. Abs.*, 1933, 27, 5272).—[In Russian.] Dissolve 10 grm. on the sand bath with 18 c.c. HNO_3 (d 1.4) and 36 c.c. HCl , let cool, add 3 vol. distilled H_2O ; if the sample contains Ag even in very small quantities the solution becomes turbid because of precipitation of AgCl , allow to settle, warm slightly, filter and weigh.—S. G.

Analysis of Bearing Metal. F. Schwarz (*Bul. facultatii stiinte Cernauti*, 1933, 6, 225–228; *C. Abs.*, 1933, 27, 4754).—A modification of the Treadwell method for the analysis of bearing metals is given. By use of the original method, it was found that Sn was lost in large amounts as SnCl_4 , when high-lead alloys were dissolved by *aqua regia* on the water bath, and that a loss also occurred when the alcoholic filtrate from the Pb determination was evaporated to dryness. This difficulty was overcome by dissolving the sample in a tall beaker with cover and keeping the temperature between 60° and 70° C. on a Costeanu bath. The alcoholic filtrate was evaporated at the same temperature from this bath; a conical porcelain dish was used to help to obviate creeping. With these modifications, the method gave correct results.—S. G.

Analysis of Babbitt Metal by a Volumetric Method. E. S. Gavrilenko and V. S. Kobzarenko (*Nauk. Zapiski Tzukrovoi Promishlenosti*, 1933, 10, (29/30), 27–32; *C. Abs.*, 1933, 27, 5678).—[In Russian.] Dissolve 0.5–1.0 grm. of alloy in 10 c.c. of concentrated H_2SO_4 and boil for 5–7 minutes after the metal has dissolved. Dilute with 50 c.c. of water, add 20 c.c. of concentrated HCl , boil for 5 minutes, add 150 c.c. of cold water and 5 c.c. of saturated MnSO_4 solution. Titrate the cold solution with KMnO_4 to determine Sb. Reduce the Sn^{++++} in the filtrate by heating with Fe in a stream of CO_2 and titrate the resulting Sn^{++} with I_2 solution. To determine Pb, take a fresh portion of alloy and treat 0.5 grm. with 3–5 c.c. of water and 10–15 c.c. of concentrated HNO_3 . Evaporate to dryness, digest the residue with 15 c.c. of 5*N*- HNO_3 and filter off the oxides of Sn and Sb. Wash with 1% NH_4NO_3 solution, evaporate to about 100 c.c., neutralize with NH_4OH and precipitate the Pb as oxalate. Titrate the precipitate with KMnO_4 in the usual manner. In the filtrate from the PbC_2O_4 determine Cu iodometrically after evaporating to about 75 c.c. and properly neutralizing.—S. G.

***Spectrographic Investigations of Technical and Very Pure Metals. I.—Zinc.** Walther Gerlach and E. Riedl (*Metallwirtschaft*, 1933, 12, 401–405).—Methods of exciting spectra are critically reviewed. The most suitable method depends on the nature of the problem in hand. In zinc, lead is best detected by the line 4057.8 Å., cadmium by the line 2288 Å. or by the line 3611 Å. in the longer wave ultra-violet region. The sensitivity of the test is $10^{-4}\%$ for Pb, $10^{-5}\%$ for Cu, $10^{-4}\%$ for Cd, and $10^{-3}\%$ for Fe. Very pure (99.9996%) New Jersey zinc contains Cu and Pb but no Cd or Ag. In testing Zn the condensed spark is unsuitable; the interrupted arc discharge should be used. Qualitative analyses of various kinds of zinc are given.—v. G.

Methods of Chemical Analysis for Zinc Plants. B. Zuhoe and M. I. Popov (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, 214-228; *C. Abs.*, 1933, 27, 3681).—[In Russian.] A detailed description is given of methods used in European zinc plants.—S. G.

The Qualitative Detection of Vanadium. Darwin Harris (*Chemist-Analyst*, 1933, 22, (3), 11, 15).—The method depends on the blue colour developed by treating V_2O_5 solutions with $C_6H_5 \cdot NH_2 \cdot HCl$.—A. R. P.

Colorimetric Determination of Aluminium. F. Alten, H. Weiland, and H. Loofmann (*Angew. Chem.*, 1933, 46, 668-669).—The method depends on the yellowish-red compound produced by coupling the Al compound of 8-hydroxyquinoline with diazotized sulphanilic acid in HCl solution and adding NaOH in excess. The Al is separated from Mg, Co, Ni, and Zn by boiling with $(CH_3)_3N_4$, and from Fe by boiling with 0.5N-NaOH; it is then precipitated from dilute acetic acid solution by addition of 8-hydroxyquinoline.—A. R. P.

Determination of Bismuth in Copper by Spectral Analysis. B. A. Lomakin (*Trudi Vsesoiznago Nauchno-Issledovatel'skogo Instituta Metrologii i Standardizatsii (Trav. Inst. Metrol. Standardisation (U.S.S.R.))*, No. 2, 1932, 139-163; *C. Abs.*, 1933, 27, 4189).—[In Russian, with French summary.] A study of the relationship between the log of the percentage of Bi in Cu and the density of the Bi spectral lines (cf. *J. Inst. Metals*, 1930, 43, 550).—S. G.

Volumetric Determination of Bismuth as Oxychloride. E. von Migray (*Chem.-Zeit.*, 1933, 57, 774).—The metal is precipitated as BiOCl in the usual way and the precipitate dissolved in dilute HNO_3 ; the solution is then treated with an excess of 0.1N- $AgNO_3$ and the excess titrated with NH_4CNS .

—A. R. P.

Determination of Cadmium in Zinc. M. I. Shubin (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, (12), 81-94; *C. Abs.*, 1933, 27, 5675).—[In Russian.] The method, essentially, consists in separation from solution of the sample, of all metals with the exception of Zn and Cd, and in separation of the Cd from the Zn in ammoniacal solution by means of Na_2S . The Cd precipitate is dissolved in HCl, and the Cd then precipitated by H_2S . The precipitate is dissolved and the ammoniacal solution electrolyzed. One or two samples can be analyzed in 10-14 hrs. The accuracy of the method is within the following limits: with Cd contents of up to $0.05 \pm 0.002\%$, from 0.05 to $0.20 \pm 0.003\%$, and from 0.20 to $0.30 \pm 0.005\%$ the accuracy is 0.003, 0.005, and 0.01%, respectively. The method is good for all grades of zinc. The details of the procedure and the methods of separation of the metals, such as Cu, Pb, Fe, Bi, As, Sb, Sn, are described.—S. G.

Volumetric Determination of Cobalt by Means of Ferrous Sulphate and Potassium Dichromate. Landon A. Sarver (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1933, 5, 275-276).—The Co is precipitated from a $CoSO_4$ solution by addition of $NaBO_3$ and an excess of NaOH. After boiling to expel O_2 , $FeSO_4$ is added, without admitting air, followed by an excess of H_2SO_4 , and the unoxidized $FeSO_4$ is titrated with $K_2Cr_2O_7$ in the presence of H_3PO_4 and Ba diphenylaminesulphonate.—A. R. P.

Electrolytic Zinc: The Determination of Small Amounts of Germanium. Harald Lundin (*Trans. Electrochem. Soc.*, 1933, 63, 149-153; discussion, 153).—For abstract of the paper see *J. Inst. Metals*, 1933, 53, 320. In the discussion U. C. Tainton said that the flue dust produced at the East Helena plant of the American Smelting and Refining Co. contained about 2 lb. of germanium per ton and that about 1000-2000 lb. of the metal per month could be produced from this source if there were any demand for it.—A. R. P.

Determination of Molybdenum and Lead by Fajans's Method. Z. Raichinschten and N. Korobov (*Zhurnal Obshtchey Khimii (Journal of General Chemistry)*, 1933, [A], 3, 531-533).—[In Russian.] The method previously de-

scribed (*J. Inst. Metals*, 1933, 53, 321) is shown to be more rapid than other procedures for the determination of Mo or Pb.—M. Z.

A New Volumetric Determination of Niobium in the Presence of Tantalum. Victor Schwarz (*Angew. Chem.*, 1933, 46, 552–553).—The mixed oxides are fused with KHSO_4 , the fused cake is leached with concentrated H_2SO_4 , and the solution poured into dilute H_2SO_4 containing 5 grm. of tartaric acid. The solution is then shaken in a bulb-shaped stoppered funnel with 3% Zn amalgam in a current of CO_2 for 1 hr., whereby complete reduction of Nb_2O_5 to Nb_2O_3 is stated to occur. The dark-coloured liquid is treated with an excess of FeCl_3 and the excess is titrated with TiCl_3 using KCNS as indicator.—A. R. P.

Influence of Iron and Aluminium on the Accuracy of Determination of Tin in Copper-Zinc Alloys. M. I. Shubin (*Zavodskaya Lab.*, 1933, (1), 25–33; *C. Abs.*, 1933, 27, 5676).—[In Russian.] At 1% Sn absorption of Fe raises the result 0.05% for 0.2% Fe, 0.10–0.15% for 1–3% Fe, and 0.03–0.06% for 1–4% Al.—S. G.

Determination of Tin in Babbitt Metal by Reduction with Zinc. A. A. Botchvar and A. M. Potapova (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, 319–321; *C. Abs.*, 1933, 27, 3895).—[In Russian.] Dissolve a 0.2–0.5 grm. sample in 30 c.c. HCl (d 1.2) with a small quantity of KClO_3 (0.5–1 grm.). Boil for 10 minutes to remove Cl_2 , add 3 grm. Zn, boil for 15–20 minutes until all Zn is dissolved, and then 1–2 minutes more to ensure the complete solution of the Sn. Remove from the flame, introduce a small piece of coarse-grained marble, cool rapidly under tap-water without shaking, and titrate with I_2 .—S. G.

Determination of Small Quantities of Zinc in Aluminium. M. I. Shubin (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, 147–162; *C. Abs.*, 1933, 27, 3681).—[In Russian.] Dissolve 5–10 grm. of metal in 125–250 c.c. of 20% NaOH solution. Dilute to 250–400 c.c. and filter. To the filtrate add 10–15 c.c. of 20% NaOH solution which has been saturated with H_2S . Boil and filter off the insoluble sulphides. Discard the filtrate. Dissolve the precipitate in 25–32 c.c. of 6*N*- H_2SO_4 , boil to remove H_2S and oxidize with H_2O_2 . Make the solution slightly basic by adding NH_4OH , boil off excess NH_3 and filter after adding 1–2 c.c. of 25% NH_3 solution. To the filtrate add 4–5 c.c. more of the strong NH_3 solution and electrolyze.—S. G.

†**Rapid Methods for the Determination of Zinc in Galvanized Iron.** E. Azzarello, A. Accardo, and A. Scalzi (*Riv. tec. ferrovie ital.*, 1933, 43, 267–289; *C. Abs.*, 1933, 27, 5677).—The methods for examining galvanized metals are reviewed and a bibliography is appended. Two methods for determining total Zn are modified as follows: (A) Treat the sample of galvanized Fe (in a special apparatus) with dilute H_2SO_4 and measure the volume of H_2 evolved. Titrate the Fe^{++} in the solution with KMnO_4 . (B) Plunge the sample into dilute H_2SO_4 for 10–20 seconds, whereby the greater part of the zinc is dissolved with relatively little Fe. Electrolyze the solution for Zn, using as anode the material undissolved by the dilute H_2SO_4 and as cathode Pt gauze.—S. G.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

(See also “Testing” and “Temperature Measurement and Control.”)

A New Differential Dilatometer. Otakar Quadrát and Rudolf Pospíšil (*Chim. et Ind.*, 1933, Special No. (June), 623–630; *C. Abs.*, 1933, 27, 5582).—A detailed description is given of the construction, operation, and application to the calculation of the true expansion coeff. of an optical dilatometer, in which the defects of previously proposed instruments have been eliminated.—S. G.

The Thermal Expansions of Certain Crystals with Layer Lattices. Helen D. Megaw (*Proc. Roy. Soc.*, 1933, [A], 142, 198-214).—Apparatus for the X-ray measurement of the expansion of crystals between 0° and 100° C., with possible extension down to the temperature of liquid air, is described.—J. T.

A Simple Universal Camera for Röntgen Crystal Structure Analysis. E. Sauter (*Z. Krist.*, 1933, 85, 155-159; *C. Abs.*, 1933, 27, 3643).—A new type of camera is described in which the film may be in the form of a sheet, cone, or cylinder. The apparatus is particularly useful in investigations in the field of X-ray studies of metals.—S. G.

***The Dependence of the Focussing Effect Associated with the Use of Bent Crystals in X-Ray Spectroscopy on the Bending Mechanism of the Crystal.** Erik Carlsson (*Z. Physik*, 1933, 84, 801-810).—The focussing effect associated with the use of a crystal bent into the form of part of a circular cylinder in X-ray spectroscopy is discussed mathematically and experimentally.—J. T.

***A High-Vacuum X-Ray Spectrometer Employing a Concave Crystal as Suggested by Johann.** Arne Sandström (*Z. Physik*, 1933, 84, 541-556).—A high-vacuum, focussing X-ray spectrometer is described and its use and accuracy are discussed.—J. S. G. T.

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

***A Plane-Bending Fatigue-Testing Machine of the D.V.L. (Deutsche Versuchsanstalt für Luftfahrt) and Some Results Obtained with It.** Kurt Matthaes (*Metallwirtschaft*, 1933, 12, 485-489).—Sheets, profiles and tubes of metal can be tested in the new machine, in which the applied bending moment is approximately constant throughout the length of the specimen. Alternating bending tests with a superimposed constant bending stress and alternating torsion tests can also be made with the machine. The results for round rods agree exactly with those obtained on the Schenck machine. The fatigue limit of shaped sections is generally much lower than that of plain test-pieces.—v. G.

***On the Endurance Testing of Various Materials with the MAN Alternate Bending Machine.** A. Jünger (*Mitt. Forsch. Anst. G.H.H. Konzern*, 1930, 1, (1), 8-18).—A modification of the Wöhler alternate bending test is described, with the results of tests on 25 materials, mainly ferrous, but including sand-cast Elektron and 2 samples of Duralumin. The method is further applied to the testing of welded samples and to investigating the effects of surface finish.

—P. M. C. R.

Further Endurance Tests on Various Materials with the MAN Alternate Bending Machine. A. Jünger (*Mitt. Forsch. Anst. G.H.H. Konzern*, 1931, 1, (3), 45-58).—The MAN apparatus (see preceding abstract) is applied to further investigations of the effects of surface finish, to the endurance testing of welded samples, including aluminium alloy sheet and 70:30 copper-nickel sheet, and to combined corrosion and endurance tests. The last-named series were performed on ferrous pieces only.—P. M. C. R.

***Testing of Thin Sheets.** M. v. Schwarz and K. Christoph (*Metallwirtschaft*, 1933, 12, 476-477).—If t mm. is the depth of penetration in the Erichsen test for sheet d mm. thick having a tensile strength of s_B kg./mm.² and an elongation of $\delta_{10}\%$ then the following expression holds for numerous metals and alloys: $t - \sqrt{10d} = 0.019s_B + 0.15\delta_{10} + 1.7$.—v. G.

***Grain Measurements on Technical Compression Test-Specimens.** W. Tafel and H. Waschek (*Metallwirtschaft*, 1933, 12, 445-447, 460-463).—A mathematical method is given for calculating the true grain-size of a metal from measurements made of the area of grains in two sections. With the aid of this method the deformation of the crystal grains during compression tests

has been followed. The compression of the grains increases from the edges towards the centre. A relatively large deformation also occurs in the vicinity of the end-surfaces. This is in direct opposition to the theory that cone-shaped regions under the end-surfaces take no part in the deformation.—v. G.

Wire and Tube Flaw Locator. Anon. (*Instruments*, 1933, 6, 88).—Tungsten or molybdenum wire or copper tubing is passed through one or two coils connected in oscillator circuits. The presence of flaws is detected by changes in the induced currents.—J. C. C.

The Modulus of Elasticity of Metals at Different Temperatures. A. Mitinsky (*Chim. et Ind.*, 1933, Special No. (June), 616–619; *C. Abs.*, 1933, 27, 5696).—A simplified bending tester is placed in a furnace; the test-piece lies freely on 2 supports and the load is applied in the centre; the displacement of the free end projecting outside the furnace is measured by means of a delicate micrometer. Results are given and discussed of determinations of the modulus of elasticity of various steels and brasses carried out at temperatures of 20°–800° C.—S. G.

A New Method of Determining Elastic Moduli. Paul Le Rolland and Pierre Sorin (*Technique moderne*, 1933, 25, 472).—Full abstract of a paper read before the Académie des Sciences. See also *J. Inst. Metals*, 1933, 53, 518.—R. B. D.

The Determination of Tensile Strength of Welded Joints. W. Hoffmann (*Elektroschweissung*, 1933, 4, 87–88).—The usual type of tensile test-piece is of little use owing to the reduction of area of the parent metal on each side of the weld. Reliable figures are given on test-pieces in which the weld is at the centre of a reduced section formed by removing equal circular segments, the radius of which is proportional to the thickness of the material. Test-pieces made from deposited metal gave unreliable results. (The results refer to steel.)—H. W. G. H.

New Tensile Strength Tester. Anon. (*Instruments*, 1933, 6, 103).—A simple testing machine, in which the load is indicated on a dial-type spring dynamometer, is described and illustrated.—J. C. C.

Tensile Strength Tester. Anon. (*Instruments*, 1933, 6, 199).—A small motor-driven horizontal pendulum-type testing machine for testing wires or light sheet material is briefly described.—J. C. C.

Measurement of Abrasive Hardness of Metallic Surfaces. R. J. Piersol (*Metal Cleaning and Finishing*, 1933, 5, 321–325; *C. Abs.*, 1933, 27, 5285).—A discussion of hardness testing methods and experimental equipment developed to measure the abrasive resistance of metal surfaces.—S. G.

***The Influence of a Linear State of Stress on the Ball Hardness [of Metals].** Hans Kostron (*Metallwirtschaft*, 1933, 12, 473–476).—To determine the effect of internal stresses on the Brinell hardness of metals hardness measurements have been made during loading of the specimens in a tensile machine or in a press. Tensile stresses reduce the hardness (by up to 10% for the mild steel tested), whilst compression stresses are without action.—v. G.

A Simple Hardness Testing Apparatus. G. Oehler (*Werkstatt u. Betrieb*, 1933, 66, 412–413).—A method is described for determining approximate hardness values by comparison with standard pieces. The application is mainly to ferrous materials.—P. M. C. R.

Apparatus for the Control of Materials. Anon. (*Technique moderne*, 1933, 25, 403).—Hardness testing machines of new design of the Rockwell and direct-reading Brinell types are described—particularly adapted for the testing of nitrated steels and thin sheets. The internal construction of the Guillery machine is schematically depicted.—R. B. D.

New Apparatus for Measuring Hardness [Microbilleur]. — (*Technique moderne*, 1933, 25, Suppt. (June 15), 29).—A brief description of the “Microbilleur” in which a hammer falls on a head carrying a penetrator (ball, or sphero-conical diamond). The hardness is determined by the diameter of the

impression. The apparatus is stated to be particularly suitable for thin sheet and for very hard surfaces; up to 980 Brinell can be accurately determined.

—R. B. D.

Wire Hardness Tester [Durosokop]. Anon. (*Instruments*, 1933, 6, 104).—The "Durosokop" measures hardness by the angle of rebound of a falling pendulum. For testing wire, a cylindrical anvil is used which strikes across the wire. Cf. *J. Inst. Metals*, 1932, 50, 246, 369, 627.—J. C. C.

Instrument for Testing Hardness of Wire [Durosokop]. Anon. (*Canad. Mach.*, 1933, 44, (10), 37).—The Durosokop is described. Cf. *J. Inst. Metals*, 1932, 50, 246, 369, 627.—P. M. C. R.

Die Filling, Hardness, and Wedging of Dust Pressed Tiles. Harry W. Webb (*Trans. Ceram. Soc.*, 1933, 32, 218-246).—Contains a useful general note on hardness.—S. V. W.

Micro-Calipers for Measurement of External Diameters. Anon. (*Anz. Berg-, Hütten- u. Masch.*, 1933, 55, (76), 5-6).—Some recent improvements in calipers and snap gauges are described.—B. Bl.

The Development of Testing of Wire Mesh. Hans Hecht (*Tonind. Zeit.*, 1933, 57, 483-484).—Apparatus, e.g. micrometers and microscopes, for testing wire mesh is described.—B. Bl.

RADIOLOGY

Recent Progress in X-Ray Inspection of Welds. Herbert R. Isenberger (*Canad. Mach.*, 1933, 44, (11), 34 and 36).—Abbreviated from a paper read before the American Society of Mechanical Engineers. See *J. Inst. Metals*, 1933, 53, 569.—P. M. C. R.

New Method for [Making] Angle-Exposures in X-Ray Investigations on Welded Joints. W. Grimm and F. Wulfi (*Autogene Metallbearbeitung*, 1933, 26, 120-123).—Faults in V- and X-welded joints can be clearly identified only if the X-ray beam is parallel to the chamfered edges of the sheets. This necessitates two exposures. It is proposed that these should be made on the same film. Examples are illustrated of the two exposures separately and superimposed.—H. W. G. H.

***Gamma-Ray Radiographic Testing.** Gilbert E. Doan (*J. Franklin Inst.*, 1933, 216, 183-216, 350-385).—A comprehensive survey of the subject. The nature and properties of γ -rays are described together with the sources and their rates of decay. The rate of action of the rays on photographic films, exposure times for steel and other objects, the sensitivity of the method for detecting flaws and the like, are discussed at some length. If 7 or more objects of steel 1 in. thick are exposed simultaneously, the cost of testing objects of this thickness is less than for testing single objects by X-rays. Above 4 in. the cost is less with γ -rays even for single exposures. The principal advantages of the method are: (a) portability of the apparatus; (b) the simplicity of its operation; (c) the capacity to test very thick sections of metal; (d) the ability to test a great many objects at one time; (e) the low operation, maintenance and obsolescence costs. 23 references are given.

—S. V. W.

XII.—TEMPERATURE MEASUREMENT AND CONTROL

Temperature Measuring Apparatus and Its Application in the Foundry. Erich Becker (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 54, 389-390, 409-411, 455-457).—The principles, method of use, and applications in the foundry of the 4 chief types of pyrometer equipment are described. These types are those depending on (1) alteration of volume or length, (2) alteration in electrical conductivity, (3) alteration of e.m.f. of metal couples, and (4) alteration of radiation from heated bodies.—J. H. W.

†**Colour Pyrometry.** Gustav Haase (*Arch. tech. Messen*, 1933, 3, (28), T133–T134).—A survey of the principles of colour pyrometry, with descriptions of Mesuré and Nouel's pyroscope, Arons' chromoscope, Helmholtz's leucoscope, the Naeser pyrometer, and of a recent development involving two photo-cells, sensitive respectively to red and green radiations. The working range, sensitivity, and accuracy of each type are described.—P. R.

Thermo-Elements. Georg Keinath (*Arch. tech. Messen*, 1933, 2, (19), T10).—The e.m.f. developed at various temperatures is shown graphically for tellurium/platinum, 1% tellurium/1% antimony-platinum, Constantan/nickel-chromium, platinum/platinum-rhenium H_2 , and H_2 , platinum/platinum-rhodium, molybdenum/1% ferro-tungsten. The properties and appropriate temperature ranges of several types of "noble" and "base" metal couples are discussed; the tungsten-molybdenum couple is placed with the former on account of its high working range (up to 3000° C., if the molybdenum is alloyed with 1% iron), although it requires special protection against deterioration. Among base-metal couples, nickel/chrome-nickel, "platinum substitute," nickel/carbon, tellurium/platinum are especially discussed: working temperatures are given for these, as well as for several base-metal couples in common use.—P. M. C. R.

***Investigations on Platinum/Platinum-Rhodium Thermocouples.** V. N. Bozhovskii and B. V. Drozdov (*Trudi Vsesoiznago Nauchno-Issledovatel'skago Instituta Metrologii i Standardizatsii (Trav. Inst. Métrol. Standardisation (U.S.S.R.))*, 1932, 2, 3–19; *C. Abs.*, 1933, 27, 4142).—[In Russian, with French abstract.] The e.m.f. produced by Russian-made platinum/platinum-rhodium (alloy 10% rhodium) thermocouples, and the variation of e.m.f. due to time of heating and purity of platinum were determined. Tests carried out with the thermocouples made by the (Russian) Institute of Metals, Platinum Institute, Sverdlovsk Works, and others showed that the e.m.f. is near to or within 10.20–10.40 mv. at 1063° C. (temperature of cold-junction 0°), being of the same accuracy as the non-Russian makes. The variation of e.m.f. after prolonged heating at 1000° C. was ± 20 microvolts corresponding to $\pm 2^\circ$. Considerable variation of the platinum potential was observed after heating, especially for platinum of inferior purity, while the platinum-rhodium alloy potential remained practically the same.—S. G.

***Thermoelectric Temperature Scale of the Pt/Pt Rh Thermocouple.** Katashi Bitō and Mototarō Matsui (*Kōgyō Kwagaku Zasshi (J. Soc. Chem. Ind., Japan)*, 1933, 36, (7); *C. Abs.*, 1933, 27, 4970).—[In Japanese, with English abstract in supplemental binding, pp. 421–424.] Experimental procedure and results are reported of a comparison of the International Temperature Scale (calculated from $E = a + bt + ct^2$ with melting points of antimony, silver, and gold as fixed points) with scales obtained by calculation from $t = a + bE + cE^2$ for the same fixed points and from both equations for melting points of zinc, antimony, and silver as fixed points. In these equations E is the e.m.f. in $\mu v.$ and t the temperature. The cold-junction is at 0° C.—S. G.

***The Treatment of a Pt/Pt-Rh Thermocouple.** Katashi Bitō and Mototarō Matsui (*Kōgyō Kwagaku Zasshi (J. Soc. Chem. Ind., Japan)*, 1933, 36, (7); *C. Abs.*, 1933, 27, 4970).—[In Japanese, with English abstract in supplemental binding, pp. 424–426.] Cf. preceding abstract. Freezing point determinations on gold, silver, antimony, and zinc were made to determine the results of exposure of the couple, in a porous porcelain tube, to a reducing atmosphere. The couple was seriously contaminated, especially by antimony, but it could be restored by cleaning with dilute hydrochloric acid, or nitric acid, molten borax, and electric annealing at 1500° C.—S. G.

The Measurement of Thermal Radiation. Ernst Otto Seitz (*Arch. tech. Messen*, 1933, 3, (25), T93).—Total radiation is defined in terms of wave-length, and the general principles of its measurement are explained. The thermo-

couple, the bolometer, the radiometer and micro-radiometer, and the pyrheliometer are described in detail, and their calibration is considered. The pyrometric application of radiation instruments is described.—P. M. C. R.

†**Electrical Temperature Measuring Apparatus.** Fritz Beck (*Metallwirtschaft*, 1933, 12, 561-562, 575, 589-590, 605).—The following types of instrument are described: resistance thermometers, thermocouples, contact thermocouples, optical and total radiation pyrometers, and information is given on their use in technical measurements, on the physical principles on which they are based, and on their manipulation.—v. G.

New Line of Indicating Pyrometers. Anon. (*Instruments*, 1933, 6, 129).—An illustrated note describing some recently-introduced thermo-electric instruments.—J. C. C.

Multi-Point Temperature Indicator. Anon. (*Instruments*, 1933, 6, 125).—A Wheatstone-bridge type of indicator which can be connected to any of 8 thermo-sensitive resistance coils is illustrated and briefly described.—J. C. C.

A Simple Constant Temperature Control Circuit. H. Clarke (*J. Sci. Instruments*, 1933, 10, 329-330).—A note describes a valve circuit for use with temperature controlling devices.—W. H.-R.

Apparatus for Thermal Control. Anon. (*Technique moderne*, 1933, 25, 425-426).—The toroidal mercury transmitter (consisting of a coiled glass tube with a platinum wire sealed into it and containing a certain quantity of mercury) can be used for transmitting to a distance measures of pressure, &c., or of the degree of movement of a movable member, by the movement of the mercury causing a variation of the circuit resistance. This variation can be used to reinstate equilibrium of a Wheatstone bridge in the case of temperature registration or to vary the equilibrium in the case of temperature regulation. In conjunction with this the "logometre" is used to overcome the effect of variation (during test) of the voltage applied to the Wheatstone bridge, whilst the mercury transmitter is applied in the "de programme" regulator to the regulation of heating and cooling to specific heating or cooling curves.—R. D.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

Recommendations for the Design of Non-Ferrous Castings. H. F. Seifert, L. H. Fawcett, and T. D. Stay (*Trans. Amer. Found. Assoc.*, 1933, 41, 518-526).—Report of a sub-committee of the A.F.A. giving recommendations for the detailed design of castings, selection of alloy, and choice of pattern equipment, with the object of enabling, by a better co-operation between founder and designer, the production of better and cheaper castings.—R. B. D.

Piston Manufacture. Anon. (*Automobile Eng.*, 1933, 333, 411-415).—The foundry practice involved in the manufacture of B.H.B. self-adjusting pistons in Hiduminium R.R. 53 alloy is dealt with. The pistons are die-cast and the selection of material, method of melting, type of dies used, casting procedure, and temperature control are considered in detail. After casting, two heat-treatments are given in the foundry, the pistons being heated in a continuous muffle furnace and quenched in boiling water, and this treatment is followed by ageing at carefully controlled temperatures for 18 hrs., followed by quenching in cold water. Heat-treated pistons and small castings up to 5 and 6 lb. are produced in quantity.—J. W. D.

The Utilization of Copper from Secondary Metals and Slags. P. S. Belonogov (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, 357-360).—[In Russian.]—S. G.

How is Flawless "Aluminium-Bronze" Made? E. T. Richards (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 44, 411-421).—"Aluminium-bronze" (copper

with 7–10% aluminium) may contain up to 5.5% iron, 3–4% manganese, and 5% nickel; zinc, lead, and especially silicon are harmful, although lead up to 1–2% is sometimes added to improve the machinability of the alloy. Careful deoxidation before the addition of aluminium to the melt is necessary; aluminium-containing scrap should not be used in the charge. The preparation of the moulds, charging in the constituents, and melting and casting the alloy are described. A casting temperature of 1175°–1200° C. is recommended.

—J. H. W.

On the Question of Melting and Casting Copper-Nickel Alloys. W. O. Hagen-Torn (*Metallurg (The Metallurgist)*, 1932, 7, 65–112).—[In Russian.] Experiments on the melting of copper-nickel alloys have shown that porosity in alloys free from volatile metals, such as zinc, is due to adsorbed gases. Good, non-porous castings may be obtained (a) by melting under charcoal in a slightly oxidizing atmosphere using solid deoxidizers, or (b) by melting in a reducing atmosphere under conditions which promote the escape of adsorbed gases. The alloys should be cast at about 150° C. above the melting point with a slow rate of pour. When flat open moulds are used method (b) should not be employed; only method (a) gives sound castings.—M. Z.

***A Practical Foundry Test on the Effect of Phosphorus, Aluminium, and Silicon on Leaded Bronze.** Harold J. Roast (*Trans. Amer. Found. Assoc.*, 1933, 41, 82–97, with discussion; and *Met. Ind. (Lond.)*, 1933, 43, 33–36, 443–446).—Experiments on (A) journal bearing castings of bronze with copper 70, tin 6, lead 21, and zinc 3% and with (B) large locomotive drivers cast in copper 75, tin 8, lead 15, and zinc 2% show that (1) phosphorus up to 0.05% is not injurious to either alloy but necessitates lower casting temperatures, (2) aluminium up to 0.05% gave a fracture of poor appearance with both alloys and, whilst having no effect on the surface appearance of (B), caused a silvery-white surface on (A), and (3) 0.05% silicon produces a white surface with both alloys, but with (B) has no influence on the fracture structure.—R. B. D.

†The Influence of Design on Brass and Bronze Castings. L. H. Fawcett (*Trans. Amer. Found. Assoc.*, 1932, 40, 360–374; and (abstracts) *Met. Ind. (Lond.)*, 1933, 42, 471–474; *Found. Trade J.*, 1933, 47, 111–113).—The relation of design to ease of production in the foundry, choice of suitable alloy, and arrangement of pattern in order to attain soundness are discussed. Composition and properties of some U.S. Navy bronzes and brasses are given. Examples are given showing the effect of design on the properties of the casting. Great stress is laid on evenness of section.—R. B. D.

Magnesium—Its Founding and Metallurgy. P. Bastien (*Bull. Assoc. Tech. Fonderie*, 1933, 7, 383–390).—The physical and chemical properties are reviewed with particular reference to their effect on the founding and on the corrosion-resistance, and the classes of alloys normally used are briefly described. Magnesium produced industrially either by electrolysis of fused minerals containing $MgCl_2$, or by converting $MgCO_3$ into $MgCl_2$ followed by electrolysis, contains inclusions of $MgCl_2$ and/or KCl which deleteriously affect the corrosion-resistance. The sublimation process of Chaudron and Hérenguel, which removes these and other impurities, has reached semi-industrial scale. The methods of melting and alloying, the melting and refining fluxes used, and the means employed to prevent oxidation and nitration during casting are discussed in relation to sand and chill casting as well as pressure die-casting. The castability of magnesium and its alloys and the effect of repeated remelting and of mould materials on this property are considered at some length, as is the effect of alloy composition on the total (patternmakers) contraction. Several references are given.—R. B. D.

Melting of Elektron from Magnesium Produced by a Soviet Magnesium Plant. P. S. Maiboroda (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, 374–377; *C. Abs.*, 1933, 27, 4201).—[In Russian.] Describes some difficulties

encountered in melting Elektron made from Soviet-manufactured magnesium, and means of overcoming them.—S. G.

Melting of Zinc in the Ajax Induction Furnace. P. A. Zakharov (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, (5/6), 66-68; *C. Abs.*, 1933, 27, 5648).—[In Russian.] Experiments showed that 300-600 kg. charges of zinc may be melted without superheating or volatilization, with 220 v. and 620 amp. The loss in melting (1%) was found to be considerably less than when melting in crucible, reverberatory, or other types of furnace (3-4%). A study of the structure of the melts of zinc with addition of lead and cadmium showed a very uniform distribution of these additions, attributable to the self-stirring of the molten charge in the induction furnace.—S. G.

Light Metal Die-Castings. — Nohl (*Werkstatt u. Betrieb*, 1933, 66, 372-374).—Successful die-casting depends on the combination of casting machine, mould, and material. Each factor is considered. Light alloy castings will take a high surface finish, or will afford a good base for subsequent electrodeposition. Cost, accuracy, life of moulds, and applicability of the method are considered. Illustrations show the use of inserts in avoiding great variations in the thickness of the casting, and a number of other precautions are enumerated.—P. M. C. R.

The Standardization of Moulding Boxes. André Debar (*Bull. Assoc. Tech. Fond.*, 1933, 7, 477-484).—Detailed description with drawings and tables of sizes of the suggestions of D. for the standardization of moulding boxes in metric dimensions.—R. B. D.

†Mould Materials for Non-Ferrous Strip Ingot Casting. G. L. Bailey (*Rolling Mill J.*, 1933, 7, 137-138, 146).—Copper is considered the most satisfactory material for brass-strip ingot moulds, its high thermal conductivity preventing serious temperature gradients and consequent distortion. The article is a detailed discussion of Bailey's findings given in his paper (*J. Inst. Metals*, 1932, 49, 203-226).—A. B. W.

Some Practical Applications of Sand Tests. G. Hénon (*Bull. Assoc. Tech. Fond.*, 1933, 7, 506-513).—The relation between various sand tests and the applicability of those sands to different types of foundry work are discussed and permissible variations of cohesion and permeability for certain moulds are given. The methods of test are indicated and references are given.—R. B. D.

The Control of Methods of Sand Preparation and the Control of Moulds. H. W. Dietert (*Bull. Assoc. Tech. Fond.*, 1933, 7, 471-477).—Exchange paper from the American Foundrymen's Association. Tests on three different types of sands show that (1) the cohesion of green-sand moulds is affected by the method of sand preparation used and the method used has more effect on natural than synthetic sands; (2) the hardness of the rammed mould is less when the sand has been aerated; (3) aerated sand is more sensitive to intensity of ramming; (4) the hardness increases as the "green-cohesion" increases; (5) preparation methods which increase the density (green) increase the hardness; (6) the greater the initial plasticity of the bonding material the more effect has the method of preparation on the cohesion of dry-sand moulds; (7) the permeabilities both green and dry are increased in relation to the amount of aeration and the grain size produced by the preparation; (8) the permeability of a green mould decreases, as the amount of ramming increases, up to a limit, after which it decreases; and (9) the permeability decreases as the mould height increases. Many figures and several formulæ are given.
—R. B. D.

Monorail Materials Handling in the Foundry. J. B. Forker (*Trans. Amer. Found. Assoc.*, 1932, 40, 375-386).—Brief consideration of methods of handling materials in foundries and general survey of applicability of overhead monorail system together with brief details of advantages for specific uses.—R. B. D.

XVI.—REFRACTORIES AND FURNACE MATERIALS

*On the Ceramic Properties of Calcium-Aluminium Silicates and Other Refractories. E. Berl and Fritz Löblein (*Forschungsarbeiten*, 1930, (325), 1-28).—An investigation of the thermal properties of the ternary system calcium oxide-silica-alumina reveals the presence of two minima at 1320° and 1300° C., and two maxima at 1512° and 1525° C. A 3-dimensional model is reproduced. The properties of a series of 20 chemically pure refractory bricks are investigated. Their mechanical strength is found to depend on the silica content, and especially on the temperature of the quartz-cristobalite transformation. The factors influencing softening under load, sensitiveness to changing temperature, and thermal conductivity are discussed. Porosity is shown to decrease the thermal conductivity; basic slags cause the most severe attack. Details as to manufacture are given. Other materials considered are Westerwald quartzite, Austrian magnesite, French and Istrian bauxites, two carborundum-clay preparations, and corundum.—P. M. C. R.

The Manufacture of Slag-Resisting Crucibles in Magnesite and Alumina. H. Salmang and N. Plauz (*Technique moderne*, 1933, 25, 617-618).—Short abstract of an article published in *Arch. Eisenhüttenwesen*, 1933, 6, 341. See *J. Inst. Metals*, 1933, 53, 664.—R. B. D.

XVII.—HEAT-TREATMENT

*A Study of the Heat-Treatment of Alloys of the Aldrey Type. F. A. Borin, A. A. Botchvar, I. P. Velichko, K. V. Gorey, and M. O. Kuznetsov (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, (12), 94-108; *C. Abs.*, 1933, 27, 5701).—[In Russian.] A series of aluminium-magnesium-silicon alloys containing silicon 0.2-0.9, magnesium 0.36-1.54, and iron 0.2-0.3% was made and rolled according to the usual commercial practice. By a combined variation in composition and heat-treatment a product was obtained of better mechanical properties than had been possible heretofore. Tensile strength values of 36 and 38 kg./mm.² were obtained, with corresponding elongations of 15 and 8%. Excess silicon considerably improved the mechanical properties of the alloys with low Mg₂Si content, and 0.5% excess silicon improved the qualities of all the alloys studied; these phenomena are explained on the basis of the solubility relations of the alloy. Quenching from 525° C. followed by tempering at 140°-150° C. for 48 hrs. or longer is recommended for alloys of this type. The most beneficial effect of heat-treatment on the mechanical properties was obtained in the alloys containing 0.7, 0.75, and 0.90% silicon, and 0.40, 0.50, and 0.90% magnesium, respectively, or generally, in the aluminium-magnesium-silicon alloys with 0.4-0.9% magnesium and with an excess of 0.4-0.5% silicon over the amount of silicon theoretically required for the formation of Mg₂Si.—S. G.

XVIII.—WORKING

Stresses in Wire-Drawing. A. C. Blackall (*Wire and Wire Products*, 1933, 8, 232-233).—A résumé of research work carried out by F. C. Lea at Sheffield University and by F. C. Thompson at Manchester University on the stresses in wire during drawing especially when the wire is subjected to back tension. The chief points to be considered are: (1) lubrication; hard soap was used in T.'s experiments; (2) die material; T. used a tungsten carbide die with a Vickers diamond hardness of 1350; (3) surface finish of the die; (4) die angle; 5°-8° is recommended.—J. H. W.

Wet Drawing in Wire Manufacture. Richard Saxton (*Machinist (Eur. Edn.)*, 1933, 77, 533-534r).—The use of a lubricant in wire-drawing facilitates slip, prevents excessive wear, and exercises a restraining influence on the heat generated by the friction. It is the best method of drawing the finer sizes (20 S.W.G. and smaller), but does not permit as great a reduction per draft as dry drawing. The precautions to be taken in drawing various metals and alloys by this method and its practical applications are described.—J. H. W.

The Wire-Drawing Die.—II, III. Kenneth B. Lewis (*Wire and Wire Products*, 1933, 8, 234-239, 243, 251, 266-269).—The die stresses and strains during the drawing operation have been studied and a theoretical discussion of the mechanism of wire-drawing is given.—J. H. W.

Sizing and Resizing Carbide and Diamond Dies for Copper Wire-Drawing. J. J. Kehoe and F. D. Ruhl (*Wire and Wire Products*, 1933, 8, 305-308, 330).—Read before the Wire Association. Describes the process and methods of die sizing and resizing used by the General Electric Co., New York.—J. H. W.

Extruded Condenser Tubes. Anon. (*Marine Eng. & Shipping Age*, 1933, 38, 420-421).—A recent development in condenser tube manufacture is the production of extruded, rolled, and drawn tubes. Tubes are produced by extruding cast billets and the extruded tubes are cold swaged-rolled on a mandrel by a new process which preserves and improves the smoothness of the inside surface. This last operation, which is a combination of forging and rolling, is followed by annealing and cold-drawing, and a final low-temperature annealing in an electric furnace to ensure a fine and uniform grain structure. The tubes manufactured by the process include super-nickel tubes, aluminium-brass tubes, and tubes of an alloy of copper 75, nickel 20, and zinc 5%. The results of physical tests on the various tubes manufactured by the process are given.—J. W. D.

Methods for Fabrication of Nickel-Clad Steel Sheet, Strip, and Wire. Anon. (*Boker Bull.*, 1933, 1, 12 pp.; *Bull. B.N.-F.M.R.A.*, 1933, (60), 7).—Deals with properties, sizes, and finishes, hot- and cold-working, drawing and stamping, joining: welding, soldering, and brazing.—S. G.

"Ferrane" [Aluminium-Iron Bi-Metal]. L. E. Miller (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, 360-369; *C. Abs.*, 1933, 27, 4198).—[In Russian.] Describes experiments carried out with the object of improving the process of manufacture and the properties of "Ferrane" (aluminium-iron bi-metal) sheet and strip.—S. G.

New Special Oils for the Working of Aluminium. K. Krekeler (*Werft, Reederei, Hafen*, 1933, 14, 264-266).—The use of cylinder oils in the rolling of aluminium sheet and foil, whilst to some extent obviating fire, was the cause of surface defects owing to the formation of gummy residual products. Oil specially refined with sulphur dioxide gives better results: its uses and limitations are discussed, together with methods of adapting it to lubricating systems in common use. A suitable oil-water emulsion is recommended for the lubrication of grinding, turning, and drilling; a testing apparatus for such emulsions is described, with directions for use. The increasing use of bitumen in "silvering" paper with aluminium foil is due to the close bond and absence of undesirable products; the process is described.—P. M. C. R.

Drawing Tools for Aluminium Sheet 0.5 mm. or Less in Thickness. F. Habeland (*Werkstatt u. Betrieb*, 1933, 66, 369-370).—Suitable tool forms are described, and shown diagrammatically, for the deep-drawing of aluminium sheet of small section. The various stages of the operation are described, with the necessary adaptations for various thicknesses.—P. M. C. R.

Unique Stamping Process. Anon. (*Metal Stampings*, 1933, 6, 72).—A new process for producing metal stamping blanks has been developed in America, and employs neither the wafer temporary die nor the "tin die." The dies are

said to be particularly adaptable for blanking thin steel, brass, copper, aluminium, bronze, and similar materials of 0.015 in. thickness and thinner.

—J. H. W.

Press Work Pressures. XI.—Embossing. XII.—Coining. XIII.—Forming. XIV.—Coining. Anon. (*Machinist (Eur. Edn.)*, 1933, 77, 472-473, 506-507, 538-539, 568-569).—The sizes and pressures for various operations in working steel, brass, bronze, and aluminium alloys are given.—J. H. W.

Standardization in Cutting and Stamping Tools. H. Stein (*Anz. Berg-, Hütten- u. Masch.*, 1933, 55, (64), 4-6, (65), 4-5).—Discusses the standardization of tools for cutting and stamping metals and gives special examples.—B. Bl.

Machining Aluminium and Its Alloys. Anon. (*Machinist (Eur. Edn.)*, 1933, 77, 501-502).—Selection of tools, cutting speeds, lubricants, angle of tool, use of milling cutters, threading tools, twist drills, and saws are discussed.

—J. H. W.

Getting Optimum Results from Modern Cutting Tool Materials. Joseph Geschelin (*Automotive Ind.*, 1933, 69, 580-583).—The factors governing the selection of tool materials for a given piece of work are considered and summarized. A list of such materials is given; special reference is made to the use of cobalt and molybdenum as ingredients in high-speed steels, to Stellite and its development, J-metal, to the carbides of tungsten and tantalum, and to the recently developed "548" alloy. The latter, an iron-tungsten-cobalt derivative, is capable of profound modification by suitable heat-treatment. A table of recommended practice for J-metal gives average cutting-speeds and feeds for turning, facing, and boring bronze and a variety of ferrous materials.

—P. M. C. R.

Modern Metal-Cutting Materials and How to Select Them. J. M. Highducheck (*Machinery (N.Y.)*, 1933, 40, 12-17).—Recommendations, based on tests carried out by the Westinghouse Electric and Manufacturing Co., are given for cutting speeds and feeds for rough-turning and boring ferrous and non-ferrous metals with tools made of high-speed steels, Stellite No. 3, Stellite J-metal, tungsten carbide, and tantalum carbide. Factors governing the choice of cutting material are discussed.—J. C. C.

XIX.—CLEANING AND FINISHING

Polishing Agents for Metal Coatings and Artificial Materials. E. Belani (*Kunststoffe*, 1933, 23, 156-157; *C. Abs.*, 1933, 27, 4633).—The use of micro-asbestos, *i.e.* asbestos fibres broken up very finely, in polishing agents is recommended.—S. G.

Developments During 1932 in New and Improved Materials and Equipment. Anon. (*Indust. Finishing (U.S.A.)*, 1933, 9, 7-10, 40-41).—A summary of recent developments in metal finishes, including one-coat finishes, metal primers, heat-resistant finishes, refrigerator enamels, lacquers for tinplate food containers, and for other purposes.—E. S. H.

Black Finish on Metal Chemically. C. F. Scribner (*Indust. Finishing (U.S.A.)*, 1933, 9, 15-16).—Directions are given for obtaining a black finish on copper, brass, or bronze, and a steel grey on brass.—E. S. H.

XX.—JOINING

V.D.M. Process for Joining Copper Tubes. Anon. (*Apparatebau*, 1933, 45, 88-89; also *Z.V.d. Kupferschmied.*, 1933, 45, 117-118).—Description of a simple joining method (by means of a suitable thread) for copper tubes in water installations.—M. H.

Assembly Involving Many Welds Now Produced in Single Operation by Hydrogen-Electric Welding Process. T. M. Rude (*J. Amer. Weld. Soc.*, 1933, 12, (4), 4-6).—Copper brazing in an atmosphere of hydrogen is particularly applicable to quantity production, on which basis it possesses great advantages in time-, material-, and labour-saving over other methods of joining steel parts. Joints stronger than the steel itself are obtained, an interstitial alloy of approximately 97% iron and 3% copper being formed. A large furnace for continuous operation is illustrated.—H. W. G. H.

The Resistance Welding of Aluminium and Its Alloys. D. I. Bohn and G. O. Hoglund (*Welding Eng.*, 1933, 18, (6), 25-29).—Spot and seam welding are discussed at some length, and butt-welding more briefly. Resistance welds of aluminium alloys must be made with the metal in the molten state. The temperature gradient from the weld to the surface of the sheet must therefore be extremely high, and the great thermal conductivity of the material necessitates the application of immense power for a very short period. Synchronous control of the welding current is highly desirable for spot welding, although good results may be obtained without it by the use of "projection" electrodes; for seam welding, it is essential. Seam welding is recommended in preference to spot welding. Butt-welding offers no special difficulties except the need for great power, but experiments in flash welding have met with little success.

—H. W. G. H.

Some Economic Aspects of Welding Aluminium. D. E. Roberts (*Welding*, 1933, 4, 111-114).—See *J. Inst. Metals*, 1933, 53, 586, 720.—H. W. G. H.

Welding Non-Ferrous Process Piping. Anon. (*Oxy-Acetylene Tips*, 1933, 12, 197-201).—Describes modern practice in jointing aluminium and copper piping for chemical work. In addition to true welds, bronze-welded, silver soldered, and sweated joints are suggested for copper piping.—H. W. G. H.

Welding Copper-Alloy Tanks with the Carbon Arc. Anon. (*Welding Eng.*, 1933, 18, (4), 13).—Everdur shells for hot-water heaters are welded by carbon arc, using not a filler rod, but a flux consisting of 90% fused borax and 10% sodium fluoride.—H. W. G. H.

Welding with Copper Alloys. G. T. Piersol (*J. Amer. Weld. Soc.*, 1933, 12, (2), 22-24).—The effect of cuprous oxide in copper on welding behaviour is discussed, and some remedies—the use of deoxidized copper, brazing, or silver soldering—are suggested. Everdur is recommended as the most weldable of the high copper alloys, and its properties are described. Everdur No. 9, containing 57% copper, 42% zinc, $\frac{1}{2}$ % manganese, and some silicon, is used in the form of extruded sections for architectural work, and can be gas welded to give joints which are undetectable after polishing. Tobin bronze is the most satisfactory material for general oxy-acetylene welding, being used as filler rod for all brasses, nickel silver, steel, cast-iron, copper, and Monel metal.—H. W. G. H.

Notes on Welding Sheet Brass. Anon. (*Indust. Gases*, 1932, 13, 215-217).—The usual instructions in technique are given.—H. W. G. H.

The Use of Lead Burning in the Manufacture of Lead Batteries. Anon. (*Electric Vehicles and Batteries*, 1932, 16, 244-247).—An illustrated account is given of the lead-burning operations carried out in an accumulator factory. For train cells, the plates are laid flat in a jig and welded to cast bridge lugs. For bus lighting cells, the plates and bridges are cast in one piece, and the bridges subsequently built up and strengthened by lead burning. For car starter batteries, the plates are held upright in a jig, and the bridge, instead of being cast, is built up by lead burning.—J. C. C.

Welding Technique for Nickel and Nickel-Rich Alloys. Herbert Herrmann (*Iron Age*, 1933, 132, 25-26, 70).—Abstracted from the *Metallurgist* (Suppt. to *Engineer*), 1933, 9, 30-32. See *J. Inst. Metals*, 1933, 53, 587.—J. H. W.

Instructions for Finishing Welded Plates of Monel Metal and Pure Nickel. W. F. Burchfield (*Welding Eng.*, 1933, 18, (7), 24-26).—Abstracted from the International Nickel Company's Bulletin No. T.S.-5.—H. W. G. H.

First Nickel-Clad Water Storage Heater. Anon. (*Welding*, 1933, 4, 12 and 21).—An illustration, showing design details, and description of a 1000-gall. water storage heater, working at 90 lb./in.², fabricated from $\frac{5}{8}$ -in. nickel-clad plate.—H. W. G. H.

Left- or Right-Hand Welding? [for Steels, Monel Metal, and Nickel]. F. Hermann (*Autogene Metallbearbeitung*, 1933, 26, 145-150).—The advantages of "rightward" over "left-hand" welding, for steels, Monel metal, and nickel, are reviewed. The former method, in which the blow-pipe precedes the welding rod, is faster and more economical in gas, gives a smaller and neater bead, and produces less distortion. Greater protection of the molten metal by the welding flame results in more ductile welds, on account of their freedom from oxides and nitrides. Greater heat concentration produces lower cooling stresses.—H. W. G. H.

The Use of Monel Metal for Obtaining Workable Welds in Pieces of Iron. Anon. (*Rev. Nickel*, 1933, 4, 92-94).—The use of Monel metal instead of iron electrodes in arc welding is suggested, in order to obviate the formation of the very hard and unworkable cementite. Photomicrographs and illustrations of work done by this method are included.—W. A. C. N.

Welding Tests on Cast-Iron and Non-Ferrous Metals. Th. Weiss (*Welding Industry*, 1933, 1, 83-85).—An account, illustrated by photomicrographs, of the results of tests on welds produced in wrought and cast aluminium, brass, and cast-iron, using "RU" universal flux.—H. W. G. H.

Informal Communications of the Committee on Welding of the Verein Deutscher Ingenieure. — (*J. Amer. Weld. Soc.*, 1933, 12, (5), 27-30).—A list of researches, giving the name of the worker, the state of progress, and the publication reference, if any.—H. W. G. H.

Macrography Applied to Welds. E. C. Rollason (*Welder*, 1933, 4, (41), 9-14).—Defects which can be detected by macroscopic examination are classified and described. The technique recommended is suitable mainly for steel. The Schmuckler milling test is mentioned and its application illustrated.

—H. W. G. H.

Welding Design—No. 1, Distribution of Stresses in Welded Structures. C. Helsby (*Welding Industry*, 1933, 1, 5-9, 45-48).—Refers to structural steel welding, but is of wider interest. The necessity for ductile welds is emphasized. Two types of distortion are produced: that from the relief of rolling and straightening stresses in the members, and that from the contraction of the weld metal. The design of welded structures follows closely the practice usual for reinforced concrete, the joints being almost rigid connections. Allowance must be made for induced wracking stresses, which are usually considerable. Excessive deflection must be guarded against by suitable cross-bracings. Butt joints require careful preparation, and lap joints, with fillet welds, are more frequently employed on account of the greater tolerances permissible. A table is given, showing the relative value of welds in tension, compression, and shear, their cubic contents, and the approximate times taken to execute them. An example is also given to explain the application of this table to the design of a typical welded joint.—H. W. G. H.

Stress Distributions in Fusion Joints of Plates Connected at Right Angles. E. G. Coker and R. Russell (*Welder*, 1933, 4, (42), 11-13; also *Electric Welding*, 1933, 2, 148; discussion, 149-151; and *Syren and Shipping*, 1933, 147, 59-60).—An abstract of a paper read before the Institution of Naval Architects, describing the application of photo-elastic methods to examine the effects of bending moment. Stress concentration is found to take place at points where changes of angle or of cross-section occur, especially where the change is abrupt. Internal discontinuities are a serious source of danger.—H. W. G. H.

Tests on the Fatigue Limit of Welded Joints Subjected to Repeated Tension Stresses. Otto Graf (*J. Amer. Weld. Soc.*, 1933, 12, (8), 30-32).—It is shown that butt-welds can be made of higher fatigue strength than riveted joints of similar design, but faults in the former are of far greater effect than faults in the latter, so that the relation between the fatigue strength and work stress must be different for each type of joint, except where the weld can be proved flawless by careful tests. Joints made by straps with longitudinal fillet welds and with fillet welds at the butt ends, although in considerable use for withstanding static loads, are not to be recommended where the stressing is due to repeated loads. Cover-plates over a butt-weld, with fillet welds to the plates, give a stronger joint only if the butt-weld is unsatisfactory. Considerations of design are illustrated in the article, the purpose of which is to prove that existing specifications, for fixing safe stresses on welded joints, require revision.

—H. W. G. H.

Stresses in Butt-Welds. A. C. Vivian (*Welder*, 1933, 4, (37), 1-6).—Poor test-results on welded joints may be due to faulty design as well as to faulty material or workmanship. Distortion after welding may cause the test-piece to be eccentrically loaded in the testing machine, thus giving low results. The internal stresses in a butt-weld may be illustrated by rubber models. The stresses due to temperature differences are higher than the yield-point at various temperatures during cooling, so that there must be high initial stress in an unannealed welded joint.—H. W. G. H.

Heat Stresses in Welded Bars. Karl Melcher (*Elektroschweissung*, 1933, 4, (1), 7-9).—An account of experiments made by sawing off strips for the specimens and noting the amount of distortion.—H. W. G. H.

Welding of Pressure Vessels. Anon. (*J. Amer. Weld. Soc.*, 1933, 12, (2), 13-15).—Some recent additions to the American Society of Mechanical Engineers' boiler construction code are discussed, with special reference to the proper method of attachment of nozzles, the reinforcement of openings cut in shells or heads, and the weakening effect of holes cut in a cylindrical shell. Dimensioned drawings are given to show acceptable types of fusion welded nozzle construction.—H. W. G. H.

Welded Spiral Seams in Pressure Vessels and Boilers. Anon. (*Welding Industry*, 1933, 1, 17-19).—The stresses on longitudinal seams are double those on circumferential seams. A spiral seam at 45° or less to the highest ring stress may be considered about 50% stronger than an ordinary longitudinal seam.—H. W. G. H.

Removing the Hazards in Welding Tanks Containing Inflammable Vapours. W. E. Archer (*Welding Eng.*, 1933, 18, (5), 14-15).—It is found practicable to conduct welding operations on a petrol tank without the expense and trouble of steaming, or loss of petrol, by injecting sufficient carbon dioxide to give a content of 40% in the gases in the tank. The actual safety limit is 28% of carbon dioxide.—H. W. G. H.

Effect of Fillet Welds on Eccentricity. James R. Griffith (*Welding*, 1933, 4, 9-11).—When a structural angle is connected to a gusset plate by means of one leg, eccentricity exists. There is little difference in stress distribution with rivets or fillet welds. It is shown to be unsound to compute the distribution of the fillets from the distance from the neutral axis of the angle, and equal distribution gives the best results.—H. W. G. H.

Representation of Fillet Welds by Symbols. — Faltus (*Elektroschweissung*, 1933, 4, 113).—It is not considered sufficient to specify a fillet weld by the "throat" only, and it is suggested that the leg-length be given with an indication of the shape of fillet—concave, flat, or convex.—H. W. G. H.

Welding Symbols. James W. Owens (*J. Amer. Weld. Soc.*, 1933, 12, (8), 24).—A list is given of the codes of symbols approved by the American Welding Society for use on drawings and the fundamental principles on which these have been developed are explained.—H. W. G. H.

Abbreviations and Symbols for Use on Drawings of Buildings, Bridges, and Other Framed Structures. — (*J. Amer. Weld. Soc.*, 1933, 12, (8), 25).—A tentative standard issued by the Committee for Nomenclature, Definitions, and Symbols of the American Welding Society.—H. W. G. H.

Outline of Welding Processes. D. Richardson (*Welding Industry*, 1933, 1, 3-4, 49-50, and 120-121).—Various systems of classification of welding processes are considered and the following processes are briefly discussed: forge, hammer, and roll welding; electric resistance welding—butt, flash, seam, spot, projection, and percussive; Thermit welding; oxy-acetylene—high- and low-pressure systems, equal-pressure systems, multi-flame blowpipes, the Linde self-fluxing process; mixed gas processes—coal-gas and acetylene; oxy-hydrogen, oxy-coal gas, oxygen with ethylene, methane, and vaporized liquid fuels.—H. W. G. H.

Characteristics and Application of Various Welding Processes. P. L. Roberts (*Welding Industry*, 1933, 1, 95-97; discussion, 97-98).—The following processes are reviewed: metallic arc; carbon arc; atomic hydrogen; oxy-gas; resistance (butt, spot, seam, and flash); Cyc-arc and percussive arc; Thermit; and fire welding. For non-ferrous metals, the oxy-acetylene process is considered almost without rival.—H. W. G. H.

Classification and Electric Welding. R. Schmidt (*Werft, Reederei, Hafen*, 1933, 14, 223-226, 238-242).—An extended survey of electric welding and its recent developments in their relation to the shipping industry and to the question of registration.—P. M. C. R.

The Design of Jigs and Fixtures for Welding. Owen C. Jones (*J. Amer. Weld. Soc.*, 1933, 12, (8), 35-40)—Cf. *J. Inst. Metals*, 1933, 53, 673. Essentials of good design and the principles underlying them are summarized. Various methods of location and clamping are described and illustrated.—H. W. G. H.

Dynamic Characteristics of Welding Machines. Karl Meller (*Elektroschweissung*, 1933, 4, 101-110).—The "static" characteristics of welding generators are explained. The importance of the "time constant" and its dependence on self-induction and resistance is demonstrated. It is shown, moreover, how, of two machines with similar static characteristics, one may weld more easily than the other, and the reasons, as shown by oscillographic determinations, are explained. The instantaneous values of current and voltage given by the oscillogram are plotted and the resulting curves are discussed—particularly those obtained when a drop of metal falls from the electrode and when the arc is suddenly lengthened until it breaks. It is emphasized that much more research is needed, before it is possible to forecast exactly the welding characteristics of a generator from its electrical characteristics, as at present determined.—H. W. G. H.

New Improvement in Welding Machine Construction. H. Langkau (*Elektroschweissung*, 1933, 4, 48-50).—A full description, with characteristic curves and oscillographic photographs, of a self-excited welding generator.—H. W. G. H.

Advances in Metal Surgery. C. W. Brett (*Gas J.*, 1933, 204, 410-411).—The Barimar system of welding, applicable both to ferrous and non-ferrous alloys, is briefly described and illustrated.—J. S. G. T.

Joint Discussion on Reports on Technical Classification of Generators and of Electric Welding Practice; and on Generators and Transformers for Arc Welding. Marcel Mathieu, Marcel Moneyron, *et al.* (*Bull. Soc. Franç. Elect.*, 1933, [v], 3, 145-161).—A joint discussion on the reports presented by Mathieu and Moneyron. Cf. *ibid.*, 1932, [v], 2, 1081, 1088.—P. M. C. R.

Automatic Weld Timer. Anon. (*Instruments*, 1933, 6, 198-199).—An illustrated note on an automatic device consisting of a rectifier tube which charges a fixed condenser in proportion to the rate of current flowing in the welding circuit. At the required instant, a discharge takes place across two neon tubes and the welding circuit is broken through a relay. Uniformity in

the resulting welds is claimed irrespective of variations in such factors as line voltage, electrode condition, and thickness and surface condition of the work.

—J. C. C.

Innovations and Tendencies in Autogenous Welding. R. Granjon (*Soudure et Oxy-Coupage*, 1933, 10, 180-181).—Abstract from *Rev. Soudure autogène*, 1933, 25, 2750-2758. See *J. Inst. Metals*, 1933, 54, 673.—H. W. G. H.

The Fundamental Characteristics and Technique of Spot Welding Various Metals. Lawrence Ferguson (*Welding Eng.*, 1933, 18, (7), 14-16; (8), 20-23).—The fundamental factors of the spot-welding machine, of the shape, size, and material of the electrodes, and of the mechanical pressure applied, are explained. Some of the practical problems involved and their solution are discussed. Welding characteristics of various metals are described and charts are given showing which of 250 combinations of metal can and cannot be spot welded, and the open-circuit voltages are recommended.—H. W. G. H.

Vacuum-Tube Control Applied to Spot Welding Equipment. E. U. Lassen (*Welding Eng.*, 1933, 18, (1), 28-29).—Thyratron valve control of resistance welding machines permits current regulation in terms of cycles, ensuring perfect welds without possibility of burning.—H. W. G. H.

Thyratron Control of Welding in Tube Manufacture. H. W. Lord and O. W. Livingston (*Electronics*, 1933, 6, (7), 186-187).—Details of a specially controlled electrical circuit for spot-welding machines used in the manufacture of vacuum tubes.—S. V. W.

Shot Welding. Anon. (*Machinery (Lond.)*, 1933, 42, 521-522).—Shot welding is a process of spot welding in which the current is passed for the minimum time possible in order to localize the weld sharply. The equipment, which can be fitted to any standard welding machine, provides an automatic record of the duration of each weld and employs an alarm bell to direct attention to unsatisfactory welding conditions. The method was developed for welding austenitic steels, which suffer a serious reduction in corrosion-resistance if heated within the range 500°-900° C.—J. C. C.

Electric Resistance Welding. D. Richardson (*Welding Industry*, 1933, 1, 183-184).—A review of the various methods, their sphere of application, and some causes of defects.—H. W. G. H.

Electrodes for Resistance Welding Machines. Eberhard Rietsch (*Elektroschweissung*, 1933, 4, 51-54).—Recommendations of electrodes to use for welding different materials by spot, projection, and butt methods. The methods themselves are briefly discussed from the point of view of electrode requirements.—H. W. G. H.

Standard Specifications for Resistance Welding Transformers. Resistance Welder Manufacturers' Association (*J. Amer. Weld. Soc.*, 1933, 12, (6), 25-26).—The following points are covered: duty cycle; name-plate rating; primary and secondary windings; taps; cooling; insulation; core; inspection and test; mechanical protection.—H. W. G. H.

Investigations on Phenomena of Arc Welding and Gas Cutting by Slow-Motion Pictures. A. Hilpert (*J. Amer. Weld. Soc.*, 1933, 12, (7), 4).—A review of investigations made and results obtained by the use of cameras capable of taking some thousands of pictures per second. The deposition of metal in the metallic arc has been examined by means of infra-red film and by the "out-shining" method (Thun), in which the welding arc is illuminated by a powerful arc light on the opposite side from the camera lens and on its optical axis. The electrode, drop, and bead are sharply silhouetted, and the arc shows as a very bright spot on a bright background. It has been proved that the number of drops per second from a bare electrode is very much greater than from a coated electrode, and that, whilst the arc of the former extinguishes with every drop owing to short circuit, in the case of the latter, the slag forms a conductor of second degree. The time of transition of metal is found to be 15% of the

total welding time for bare electrodes and 4% for heavily coated electrodes. The infra-red film is useless in the investigation of gas-cutting and the "in shining" method (Conrady) is used. In this, the gas beam absorbs part of the light, but the slag reflects it.—H. W. G. H.

Concerning the Phenomena of the Electric Welding Arc. H. v. Conrady and G. Müller (*Elektroschweissung*, 1933, 4, 1-6).—The mechanism of the electrical discharge with hot and cold cathodes is investigated. Photographs of arcs between poles of different kinds are reproduced and discussed.—H. H.

The Use of Carbon in Arc Welding. K. L. Hansen (*Welding News*, 1932, 3, 27-29).—Abstracted from *Welding*, 1932, 3, 222. The carbon arc has been used with greater success than the metallic arc for welding copper, but still presents great difficulty. "Everdur," however, can be successfully welded by the carbon arc method. Copper alloys containing a high percentage of zinc are unweldable by this process, but the indirect carbon arc, in which the flame is struck between two carbons and the current does not pass through the work, has given very promising results. This "carbon arc torch" has successfully welded ornamental bronzes containing lead as well as zinc, for which the oxy-acetylene flame and the usual arc processes fail.—H. W. G. H.

Carbon Shapes and Paste. Anon. (*Indust. Gases*, 1933, 14, 52).—Abstract from *Oxy-Acetylene Tips*, 1933, 12, 41. See *J. Inst. Metals*, 1933, 53, 673.

—H. H.

The Carbon Arc Process. Anon. (*Welding Industry*, 1933, 1, 149-150, and 152).—A survey of the process, including its history, development, and difficulties.—H. W. G. H.

Carbon Arc Welding. Karl Reiter (*Welding Industry*, 1933, 1, 173).—The article deals mainly with the Elin process, in which the arc is stabilized by a rotating magnetic field. The hardened seam often produced by carbon arc welding is said to be due to oxidation, and not carbonization of the weld metal. The application of the process to automatic welding is described.—H. W. G. H.

Atomic Hydrogen Arc Welding and Its Applications. J. A. Dorrat (*Welding J.*, 1933, 30, 6-14; discussion, 14-16).—A comprehensive description of the process, equipment, and technique. Curves showing welding speed and consumption of electricity, hydrogen, and tungsten, are given. The process is recommended for steels, especially of the austenitic variety, brass and bronze, copper and aluminium. Adaptations for use with three-phase current supply, for using split ammonia instead of hydrogen, and for automatic welding, are discussed. In the discussion, D. gave the cost of atomic hydrogen welding as approximately 25% less than oxy-acetylene.—H. W. G. H.

Atomic Hydrogen Arc Welding. Anon. (*Welding Industry*, 1933, 1, 141-143, 185-188, 278 and 284).—Based on information given by the Metropolitan-Vickers Electrical Co., Ltd. The process and apparatus are described. Welding costs, when using hydrogen and dissociated ammonia, are discussed and curves are given to show the costs of gas, tungsten, power, and labour for welding different thicknesses of material.—H. W. G. H.

Producing Strong Joints by Hydrogen Welding. Anon. (*Machinery (N. Y.)*, 1933, 39, 778-780).—A description is given of a tubular furnace, heated by six resistance elements, and equipped with an endless chain conveyor, designed for "hydrogen welding." The parts to be welded are pressed together, copper wire is wrapped round the joint, and the parts are conveyed to the heating zone of the furnace. This is maintained at 2100° F. (1150° C.) and supplied with an atmosphere of "Electrolene," which is made by treating city gas with steam and contains hydrogen 58.4% and carbon monoxide 30%. The copper melts and flows freely under these conditions, uniting the joint. It is claimed that alloying of the copper and iron takes place, an alloy containing 3% of copper being formed.—J. C. C.

Recent Advances and Future Expectations of the Oxy-Acetylene Process. James H. Critchett (*Indust. Gases*, 1933, 13, 220-221; and *Welding J.*, 1933, 30, 17-18).—Read before the American Welding Society. See *J. Inst. Metals*, 1933, 53, 588.—H. W. G. H.

Oxy-Acetylene Welding of Very Thick Plates. R. Meslier (*Rev. Soudure autogène*, 1933, 25, 2805-2806; and (abstract) *Soudure et Oxy-Coupage*, 1933, 10, 190).—Refers to steel plate of $\frac{3}{4}$ -1 $\frac{1}{2}$ in. thickness, but the technique described may have wider interest. Backward welding is recommended and three blowpipes are used at once, the tips being water-cooled.—H. W. G. H.

Oxy-Acetylene Construction of Apparatus and Containers. The International Advisory Committee for Carbide and Welding Technique, Geneva (*J. Amer. Weld. Soc.*, 1933, 12, (2), 27-29).—Refers primarily to steel. A concise review of good practice in technique and design.—H. W. G. H.

Brewers Modernize Their Equipment. Anon. (*Indust. Gases*, 1933, 14, 86-90).—From *Oxy-Acetylene Tips*, 1933, 12, 149-153. See *J. Inst. Metals*, 1933, 53, 673.—H. W. G. H.

Increasing Welding Speed and Decreasing Gas Consumption by the Use of Angular Filler Rods. C. F. Keel (*Welding Industry*, 1933, 1, 145).—Test figures are given to show the influence of the shape of filler rods. Square and triangular bars melt first at the corners and taper off at the point, whereas round bars melt to a blunt end. Considerable economy in oxygen and acetylene is obtained by the use of angular rods. [Note: Ferrous welding only is considered.]—H. W. G. H.

Avoiding Failures in Gas Welding. Otto Lehmann (*Autogene Metallbearbeitung*, 1933, 26, 185-186).—Important precautions are tabulated. A flame, adjusted to have excess of oxygen, is recommended for welding brass, nickel-brass, and "aluminium-bronze," a "neutral" flame for steel, copper, and aluminium, and a flame with excess acetylene for cast iron.—H. W. G. H.

Procedure for Testing the Strength of Hydraulic Back-Pressure Valves for Acetylene Apparatus Against Explosion Pressures. W. Rimarski and H. Friedrich (*Autogene Metallbearbeitung*, 1933, 26, 49-54).—Cases had been observed of explosion, due to back-firing, which had ruptured the welded seams of high-pressure hydraulic valves. Since these were of a type tested by the Reichsanstalt, it was concluded that the test conditions did not reproduce those met in practice, and that the pressures resulting from explosion of a moving gas mixture differed from those obtained when the mixture was stagnant. An apparatus was devised to test back-pressure valves under the latter conditions, i.e. those which had caused failure in practice. The results, obtained with different designs of welded joint for the top and bottom of the valve, are described. It is claimed that suitable designs can now be specified, and it is expected that the present practice of using seamless tube for the valve bodies may not be necessary in all cases.—H. W. G. H.

Equipment for Testing Low-Pressure Hydraulic Back-Pressure Valves for Reliability in Case of Back-Fire. W. Rimarski and H. Friedrich (*Autogene Metallbearbeitung*, 1933, 26, 81-88).—A detailed description of the apparatus and method used for testing hydraulic back-pressure valves at pressures from 300 mm. (12 in.) to 500 mm. (20 in.) water-gauge. Tests are possible both with and without the suction-effect of an injector burner, and this suction can be increased if desired to cause entry of air to the valve through its water seal.—H. W. G. H.

Prize Competition for the Construction of Safety Receivers for Low-Pressure Acetylene Generators. Anon. (*Autogene Metallbearbeitung*, 1933, 26, 150-153).—Four prize-winning safety valves are illustrated and their mode of operation is explained. They are judged on their ability to check back-pressure of oxygen from the blowpipe or back-firing if an oxygen-acetylene or air-acetylene mixture is present in the pipe between blowpipe and generator.—H. W. G. H.

Safe Handling of Oxygen and Acetylene Cylinders. T. C. Fetherston (*J. Amer. Weld. Soc.*, 1933, 12, (6), 23-24).—Good advice, often neglected.—H. H.

The Purification of Acetylene. Anon. (*Soudure et Oxy-Coupage*, 1933, 10, 171).—Emphasizes the importance of removing all traces of sulphuretted and phosphoretted hydrogen.—H. W. G. H.

Determination of the Air Content in Acetylene. Paul Schufftan (*Autogene Metallbearbeitung*, 1933, 26, 88-90).—The method depends on the absorption of acetylene by acetone; it is claimed to be simple, rapid, and accurate. The apparatus is described and the possible errors are discussed.—H. W. G. H.

The Training of Welders. D. Richardson (*Welding Industry*, 1933, 1, 201-202 and 205).—Emphasis is laid on the need for better correlation, in this country, of syllabuses for welding instruction. It is prophesied that, in the future, technical schools, colleges, and universities will include welding as an important part of their engineering courses.—H. W. G. H.

A New Type of Welding Course. L. F. Jackson (*J. Amer. Weld. Soc.*, 1933, 12, (5), 17-18).—An outline of a lecture course of a very comprehensive nature, embracing all types of welding.—H. W. G. H.

Teaching Metallic Arc Welding. E. Tutt (*Welder*, 1933, 4, (38), 28-31).—Students of arc welding are divided into four groups: journeymen in other branches of metalwork; technical men who wish to become competent supervisors of welding; semi- or non-skilled workmen; and youths who have had no previous employment. The general principles of instruction are briefly discussed, and the importance of such details as the welder's position and grip of his electrode-holder is emphasized.—H. W. G. H.

To Make Good Welders. Anon. (*Soudure et Oxy-Coupage*, 1933, 10, 187).—Abstract of an article by M. Couturier in *Rev. Soudure autogène*, 1933, 25, 2773-2775. See *J. Inst. Metals*, 1933, 53, 674.—H. W. G. H.

Effect of Training on Welding Skill. C. R. Nailler and J. S. Anderson (*Welding Eng.*, 1933, 18, (3), 23).—Abstract of a thesis by N. and A., reporting the results of tests to determine the effects of systematic training on skill in welding.—H. W. G. H.

XXI.—INDUSTRIAL USES AND APPLICATIONS

The Toxicity of Aluminium Compared with that of Iron, Nickel, and Other Metals. Gabriel Bertrand and P. Serbescu (*Compt. rend.*, 1931, 193, 128-131; *Ann. Inst. Pasteur*, 1931, 47, 451-454; and (abstract) *Technique moderne*, 1931, 23, 673; *C. Abs.*, 1932, 26, 524).—The toxicity of aluminium (as $Al_2(SO_4)_3 \cdot 18H_2O$) is of the degree of magnitude of that of iron, and considerably less than that of nickel or copper. Fears of toxic effects from aluminium cooking vessels are unfounded, since the amount so consumed is no greater than is normally found in plant and animal tissues.—S. G.

Feeding Experiments with Foods Canned in Aluminium. Gulbrand Lunde, Valborg Aschehoug, Hans Breien, and K. Wulfert (*Tids. Hermetikind.*, 1933, 19, 174-185; *C. Abs.*, 1933, 27, 5829).—In continuing prior experiments on fish canned in aluminium, storage tests for periods up to 3-5 years with sardines in oil, kippered and fresh herring and fish-balls showed no hydrogen swells with one exception, in which case the fish had been improperly processed. Tests with crab, lobster, and shrimp were also very successful. Feeding tests on mice and rats in which canned food with high aluminium content in comparison with similar but aluminium-free food is used, showed quantitative elimination of the administered aluminium, with no harmful effects whatever. This is in accord with results of tests on foods cooked in aluminium utensils.—S. G.

Handling of Distilled Water in Aluminium. H. V. Churchill (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1933, 5, 264-266).—Aluminium equipment for

the production and storage of distilled water is described and illustrated. Water distilled from aluminium apparatus contains less than 0.8 p.p.m. of total solids, of which less than 0.03 p.p.m. consists of aluminium.—A. R. P.

Aluminium as a Structural Material. Walther Zarges (*Werft, Reederei, Hafen*, 1933, 14, 248-254).—Discusses the selection of light-alloy structural elements. Tables give the mechanical properties, prices (in marks per kg.), applications, and names of makers of aluminium, and of 18 alloys in the rolled condition, with some details as to ageing and heat-treatment and also of aluminium, and 16 alloys, sand- and chill-cast. Dimensions for round-headed and countersunk rivets, and the shear strengths and permissible loads of 9 standard alloys are also shown in tables.—P. M. C. R.

A New Alloy for Pistons. Anon. (*Alluminio*, 1933, 2, 219).—A note on a new alloy of aluminium containing chromium, studied by Metal Castings, Ltd., Worcester, and specially intended for cast pistons.—G. G.

The Manufacture of Light Metal Pistons for Motor Engines. E. Mahle (*Werft, Reederei, Hafen*, 1933, 14, 255-256).—The development of the light-alloy piston is considered historically. The principal difficulties attending its adoption were excessive wear, the high thermal expansion of the new materials, and wear on piston-rings; modern practice in combating these is described, and certain types of piston are illustrated, including two examples intended for marine work.—P. M. C. R.

Light Alloys in the Construction of Land Transport. G. Py (*Rev. Aluminium*, 1933, 10, 2157-2164; and (translation) *Aluminium Broadcast*, 1933, 4, (14), 2-9).—The applications of Duralumin for the manufacture of bicycles are described and details of the preparation and working of the alloy for this purpose are given.—J. H. W.

The Choice of Light Metals for Transport Construction. Erich Eichwald (*Automobiltech. Z.*, 1933, 36, 501-506).—This summary of the characteristics of alloys suitable for vehicle and aircraft construction includes a table of commercial light alloy products, with sp. gr. and standard dimensions. A second table gives the trade mark, name, state of treatment, makers, tensile strength, elastic limit, elongation, modulus of elasticity, Brinell hardness, sp. gr., thermal expansion, and principal applications of numerous cast and worked alloys with aluminium or magnesium base. A more highly specialized selection of alloys for vehicle construction is given, followed by a list, for the guidance of users, of important considerations as to properties, purpose, surface finish, &c. Percentage compositions are given for 22 alloys in common use. The dimensions, with weights, of some standard forms are given. An extensive bibliography is furnished.—P. M. C. R.

The Influence of Recent Research on Aero-Construction. Paul Brenner (*Z. Flug. u. Motor.*, 1933, 24, 497-505).—A major problem in aircraft construction is the combination of progressive lightening with sufficient strength, each member being worked as closely as possible to its permissible limits. Advances in this field must be conditioned by the progress of research: the great developments due to the introduction of Duralumin and the magnesium alloys are cited in illustration. Certain newer alloys are expected to modify existing practice. The properties of Silumin and Copper-Silumin are tabulated. Other alloys considered are Silumin-gamma, Elektron A 9, and a similar alloy of composition aluminium 7%, manganese 0.4%, remainder magnesium. A second table summarizes the mechanical properties of some alloys of the Duralumin class (681 B, 681 ZB, DM 31, 17 SRT). The protection of such alloys from corrosion has been developed by the results in three directions—plating, anodic oxidation, and the development of alloys of high resistance to corrosion. The results of corrosion tests on certain of these are tabulated (Duralumin 681 A, 681 ZB, 681 K, Duralplat, Hydronalium and KS-Seewasser), and in other tables the mechanical properties of certain of these and of BS-

Seewasser and Duranadium are given. Methods of mechanical testing are discussed, with special reference to endurance tests. The influence of surface finish, abrupt alterations in cross section, sharp corners, slots and rivet-holes is considered, and the sensitiveness of some common structural materials to varying stresses is investigated and compared. The possibilities of X-ray examination, especially of welds, are indicated. A *bibliography* is appended.

—P. M. C. R.

Light Metal Construction in Shipbuilding. F. Gentzcke (*Werft, Reederei, Hafen*, 1933, 14, 256–260).—The lightening effected by the adoption of light alloys in ship construction should make for increased stability, for greater carrying power corresponding with the decrease in dead weight, and for improved design. Much of the superstructure of small vessels, as well as deck plating, engine parts, fireproof partitions, and heat-insulation, is now frequently of light-metal: a list of such parts, with appropriate materials, is given, and an example of cabin-construction in Bondur and aluminium is shown in plan. A table classifies common structural alloys according to their purpose and to the probable degree of exposure, and gives approximate strengths.—P. M. C. R.

The "Mythen," a Passenger Motor Vessel with Welded Hull and Riveted Aluminium Superstructure. —Lottmann (*Werft, Reederei, Hafen*, 1933, 14, 91–93).—This vessel, which carries 200 passengers, was built for service on Lake Lucerne. The hull is of arc-welded steel, protected by a sprayed zinc coating. Apart from the external deck stringers, the deck plates are of 5 mm. Anticorodal, riveted with aluminium rivets to the steel supports; corrosive action is prevented by coating with zinc and painting with zinc white. Anticorodal is also used for deck-houses, seats, window-frames, and other portions of the superstructure; only occasionally, as in the case of skylights, is the material welded. The use of light alloys in deck and superstructure is stated to result in a 20% economy in weight. Several plans, sections, and views of various parts are given.—P. M. C. R.

Aluminium Alloy in Light-Weight Accumulators. Anon. (*Electric Vehicles and Batteries*, 1932, 16, 219).—The use of aluminium sheets sprayed with lead by the Schoop process is proposed in a recent patent as a means of reducing the weight of accumulator plates.—J. C. C.

Electric Cables of Aluminium. E. Soleri (*Alluminio*, 1933, 2, 1–13).—The possible applications of aluminium in the electrical industry are discussed, and its value is compared with that of copper for the same purposes. The use of anodically oxidized aluminium on an insulating material, in the form of ribbons and wires, as a screen, in high-voltage telephone and telegraph cables, and for external protection, as a substitute for lead, for small flexible conductors, and as a continuous support under the lead for under-sea cables for great depth, the protection of lead conductors by "metallization" with aluminium and the use of aluminium for light, non-inductive and non-magnetic support, and for uni-polar a.c. cables are also described.—G. G.

Heat Insulation with Aluminium Paper. Ralph B. Mason (*Aciers spéciaux*, 1933, 8, 276–290).—J. H. W.

Aluminium Foil—Its Use in Modern Packing. D. C. Brookes (*World's Press News*, 1933, Sept. 31; *Aluminium Broadcast*, 1933, 4, (13), 16–18).—Includes a table of the covering area per lb. of aluminium, tin, and copper foils for thicknesses between 0.006 and 0.200 mm.—J. C. C.

Alfol in Shipbuilding. H. Niemann (*Werft, Reederei, Hafen*, 1933, 14, 260–263).—P. M. C. R.

Aluminium Paints for Exteriors and Interiors. R. Schwarz (*Farbe u. Lack*, 1933, 437–438, 449–450, 463; *C. Abs.*, 1933, 27, 5991).—The American assumption that the value of "aluminium-bronze" powder lies in its leafing properties is not generally accepted in Germany. The same ideas were once applied to

micaceous iron oxide and found to be erroneous. For plaster and moist wood, an aqueous vehicle "Dilutin" is recommended. Ammoniacal casein solutions are also satisfactory. Oil vehicles should contain considerable stand oil.

—S. G.

The Cæsium-Oxygen-Silver Photoelectric Cell. M. J. Kelly (*Bell Laboratories Record*, 1933, 12, 34-39).—A photoelectric cell having a cathode of pure silver on which is formed a matrix of cæsium oxide, silver oxide, and finely-divided silver and which is then covered by an adsorbed layer of atomic dimensions of cæsium is more than fifty times as sensitive as the potassium hydride-cathode type. The construction of such cells is described.—J. C. C.

Chromium on Copper for Washing Machines. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1933, (75), 14).—The use of chromium-plated copper for the construction of domestic washing machines is illustrated.—J. S. G. T.

Cobalt and Its Uses. L. Sanderson (*Sands, Clays, and Minerals*, 1933, 1, (4), 51-57).—A brief account is given of the mineralogy and uses of cobalt.

—A. R. P.

Copper Vessels for Decomposing Fats. R. Heublum (*Metallwirtschaft*, 1933, 12, 121-122).—Copper is slightly attacked by fatty acids at first, but a protective film is soon formed which prevents further attack and has no effect on the fat hydrolysis reaction; copper vessels are, therefore, suitable for the decomposition of fats by the Twitchell method.—v. G.

Copper in Modern Breweries. Josef Mederer (*Apparatebau*, 1933, 45, 121-128; and *Z. V. d. Kupferschmied.*, 1933, 45, 145-152).—An illustrated article on the uses of copper in making brewery plant.—M. H.

Sheet Copper Combats Corrosion by Salt Water. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1933, (75), 5).—The use of copper in the construction of swimming pools and buildings at Jones Beach, New York, is briefly referred to and illustrated.—J. S. G. T.

Copper in Window Frames and Shop Fronts. Anon. (*Cuivre et Laiton*, 1933, 6, 163-176, 216-223, 269-278).—The advantages of copper in the construction of such exposed parts as window frames are summarized. Their manufacture is described, and illustrations are given of the various types of sections in most common use. Of the materials used, pure copper, brass containing 50-80% copper, Tombac with 80-90% copper, special brasses containing small proportions of nickel, iron, manganese, or aluminium, "aluminium-bronze" or ordinary bronze containing 90-70% of copper and 10-30% tin are most frequently employed. To illustrate the construction of different types of window frames, examples are shown from actual buildings, mainly in America. Straight opening, pivoting, and bascule windows are included.—W. A. C. N.

Methods of Covering in Copper. Anon. (*Cuivre et Laiton*, 1933, 6, 319-322).—Deals with: (1) general technical methods for the execution of copper coverings; (2) methods for making gutters and down-pipes; (3) methods for flat copper coverings with hammered sections; and (4) coverings with raised joints.—W. A. C. N.

America's First Copper House Strikes a New Note in Construction. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1933, (76), 6).—The construction of a copper-covered house is illustrated. The entire exterior is copper-covered; about 75% of the copper is lead-coated.—J. S. G. T.

Million and Quarter Pounds of Copper Alloys in New Structure. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1933, (76), 2-3).—The use of copper and bronze in the construction of Bronx County Court House is described and illustrated.—J. S. G. T.

New Low-Cost Paper-Thin Copper Finds Variety of Uses. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1933, (76), 10).—The application of "Electrosheet" (copper as thin as paper) for roofing and decorative purposes is briefly described and illustrated.—J. S. G. T.

Copper Alloy Wire. James T. Kemp (*Wire and Wire Products*, 1933, 8, 310-317, 342).—Read before the Wire Association. Outlines the development and principal uses of wire consisting of pure copper, copper containing small amounts of cadmium, tin, silicon, aluminium, manganese or beryllium, and 80 : 20 red brass.—J. H. W.

Applications of Bronze in the Construction of Electric Tramway Accessories.

I.—**Trolley-Head.** Anon. (*Cuivre et Laiton*, 1933, 6, 246-247).—W. A. C. N.

Historical and Technical Notes on the Greatest Statue in the World in Hammered Bronze—The Statue of Liberty, New York. A. Chaplet, J. B. Gauthier (*Cuivre et Laiton*, 1933, 6, 297-304).—An interesting description of the construction, both from a historical and a technical point of view, of the Statue of Liberty.—W. A. C. N.

Bronze Railroad Bearings Improved through Research. Anon. (*Bull. Copper and Brass Res. Assoc.*, 1933, (75), 15).—A "circulating" type of bearing effecting improvement of lubrication is illustrated and briefly described.—J. T.

Iron Wire (Bronze-Plated), Its Applications and Technical Requirements. V. N. Zvetkov and I. Dembo (*Ovladenie Tekhniki: Kozhobuinoe Proizvodstvo*, 1932, (2), 41-43; *C. Abs.*, 1933, 27, 5702).—[In Russian.] Various tests are described.—S. G.

Tentative Standards for "Universal" Bronze-Plated Wire. Anon. (*Ovladenie Tekhniki: Kozhobuinoe Proizvodstvo*, 1932, (2), 43-44; *C. Abs.*, 1933, 27, 5702).—[In Russian.] Various tests are described.—S. G.

Applications of "Tungum." Anon. (*Met. Ind. (Lond.)*, 1933, 43, 447-448).—A brief description of the principal uses of the alloy Tungum.—J. H. W.

The Manufacture of Electric Cables. G. Martinez (*Met. Ind. (Lond.)*, 1932, 41, 463-465, 491-494).—Slightly condensed from a paper read before the Portsmouth Branch of the Institution of Mechanical Engineers. The processes considered are confined to the manufacture of paper-insulated cables. Copper of high purity is used as conducting material: full details are given of the drawing process, of the necessary annealing, and of its effects on the mechanical properties of the wire. Stranding, shaping, and laying up are described. The sheathing process utilizes either lead or lead alloy; a frequent source of failure is the formation of oxide films at the junction of consecutive charges during extrusion. Typical microstructures are illustrated. The production of the oil-filled cable is discussed, and a special feeding tank is described. Some details as to oil-filled high-tension cable lines actually in use are appended.—P. M. C. R.

Lead Alloys for Building Applications. — (*Engineering*, 1933, 136, 127).—Abstract of report entitled "B.N.F. Ternary Alloys of Lead—Their Use in Buildings," published by H.M. Stationery Office. See *J. Inst. Metals*, 1933, 53, 459.—W. P. R.

Vaporization of Lead in Homogeneous Lead Coating Processes. Hans Engel and Victor Froboese (*Metallwaren-Ind. u. Galvano-Tech.*, 1931, 29, 360; and *Indust. Gases*, 1933, 14, 44).—Abstract of a paper in *Arch. Hygiene*, 1925, 96, 69-101; see *J. Inst. Metals*, 1926, 36, 592.—A. R. P.

Construction of Welded [Magnesium Alloy] Gondolas for Stratospheric Balloons. Jean Piccard (*Welding Eng.*, 1933, 18, (6), 30-31).—Describes the construction of the gondola to be used by P. and Settle in their ascent from Chicago. A magnesium alloy was used.—H. W. G. H.

Rolled Nickel in Composite Metal Products. Anon. (*Welder*, 1933, 4, (36), 3-8).—A description of nickel-clad steel including its physical and mechanical properties, structure, working, advantages, and uses.—H. H.

The Place of Nickel in Radio Tube Manufacture. A. J. Marino (*Electronics*, 1933, 6, (1), 4-5).—Summarizes the properties of nickel which render it suitable for use in the manufacture of radio valves. For grid wires the alloys of nickel with manganese or chromium are largely used and are replacing more expensive

metals such as molybdenum. The requirements of the valve industry call for very careful control of the melting and subsequent working and annealing of nickel and its alloys. The percentage elongation is usually specified when ordering.—S. V. W.

Experiences and Hints on the Manufacture of Tanks from Monel Metal Sheet. Rudolf Müller (*Apparatebau*, 1933, **45**, 97-99; and *Z. f. d. Kupferschmied.*, 1933, **45**, 129-131).—The bending, welding, and soldering of Monel metal sheet in making tanks are described.—M. H.

Sterilization of Domestic Drinking Waters with Metallic Silver. André Kling (*Bull. Acad. Med.*, 1932, **107**, 830-839; *C. Abs.*, 1933, **27**, 5450).—Pure, especially distilled, water acquires bactericidal properties after having been in contact with large surfaces of silver for 15 minutes. The antiseptic power remains unchanged after the addition of chlorine ions; it is destroyed by hydrogen sulphide. The precipitate of calcium carbonate formed by boiling natural waters removes the acidity. Electric current has no influence. 1 litre contained 0.05 mg. silver.—S. G.

A Sodium Glow Lamp. F. H. Newman (*Phil. Mag.*, 1933, [vii], **16**, 1109-1114).—Characteristics of glow lamps of the ordinary type containing fillings of sodium and either neon or argon are briefly discussed.—J. S. G. T.

Gas-Free Metals Used in X-Ray Tubes. W. D. Coolidge and E. E. Charlton (*Metal Progress*, 1933, **24**, (5), 36-40).—From a paper presented before the International Electrical Congress, Paris, 1933. A historical survey of the evolution of the X-ray tube is followed by an account of the production of tungsten in a ductile form. The metal so treated is now substituted for platinum in the target; the copper block employed for backing must be carefully deoxidized by treatment with boron, and is then attached to the tungsten by very carefully controlled heating *in vacuo*. The effects of various gases on the life of the tungsten target are summarized. The substitution of tungsten for aluminium in the cathode proved successful in the hot-cathode type of tube, an example of which is described and illustrated. Here the whole target consists of tungsten, its supports being of molybdenum. The importance of de-gassing the metals in question is emphasized, and the influence of time and temperature on this process is discussed.—P. M. C. R.

Cathode Tubes. Rudolf Sewig (*Arch. tech. Messen*, 1933, **2**, (20), 128).—The principle of the cathode tube is stated, and the relative merits of tungsten, thorium, and barium as cathodes are discussed, with the special adaptations required by each. Certain important developments are described, and their nomenclature is explained.—P. M. C. R.

Price, Patent Position, and Uses of Sintered Hard Metals. Karl Becker (*Metallwirtschaft*, 1933, **12**, 375, 391-392, 407-408).—A review.—v. G.

Price, Patent Position, and Performance of Sintered Hard Metals. — (*Metallwirtschaft*, 1933, **12**, 531).—Remarks of the Krupp A.-G. on K. Becker's article (preceding abstract) and B.'s reply—v. G.

Battery Manufacture at Dagenham. Anon. (*Electric Vehicles and Batteries*, 1932, **16**, 214-216).—A brief illustrated description of the manufacture of accumulator plates at the works of Pritchett and Gold and E.P.S. Co., Ltd., Dagenham.—J. C. C.

On the Specifications for Sheet Zinc for Galvanic Batteries and Methods of Testing. E. Zalesinski (*Metallwirtschaft*, 1933, **12**, 699-704).—The manufacture of zinc elements for batteries, especially by the cold-spray process, is described. After reviewing the usual methods used for corrosion testing it is suggested that measurement of the rate of gas evolution in 10% sulphuric acid gives the best results. Iron, copper, arsenic, and antimony are the most objectionable impurities in the zinc.—v. G.

Stability of Vitamin-A During Canning Process. G. Lunde, H. Kringstad, and K. Vestly (*Tids. Hermetikind.*, 1933, **19**, 305-313; *Bull. Brit. N.-F. Metals*

Res. Assoc., 1933, (60), 17).—[In Norwegian, with an English abstract.] These investigations show that the vitamin-A content of canned brisling sardines is almost as high as that of fresh fish, loss of vitamin-A during canning being negligible. Brisling sardines stored for 2 yrs. in tins as well as in aluminium cans have a vitamin-A content equal to that of the newly-packed product.—S. G.

Prescriptions of Quality for Sheets, Tubes, Screws, Rivets, and Wires. Georg Richter (*Anz. Berg, Hütten- u. Masch.*, 1933, 55, (62), 5-6).—Present German standard specifications for brass, bronze, copper, nickel-silver, and aluminium sheets, for copper tubes, screws, and rivets of special brasses, copper wires, overhead trolley wires, and steel-cored aluminium transmission cables are summarized.—B. Bl.

Laminated Metals. George A. Ruehmling (*Machinist (Eur. Edn.)*, 1933, 77, 567-568E).—The requirements of metals suitable for use in laminations, the forms these laminations may take, and their applications are described.—J. H. W.

Structural Materials for Heavy Vehicles. — Kracht (*Automobiltech. Z.*, 1933, 36, 551-552).—Abstract *in extenso* of a paper read before the Automobil- und Flugtechnische Gesellschaft. Structural materials are reviewed from the view-point that metals or alloys should preferably be of German origin. The supply of aluminium is seriously threatened by the shortage of German bauxite, but advances in remelting practice have facilitated the use of scrap. Elektron is of increasing importance, but its greater corrodibility prevents its entirely replacing aluminium. The possibility of replacing tin and antimony in bronzes and bearing-metals is considered.—P. M. C. R.

Metals in Aircraft Construction. Robert Jones (*Heat-Treating and Forging*, 1933, 19, 35-37).—The application of various metals and alloys to aircraft construction, their heat-treatment, and anodic hardening are briefly described.—J. H. W.

Brewers Find Changes Among Construction Materials. Anon. (*Chem. and Met. Eng.*, 1933, 40, 272-273).—During the long period of inactivity in the brewing industry in the U.S.A., rapid strides have been made in new methods, equipment, and construction materials. Tons of copper and brass are now being fabricated into kettles, filter presses, and pumps, and such materials as "Nickel-Clad," metallized wood, and "bonded" metal (metal to which a felted material is attached by a metal adhesive) have become available. Stainless steels have also been exploited during the depression and become firmly established in the process industries. Sterling silver at its present record low price is within reach of the chemical engineers, and some of its applications are given. Illustrations are given of a bronze filter press with copper sheet strainers and two ammonia beer coolers of stainless steel.—F. J.

The Problem of the Water-Cooled Piston Rod in Two-Stroke Cycle Double Acting Oil Engines. S. F. Dorey (*Trans. Inst. Naval Arch.*, 1933, 75, 200-236).—In dealing with problems connected with the water-cooled piston, reference is made to the corrosion-fatigue of such pistons, and among the methods suggested as a means of protecting the steel rod from such influences, is the use of a sleeve of cupro-nickel. Protection by the electrodeposition of metals such as nickel, cadmium, and chromium is also considered, but is not recommended.—J. W. D.

Economical Construction of Complicated Punch- and Die-Sets. A. Eyles (*Mech. World*, 1933, 93, 141-142).—Apart from the mass of expensive steel used, a one-piece die of any complication means much intricate and costly handwork. The work can be cheapened by the use of alloys of low melting-point to form a matrix for holding the various parts of the dies together. Another application of these alloys is in moulds for pressing composition and fibre. The compositions and some physical properties of a number of suitable alloys are tabulated.—F. J.

Heat Technology Turns to New Mediums. Anon. (*Chem. and Met. Eng.*, 1933, 40, 262-264).—Perhaps the outstanding tendency in heat application to-day, in all cases, where high temperatures must be maintained, is to get away from direct firing of equipment and to substitute some of the new high-temperature heat-transfer media that have recently come into use. The best-known of these applications is probably the Sun Oil Co.'s mercury-vapour process for lubricating oil distillation. This process is briefly described. In the field of power-generation, the principle of the Emmett mercury boiler has recently been used in the large new mercury-vapour plant built at Schenectady by the General Electric Co. Reference is also made to the drum, made of alternate bands of rubber and Monel metal, on which thin sheets of ice are formed. The properties and uses of Alfol are also briefly discussed.—F. J.

XXII.—MISCELLANEOUS

What a Non-Ferrous Metallurgist Should Be. Sylvain F. Perin (*Chim. et Ind.*, 1931, Special No. (March), 499-503).—I. M.

The Function of the Chemical and Metallurgical Industries in an Economic European Entente. I. J. Moltkehanen (*Chim. et Ind.*, 1930, Special No. (March), 287-290).—I. M.

Chapters in Crystal Chemistry for College Freshmen. Part II. Chapter III. Metals and Alloys. The Metallic State. Charles W. Stillwell (*J. Chem. Education*, 1933, 10, 669-674).—The characteristics of metals and alloys and the nature of metallic compounds, especially those of copper and zinc, are described.—J. H. W.

Materials of Industry. Anon. (*Machinery (Lond.)*, 1933, 42, 527-528).—A brief review of some recent developments in non-ferrous metals and alloys. —J. C. C.

Knowledge of the Metals in Ancient India. R. N. Bhagvat (*J. Chem. Education*, 1933, 10, 659-666).—Abstracts are given of a "Treatise on Polity," written by Chanakya or Kautilya in the 4th century B.C., describing briefly the metallurgy, extraction, testing, and purification of gold, silver, and copper. Mention is made of mercury, iron, steel, lead, tin, and other materials. —J. H. W.

Introduction to the Hamburg "Aluminium Day." E. Roth (*Werft, Reederei, Hafen*, 1933, 14, 247-248).—A survey of the growth of the German aluminium and light-metal industry.—P. M. C. R.

Report of the Aluminium Meeting in Hamburg, 1933. Anon. (*Werft, Reederei, Hafen*, 1933, 14, 283-289).—An account of the Aluminium Festival Meeting, Sept. 14, 1933. Abstracts are given of the Presidential Address by E. Roth, on "Aluminium, the German metal"; and of the following papers: E. Foerster: The present application and future significance of aluminium and its alloys in shipping and aviation; W. Pabst: Structural problems and the investigation of strength in seaplane construction; Hans Schmitt: Electric oxidation of aluminium and its alloys; — Herlig: Protection of light metal surfaces; Walther Zarges: On the conception of light metal construction; H. Gervens: The joining of light metal.—P. M. C. R.

Transformation of Aluminium into Nickel? Anon. (*Metallwirtschaft*, 1933, 12, 331).—A newspaper report that aluminium has been converted successfully into nickel should be received with caution.—v. G.

Prevention of Lead Poisoning in Industry. G. H. Gehrman (*Amer. J. Public Health*, 1933, 23, 687-692).—S. G.

Manganese: Its Occurrence and Uses. Robert Ridgway (*Met. Ind. (Lond.)*, 1933, 43, 83-84).—Abstract of U.S. Bur. Mines Information Circ. No. 6729. See *J. Inst. Metals*, 1933, 53, 681.—J. H. W.

Swansea Spelter, Sulphuric Acid Production. T. Benson Gyles (*Times Trade and Eng. Suppl.* (Industrial Wales Section), 1933, 33, (799), 23).—New zinc alloys, calling for zinc of a high purity, have been developed. Of these the Mazak type of alloys are being extensively used as pressure die castings. Reference is also made to the use of zinc in pigments and also to the production of sulphuric acid.—S. V. W.

Magnetic Pulleys in the Non-Ferrous Metal Industries. C. H. S. Topholme (*Met. Ind. (Lond.)*, 1933, 43, 485-486).—The construction, requirements, and applications of a magnetic pulley, suitable for removing magnetic material from non-ferrous metals and for treating foundry sands, are described.—J. H. W.

Reducing Material Waste. C. H. McKnight (*Mech. Eng.*, 1932, 54, 109-112; and (abstract) *Mech. World*, 1932, 91, 243-244).—Much waste of material, hitherto considered inevitable, can be saved by intelligent co-ordination of design, process, and labour efficiency. Some useful adaptations of design and process are described and illustrated.—P. M. C. R.

Workshop Practice in Automobile Engineering. (Sir) Herbert Austin (*Trans. Inst. Eng. Ship. Scotland*, 1931-1932, 75, 368-378; discussion, 378-390; and (abstract) *Mech. World*, 1932, 91, 215-218).—Recent developments include the extended use of automatic or semi-automatic machinery, necessitating careful alignment and inspection, and requiring rigidly standardized material. Certain cutting, grinding, and forging assemblies are described, the application of electric welding is considered, the electrical upset method of valve manufacture is summarized, and the close correlation of all manufacturing processes is justified by a brief statement of output and prices.—P. M. C. R.

1932 Stimulated Ingenuity. Joseph Geschelin (*Automotive Ind.*, 1933, 68, 71-72, 80).—A review of recent developments in manufacturing equipment, heat-treatment, plating, welding, and evolution of new materials in 1932.

—P. M. C. R.

Glossary of Technical Terms. Anon. (*Light Metals Research*, 1933, 2, (31), 38 + xv pp.).—A glossary of metallurgical terms in English, German, French, and Italian.—J. C. C.

A Slide Rule for Converting Weight Percentages into Atomic Percentages. C. Herrmann (*Metallwirtschaft*, 1933, 12, 104-105).—The slide rule can be obtained from the editorial offices of the periodical *Metallwirtschaft*.—v. G.

Engineering Research at the National Physical Laboratory. H. J. Gough (*Trans. Inst. Eng. Ship. Scotland*, 1932-1933, 76, 205-258).—In a description of the various activities of the N.P.L., special attention is given to the work carried out in the Engineering Department, particularly in connection with the mechanical properties of materials at high temperatures, and tensile, creep, fatigue, impact, and torsion tests at such temperatures are discussed. Special consideration is also given to the testing of chains and lifting gear components. In the discussion important points are raised both in regard to high-temperature testing and in the testing and annealing of chains.—J. W. D.

The Torsion and Flexure of Shafting with Keyways or Cracks. W. M. Shepherd (*Proc. Roy. Soc.*, 1932, [A], 138, 607-634).—The stresses in shafts of circular cross-section, having keyways or slits cut in them and subjected to torsion or bent by a transverse load at one end, are investigated mathematically.—J. S. G. T.

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($Fe \begin{matrix} \diagup O \\ \diagdown OH \end{matrix}$) auf einige Metallhydroxyde in alkalischer Lösung"; V. Rodt: "Zur

Entstehung von gelbem Eisenoxydhydrat $Fe \begin{matrix} \diagup O \\ \diagdown OH \end{matrix}$ aus den Eisensulfiden."]

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[Includes statistics regarding the following metallic materials: aluminium, antimony, arsenic, barium minerals, bismuth, cadmium, chrome ore and chromium, cobalt, copper, gold, iron and steel, lead, magnesite, manganese, molybdenum, nickel, platinum, pyrites, quicksilver, silver, strontium minerals, tin, titanium minerals, tungsten, uranium minerals, vanadium, and zinc. A useful list of statistical publications is appended.]
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XXIV.—BOOK REVIEWS

The Crystalline State. Edited by Sir W. H. Bragg and W. L. Bragg. Volume I.—**A General Survey.** By W. L. Bragg. Med. 8vo. Pp. xiv + 352, with 187 illustrations. 1933. London: G. Bell and Sons, Ltd. (26s. net.)

The two text-books, "X-Rays and Crystal Structure" and "An Introduction to Crystal Analysis," published first of all in 1915 and 1928, respectively, which we owe to Sir William Bragg and his son, have been standard English works on the subject of crystal structure and analysis since their appearance. Progress in the science has been so rapid within the last few years that those two books no longer give anything like an adequate picture of the present state of development of the science. Sir William and his son have therefore decided to recast the whole form of the previous books, and here is Volume I of the completely new publication. It gives a complete survey of the whole subject, and forms at the same time an introduction to Volumes II and III, which will be contributed by expert collaborators, and which will deal with X-ray optics, crystallography, space-group theory, technique of analysis, growth and deformation-structures, semi-crystalline bodies, and technical applications. The present volume reviews these and allied subjects in a manner that can be followed by anyone who is interested in the main principles of the subject. It is hoped that the volume will be useful to students who do not require a full treatment. Attempt to commend the book I cannot—the authors' names and their work are more than adequate commendation. I would like, however, to point out how scrupulously fair the author has been in allotting credit to Ewald for the part he played in precipitating the discovery of X-ray diffraction by Laue, Friedrich, and Knipping. One scarcely ever hears of Ewald in this connection. The author's debt to C. T. R. Wilson in the early development of the subject—the author being then a supporter of his father's corpuscular theory of X-rays—is duly acknowledged. One minor point of adverse criticism may, I hope, be permitted. The insertion of 32 plates in the text has apparently interfered greatly with the order of the illustrations. Thus, *e.g.*, I find illustrations 161, 160, 163, 162, 166, 164 following one another in this order of sequence. The same sort of thing occurs in other parts of the book.

The book is well printed on fairly good paper, is well illustrated, and is sold at a reasonable price. Subject and name indices are provided. From the latter I miss the name of Owen; his co-worker, Preston, is referred to in the index, but I can find no reference to the latter's work on the page quoted.—J. S. G. THOMAS.

Neuere Wege in der Metallurgie der Lager- und Weissmetalle. Von Friedrich Vogel. Med. 8vo. Pp. iv + 97, with 8 illustrations. 1933. Halle (Saale): Wilhelm Knapp. (Br., R.M. 7.50.; geb., R.M. 8.80.)

This book is intended for the process metallurgist concerned with the recovery of usable metals and alloys from commercial white-metal residues and scrap. From the point of view of physical metallurgy it is of interest in that existing liquation processes are critically examined in the light of a detailed application of the equilibrium diagram of the ternary lead-tin-antimony system. The author rejects the idea that with the type of material which he is considering the liquation operation should be based necessarily on the formation of the so-called eutectic mixture containing tin 55, lead 41.3, antimony 3.6, and copper 0.1 per cent. He points out how the course of liquation and the nature of the final product are influenced by the formation of the tin-antimony β -phase containing 50 per cent. each of tin and antimony, and why in general it is desirable to prevent the formation of this constituent. Methods of working with this object are outlined, and the relation of the character of the product to other dry and wet recovery processes is discussed.

The declared object of the author is not so much to give a detailed account of procedure as to stimulate the re-examination of the theoretical bases of methods of recovery, with special reference to raw materials arising from bearing metals, type metals, die-cast white-metals, and various ashes. In pursuance of this idea, the author, after dealing with the characteristics of the available raw materials, considers the application to these classes of material of pure smelting processes, the Harris process, and electrolysis.

The book should be useful to metallurgists working in this rather specialized field, to whom the list of more than 120 process patents will no doubt be of particular interest.—A. J. MURPHY.

Working in Precious Metals. By Ernest A. Smith. With an Introduction by Sir Harold Carpenter. Med. 8vo. Pp. xiv + 400, with 20 illustrations. 1933. London: N.A.G. Press, Ltd., 26-34 Old Street, E.C.1. (15s. net.)

The aim of this book, which is especially written for working goldsmiths and silversmiths, is to provide the craftsman with "a scientific insight into the properties and behaviour of the materials with which he works." To this end the author first gives an account of modern views of the nature of metals and alloys and methods of investigating their properties; this is followed by a description of the crystalline structure of metals and the constitution of alloys,

in which the construction and use of equilibrium diagrams are explained. Having thus dealt with the theoretical side of the subject, the practical side is introduced by a discussion of the methods and apparatus of melting, casting, mechanical and heat-treatment, and pickling. Gold, silver, and platinum are then each considered, together with their important technical alloys, methods of making and working the alloys being described and an account of their valuable properties given. Finally, the problems associated with soldering, polishing, and enamelling are discussed and a brief survey is given of the methods of collecting, evaluating, and treating waste products from the workshops for the recovery of their precious metal content. A short chapter on substitutes for precious metals (*e.g.* rolled gold, gilt, and plated base metals) concludes the book.

From a life-time spent in the study and working of the precious metals Mr. Smith has obtained a thorough theoretical and practical knowledge of every branch of the subject, and, in addition, he has the gift of presenting his knowledge to others in an easily readable and readily assimilable form, and the book should therefore be of considerable value to those craftsmen who desire to carry out their work in a scientific manner. Unfortunately, there are still far too many workers in precious metals who adopt the old rule-of-thumb methods, and who, when they meet trouble, are inclined to blame the makers of the alloys for supplying faulty metal, whereas the real cause of the trouble is to be found in their incorrect methods of working. With the fierce competition of the present day, satisfactory products are obtained only by the strict adherence to scientific principles in all stages of the fabrication of metals and alloys into useful articles; this applies equally well to precious metals as to base metals, but it is to be regretted that many workers in the precious metals have not yet appreciated this. This book should, however, bring home to them the facts, since one of its chief features is to point out the various faults which can develop by bad working, and to indicate their causes and means for their prevention.

The book is well printed in a large, clear type on good paper, and is well worth the price charged. The only adverse criticism the reviewer can find is to lament the absence of illustrations of modern furnaces, working tools, and testing appliances.—A. R. POWELL.

Das Quecksilber, seine Gewinnung, technische Verwendung und Giftwirkung, mit eingehender Darstellung der gewerblichen Quecksilbervergiftung, nebst Therapie und Prophylaxie. Von Ernst W. Baader und Ernst Holstein. Med. 8vo. Pp. 239, with 21 illustrations. 1933. Berlin: Richard Schoetz. Wilhelmstrasse 10. (Br., R.M. 12.60; geb., R.M. 14.80.)

This work is sub-divided into seven sections, the first of which deals with the chemistry and technology of mercury. Here the occurrence, methods of extraction, and physical properties of the metal are described. This is followed by an account of the uses of (i) the metal, (ii) the inorganic compounds, (iii) the organic derivatives, in industry, scientific work, and in medicine. A brief description of the more important properties and methods of preparation of the better-known inorganic and organic compounds is included in this section. The second and third sections deal with the pathogenic action of mercury and the compounds of mercury, the methods by which it enters the body, and the fate of the metal in the body. The effects of mercury poisoning are also described with illustrative diagrams, some of which are in colour. The fourth and fifth sections deal with pathology and the therapeutics of mercury poisoning. The sixth section deals with the hygiene of the workers in mercury and mercurial compounds, and the final section considers the laws set up in the various countries for the protection of the workers in trades using mercury or mercury compounds.

This is a work which should be read by everyone engaged in work in which mercury takes any part; there is little strictly chemical information in the book, but much information which the worker with mercury ought to possess for his personal safety and well-being.—JAMES F. SPENCER.

Das Rhenium. Von Ida und Walter Noddack. Roy. 8vo. Pp. viii + 86, with 7 illustrations. 1933. Leipzig: Leopold Voss. (R.M. 7.80.)

This monograph presents an account of the knowledge of the newly discovered element rhenium. After a historical introduction the authors discuss the occurrence of rhenium in minerals, extra-terrestrial bodies, and technical residues. They follow this with an account of the isolation of rhenium compounds from (i) oxide minerals, (ii) sulphide minerals, (iii) molybdenum glance, and (iv) technical residues. The fourth chapter deals with the metal itself, and here the preparation, physical and chemical properties are described. The methods of detection and estimation are discussed in Chapter V. In the succeeding six chapters the septa-, sexa-, quinq-, quadri-, ter-, bi-, and uni-valent compounds of rhenium are dealt with in the order stated. The final chapter discusses the position of rhenium in the periodic classification, and here a table of the wave-lengths of the lines of the arc spectrum of rhenium is included. A bibliography containing 152 references is appended to the book.

The book is exceedingly interesting; it is clearly written and presents an authoritative account of all that is known of the element. The work is most valuable, and it is rendered especially so by the bibliography, and should be in the hands of all chemists.—JAMES F. SPENCER.

Gmelins Handbuch der anorganischen Chemie. Achte völlig neu bearbeitete Auflage. Herausgegeben von der Deutschen Chemischen Gesellschaft. Bearbeitet von R. J. Meyer. System-Nummer 54: **Wolfram.** Sup. Roy. 8vo. Pp. xviii + xi + 397, illustrated. 1933. Berlin: Verlag Chemie G.m.b.H. (R.M. 64; subscription price, R.M. 56.)

The present section of Gmelins *Handbuch* deals with the chemistry of tungsten, and opens with an historical account of the discovery of the metal and the development of its chemistry and industrial applications. This, as is usual in this work, is followed by an account of the distribution of the element in Nature and of the many minerals in which it is found. The element is then considered at great length (88 pages) and in great detail. This is a most illuminating chapter; the following points are considered in order: methods of preparation and manufacture, the physical and chemical properties of the metal, and the methods by which it may be detected and estimated. The alloys of tungsten with antimony, bismuth, zinc, aluminium, titanium, zirconium, tin, hafnium, thorium, lead, vanadium, tantalum, and chromium are described together after the treatment of the metal. The remainder of the book (200 pages) is devoted to the description of the compounds of tungsten, and here, in addition to the better-known compounds, a large number of salts of the homo- and hetero-complex tungstic acids are included.

The work has been compiled with care, thoroughness, and discrimination and presents a very useful and complete account of the state of knowledge of tungsten. It is a book which must find a place in every chemical library.—JAMES F. SPENCER.

Der Einfluss der Korrosion auf die Biegungsschwingungsfestigkeit von Stählen und Reinnickel. Von Otto Behrens. (Mitteilungen des Wöhler-Instituts, Braunschweig, Heft 15.) Demy 8vo. Pp. iv + 73, with 38 illustrations. 1933. Berlin: NEM-Verlag G.m.b.H., Schöneberger Ufer 34. (R.M. 3.60.)

Dr. Behrens' research at the Wöhler-Institut is a logical continuation of earlier work, notably that of Hottenrott, conducted in the same institution. Hottenrott confined himself mainly to carbon steels, but Dr. Behrens has now extended the investigation to steels containing nickel, chromium, and tungsten, as well as to pure nickel. The tests were carried out in a machine giving alternating flexion under six conditions: (a) in air, (b) in a jacket through which Brunswick water was run, (c) in air, using specimens subjected to a process of surface pressure between rollers, (d) in water, using specimens subjected to surface pressure, (e) in water with electrochemical protection, (f) in water with electrochemical protection, using specimens subjected to surface pressure.

The results show the marked reduction produced by corrosion on the fatigue-strength of most of the ferrous materials; one nickel-chrome steel, tested over 2×10^4 cycles, resisted 44.8 kg. per sq. mm. in air, but only 16.2 kg. per sq. mm. in water. For pure nickel the reduction was merely from 16.4 to 15.8 kg. per sq. mm., whilst a certain nitride-covered steel was found to be almost uninfluenced by corrosion, except where the covering had been damaged. Perhaps the most remarkable feature of the results is the good showing of the specimens subjected to surface pressure between rollers (except in the case of nitride-covered steel). This treatment not only raises considerably the fatigue-strength as obtained by testing in air, but it also brings up the value obtained in water to a level similar to that reached by untreated specimens in air. The character of the attack is also changed in most cases; untreated steels show local rusting starting at surface defects; these defects seem to be removed by the surface pressure, for the treated specimens show comparatively uniform attack leading to rust-coats which tend gradually to peel off. If the results given are typical of the bulk of materials, surface pressure deserves serious consideration as a means of combating both ordinary fatigue and corrosion-fatigue.

The research is a valuable contribution to our knowledge of corrosion-fatigue, and the book, which is well illustrated and satisfactorily printed, should be read by all concerned with that subject.—U. R. E.

Atlas Metallographicus. Von H. Hanemann und A. Schrader. Lieferung 12: Tafel 89–96; Lieferung 13: Tafel 97–104; Lieferung 14: Tafel 105–108. 1933. Berlin: Gebrüder Borntraeger. (Lief. 12, R.M. 14; Lief. 13, R.M. 14; Lief. 14, R.M. 16; Band I. (Lief. 1–14) komplett gebunden beträgt, R.M. 128.)

These three parts complete the first volume of the "Atlas," and are concerned principally with the structural appearance of iron and steels after various degrees of working with and without subsequent heat-treatment. Especially interesting to workers in both ferrous and non-ferrous metallurgy are the effects of ball impressions made in hardness testing on the structure of steel immediately under the impression, and crystal growth after recrystallization.

The value of the "Atlas" is considerably enhanced by the four indices included in Part 14: (1) table of contents arranged according to the text in the order in which it appears, (2) index of parts, tables, photomicrographs, and titles in the order of their appearance, (3) author index, and (4) alphabetical index of the subject matter. The volume, as a whole, provides a beautiful and comprehensive yet concise summary of the structural appearance of carbon steels after long cooling and annealing, and should be invaluable as a reference book on the behaviour of this material. (Cf. *J. Inst. Metals*, 1927, 38, 712; 1929, 42, 730; 1930, 44, 762; and 1933, 53, 606.)—J. H. WATSON.

Journal of the Electrodepositors' Technical Society. Volume VII, 1931–1932. Demy 8vo. Pp. 194, illustrated. 1932. London: Electrodepositors' Technical Society, Northampton Polytechnic Institute, St. John St., E.C.1. (Members, 10s. 6d.; non-members, 15s.)

This volume contains the 13 papers (with discussions) read before the Society during the 1931–1932 session, together with accounts of the Annual Meeting of the Society and of the Faraday Centenary Exhibition. The papers deal with the deposition of nickel, chromium, zinc, and tin, the throwing power of plating baths, metal cleaning prior to plating, and certain historical aspects of plating; all have been abstracted in the *Journal*.—A. R. POWELL.

Handbook for Oxy-Acetylene Welders: a Practical Guide to Oxy-Acetylene Welding. 8vo. Pp. 254. 1933. London: The British Oxygen Company, Ltd. (3s. 6d. net.)

This is a revised and enlarged edition of the "Handbook for Oxy-Acetylene Welders" by L. M. Fox, published in 1926 by Allen Liversidge, Ltd. Both high-pressure and low-pressure systems are considered. The plant and accessories, instructions for assembling and handling are dealt with in the first six chapters. Elementary instructions in welding technique (including a very short note on "rightward" welding) are then given, with a chapter on precautions as to expansion and contraction, preheating, cooling and annealing, and the use of chills. A general chapter on the properties of metals follows, and detailed instructions are given for welding steels, Cast-iron and malleable iron, aluminium, nickel, copper, and its alloys, Monel metal and Elektron. After a chapter on metal cutting, a discussion of air-acetylene processes—brazing, plumbing, soldering, paint-burning—concludes the main part of the book. Some useful appendices give melting points of metals, flame temperatures, compositions of common alloys, gas cylinder calculations, temperature conversion tables, and the Home Office "Safety Measures" concerning the use of acetylene.

As in the majority of welding text-books, the non-ferrous metals are not treated at sufficient length or with sufficient care. We are amazed to learn that "at the present time, welding processes are not extensively applied to copper and its alloys." Can it be that Cauzler rod is regarded as a solder? The binding, printing, and illustrations of the book are excellent: blank pages are inserted at intervals for welders' notes; and there is a very fine two-page plate showing various types of flame.—H. W. G. HIGNETT.

Electrical Machinery and Apparatus Manufacture. A Complete Work by Practical Specialists Describing Modern Practice in the Construction and Manufacture of Apparatus and Machinery. Edited by Philip Kemp. Cr. 8vo. In seven volumes. Pp. 1820, illustrated. 1931; 1932. London, Bath, Melbourne, Toronto, and New York: Sir Isaac Pitman and Sons, Ltd. (6s. per volume.)

In these volumes, the principal products of the electrical industry are grouped under 19 headings, and a series of accounts—more or less detailed—is given of the salient features of each product and the methods used in its manufacture. In addition, four general sections are included, dealing with drawing office practice, electrical materials, testing methods, and works organization, respectively.

The treatment of the various sections is somewhat uneven (perhaps inevitably so where so many authors are concerned), but on the whole it may be said that each presents a readable and interesting account of modern practice in the industry with which it deals.

From the metallurgical viewpoint, it is unfortunate that the section on "Electrical Materials" is one of the weakest. It is decidedly sketchy, and gives an impression of having been "written up" at second hand. For instance, the statement regarding aluminium that "for most engineering purposes the product (of the reduction furnace), which has a purity of 99.2 per cent., need not be further refined" indicates a fundamental misconception of the process. It is admittedly no easy matter to give an intelligible and comprehensive survey of the properties of the large range of raw materials used in the electrical industry in the compass of a few pages. The task is obviously one of selection, and omissions are inevitable. The presence of irrelevant matter is, however, all the more difficult to excuse. Conversational statements such as that tungsten is "the strongest metal known" (p. 462) or that selenium

is occasionally found in the metallic state (p. 466) could only be regarded as out of place, even if they were true.

As a contrast, the section contributed by A. G. Robiette, on "Electric Furnaces," can be unreservedly recommended. All the principal types of arc and induction melting furnaces and resistance heating furnaces are described and illustrated by photographs and clear diagrammatic sketches. The outstanding constructional details are discussed, and the methods of lining melting furnaces dealt with in some detail. The result is a remarkably complete account of modern electric furnace construction. Few omissions call for notice. Rather more attention might perhaps have been given to the use of forced air circulation in low-temperature furnaces (American practice is not mentioned) and to the precautions necessary to secure uniform heating in resistance furnaces generally.

Two other sections, "Primary Cells" and "Accumulators," may be mentioned for their metallurgical interest. These contain, respectively, descriptions of the construction of zinc electrodes and accounts of the casting and welding of lead accumulator plates.

Regarding the volumes as a whole, their greatest appeal will undoubtedly be to the young student. They are not sufficiently detailed to be reference books, and in general are too elementary to be of great value to those engaged in the industries described. They do, however, contain in convenient form a good deal of information which is not generally available. The complete series could be read with considerable profit by any engineering student.

—J. C. CHASTON.

Seibt Export Catalogue. Official Handbook of the Federation of German Industries. (Reichsverband der Deutschen Industrie.) 1932-1933. Edited by Artur Seibt. $8\frac{1}{2} \times 11\frac{1}{2}$ in. Pp. 32 + 55 + 520 + 200. München: M. Müller & Son.

The first section of the catalogue deals with the Federation of German Industries and its organization, the second section gives a list of products with their classification number arranged alphabetically, and the third section provides a classified list of suppliers of the various products with their addresses, the products supplied being given in red in a side-column under their classification number. In the fourth section the firms which supply the goods in the 164 classes are arranged in alphabetical order in each class. With this arrangement it is possible to discover very quickly the firms who supply a given article or the products manufactured by a given firm. Spanish, French, German, and English equivalents of the names of the products are given in most cases.—A. R. POWELL.

Chemical Engineering and Chemical Catalogue. A Catalogue of Heavy and Fine Chemicals, Raw Materials, Machinery, Plant, and Equipment Applicable to Production Industries, Standardized, Condensed and Cross-Indexed. Edited by D. M. Newitt. Compiled with the co-operation of leading British manufacturers. Ninth edition. Demy 4to. Pp. 107 + 62 + 25 + 10 + 77 + lxxiii. 1933. London: Leonard Hill, Ltd., 231-232 Strand, W.C.2. (10s. net.)

This year's edition of this now well-known catalogue is almost identical with the 1932 edition except that the thumb indentations for finding the various sections have been replaced by protruding bookmarks. The Main Index and the Book Bibliography section have been brought up-to-date, but no changes appear to have been made in the section devoted to Data and Tables. The firms taking space this year number 77; in addition, there are advertisements of seven publishers.—A. R. POWELL.

Who's Who, 1934. An Annual Biographical Dictionary with which is incorporated "Men and Women of the Time." Eighty-sixth year of issue. Post 8vo. Pp. lxiv + 3691. 1934. London: A. & C. Black, Ltd. (60s.)

Each year "Who's Who" increases in usefulness and in bulk. The 1934 volume is 40 pages larger than its predecessor—a fact that suggests the addition of many hundreds of new biographies to last year's total of "about 40,000" (the publisher's estimate). "Who's Who" is far from being merely a chronicle of those who have achieved distinction in Britain. It knows no international boundaries. Workers of all countries are included in its extensive pages. Thus the first two entries refer to a Welshman and a Persian, respectively; whilst the two biographies ending the volume deal with "Z.'s" residing, respectively, in Natal and U.S.A.

This monumental work is invaluable to those who have occasion to keep in touch with the activities of leaders in the various branches of human activity throughout the world.

Of all the non-technical books of reference received at the Institute of Metals the one that would be missed most—could its non-appearance be imagined—would be this splendidly compiled set of biographical notices.—ED.