

## I.—PROPERTIES OF METALS

(Continued from pp. 1-10.)

**The Effect of Short Circuit Currents on the Tensile Strength of Transmission Cables of Aluminium and Copper.** F. Wöhr (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1931, 3, 271-276).—To determine the softening effect of the passage of powerful electric currents on twisted wire cables of aluminium (99.6%) and copper, cables of these metals with a cross-section of 70 mm.<sup>2</sup> were subjected for 1-50 seconds to current densities of about 40-100 amp./mm.<sup>2</sup>, whereby the temperature was raised to 125°-600° C.; and the tensile strength was then determined. The aluminium cables began to soften at 140°-150° C. and the copper cables at 170°-180° C.; at higher temperatures the tensile strength decreased to the value of the recrystallized material at 250° C. and 280° C., respectively. In contrast to the behaviour of single wires, the time of the application of the high load (*i.e.* the time taken to reach maximum temperature) was without appreciable influence on the degree of softening. The interior and exterior wires of the cable were softened to the same extent. With the same overload (*i.e.* that necessary to reach the same maximum temperature) and with the same equivalent conducting cross-section (70 mm.<sup>2</sup> for copper against 115 mm.<sup>2</sup> for aluminium) aluminium cables are superior to copper cables in their behaviour with short circuit currents.—M. H.

**Experiments on the Raising of the Electrical Conductivity of Hard Aluminium by Thermal Treatment.** H. Bohner (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1931, 3, 276-279).—When aluminium wire-bars (99.6%) are rolled down to 10 mm. at 500°, 400°, and 300° C., respectively, quenched, and then hard-drawn to 2 mm. the tensile strength and electrical conductivity are the higher the lower the rolling temperature; differences are, however, very small. The influence of the rolling temperature becomes more evident if the hot-rolled wire is subjected to an intermediate annealing at the rolling temperature before quenching and cold-drawing. In this case the tensile strength increases with rise of the annealing temperature; the electrical conductivity behaves conversely. Results indicate that an intermediate annealing at about 300° C. produces a somewhat higher electrical conductivity.

—M. H.

**The Annealing of Hard Conducting Aluminium.** H. Bohner (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1931, 3, 280-283).—The effect of annealing at 110°-150° C. on the tensile strength and electrical conductivity of hard-drawn aluminium wires (2 mm. in diameter) which had previously been hot-rolled at 500°, or at 300° C., with or without annealing at these temperatures before drawing has been determined (*cf.* preceding abstract). The decrease in tensile strength on annealing wire which was not annealed before cold-drawing is the smaller the higher the rolling temperature; the increase in electrical conductivity, however, varies only slightly with the rolling temperature. The increase in the electrical conductivity by annealing for 8 hrs. at 120° C. wire which has been annealed prior to cold drawing seems to be independent of the intermediate annealing temperature (500° or 300° C.). On annealing at 140°-150° C. the increase in the electrical conductivity is higher after an intermediate annealing at 500° C. than after one at 300° C. With a suitable combination of annealing and drawing operations it is possible

to obtain aluminium wire having a tensile strength of 18 kg./mm.<sup>2</sup> with an electrical conductivity of more than 36 m./ohm  $\times$  mm.<sup>2</sup> at 20° C.—M. H.

**The Effects of Iron on the Electrical Conductivity and Tensile Strength of Aluminium.** M. Kuroda (*Supplement to Sci. Papers Inst. Phys. Chem. Res. Tokyo*, 1931, 16, 2 pp.).—[In English.] Values are given for the ultimate tensile strength, the percentage elongation, and electrical resistance of hard-drawn and annealed aluminium wires drawn from metal containing from 0.20 to 1.53% of iron, the silicon content being of the order of 0.3–0.5%. The electrical resistance is increased by about 0.15  $\mu$  ohm cm. for each 1% of iron. The ultimate tensile strength of the annealed wire is little affected by the iron content, but for the hard-drawn wire a considerable increase takes place. The elongation is little affected below 1% iron, but above this value a slight increase in elongation occurs. The paper is very brief, but includes a bibliography of 20 papers on the subject published before 1929.—W. H.-R.

**Characteristic Curves of the Aluminium Rectifying Cell.** L. L. Barnes (*Phil. Mag.*, 1932, [vii], 13, 76–81).—The current-rectifying characteristics of a cell comprising aluminium and lead electrodes immersed in a solution of sodium borate are briefly discussed. An increase of temperature above 25° C. reduces the rectifying power of the cell.—J. S. G. T.

**Beryllium.** Anon. (*Met. Ind. (Lond.)*, 1931, 39, 530).—Notice of a monograph, issued by the Mineral Resources Department of the Imperial Institute, outlining the distribution of beryllium deposits, the processes for extracting the metal, and giving a summary of its properties and principal alloys.

—J. H. W.

**Change of Electrical Conductivity of Molten Bismuth Produced by Solution of Bismuth Chloride.** Werner Braunbek (*Z. Physik*, 1931, 73, 335–347).—Eggink found that bismuth chloride (BiCl<sub>3</sub>) dissolved in molten bismuth up to an atomic concentration of 12% of chlorine to form a homogeneous solution of BiCl in bismuth. With higher Cl-content, two fluid layers are formed, the lower being composed of bismuth saturated with BiCl, and the upper of BiCl<sub>3</sub> saturated with BiCl. The decrease of conductivity produced by BiCl is very small and of the order associated with the presence of a foreign metal in a pure metal. Thus at infinite dilution (Cl  $\rightarrow$  0) 1% (atomic) of chlorine causes a decrease of about 3% in the electrical conductivity of the molten metal, whilst 7½% (atomic) of chlorine does not reduce the conductivity by as much as 50%.—J. S. G. T.

**The Metamagnetism in Bismuth Crystals [Effect of Impurities].** A. Goetz and A. B. Focke (*Phys. Rev.*, 1931, [ii], 38, 1569–1572).—A preliminary note. The effect of small amounts of impurity on the magnetic properties of single crystals of bismuth has been investigated between –200° C. and the melting point. If the foreign atoms (like copper) do not go into solid solution, their effect is very small, but if a solid solution is formed (as with tin or lead) the effect on the susceptibility is surprisingly great, and works so as to increase the magnetic anisotropy of the crystal, and to decrease the absolute values of the susceptibilities in all directions. Bismuth crystals saturated with tin (ca. 3%) are paramagnetic parallel to the principal axis, and diamagnetic perpendicular to the axis. The coeff. of temperature of the magnetic anisotropy of the crystal is greatly changed by dissolved atoms so as to cause a large decrease with increasing temperature.—W. H.-R.

**The Isotopic Constitution and Atomic Weights of Cæsium, Strontium, Lithium, Rubidium, Barium, Scandium, and Thallium.** F. W. Aston (*Proc. Roy. Soc.*, 1932, [A], 134, 571–578).—The following weights of isotopes, packing fractions, and atomic weights of the respective metals have been determined: cæsium, isotopes 132, 133, 134; packing fraction 133 =  $-5.0 \pm 2$ ; atomic weight 132.917  $\pm$  0.02; present accepted atomic weight 132.81; strontium, isotopes and percentage abundance, 86, 10%; 87, 6.6%; 88,

53.3%; packing fraction probably — 8.2; atomic weight  $87.64 \pm 0.06$ ; present accepted atomic weight 87.63; *lithium*, isotopes 6, 7; abundance ratio probably 1:11; atomic weight  $6.928 \pm 0.008$ ; *rubidium*, isotopes 85, 87; abundance ratio 3.0:1; packing fraction probably about — 8.2; atomic weight  $85.43 \pm 0.03$ ; accepted atomic weight 85.44; *barium*, isotopes and percentage abundance, 135, 5.9%; 136, 8.9%; 137, 11.1%; 138, 74.2%; atomic weight  $137.43 \pm 0.08$ ; accepted atomic weight 137.36; *scandium*, isotope 45 only; atomic weight  $44.96 \pm 0.05$ ; accepted atomic weight 45.1; *thallium*, isotopes 203, 205; abundance ratio 1:2.40; packing fraction  $1.8 \pm 2$ ; atomic weight  $204.41 \pm 0.03$ ; Honigschmid's value 204.39.—J. S. G. T.

**Hardness of Chromium as Determined by the Vickers-Brinell, Bierbaum, and Mohs' Methods.** R. Schneidewind (*Amer. Soc. Steel Treat. Preprint*, 1931, 1-18).—This study includes a consideration of comparative hardness of electrodeposited chromium and of cast, annealed chromium, and the expression of hardness in different units. The divergent results obtained by other investigators have been examined. In this connection a rough relationship was found between Mohs' hardness and the quotient obtained by dividing the specific heats of the metals by their coeff. of linear expansion. Chromium appears to behave most abnormally. Brinell, Rockwell, Vickers, and Scleroscope tests on chromium plate were valueless, as in each case the plate cracked in the process. On Mohs' scale the maximum hardness of such plate is 8. An average of 13 rather varying readings on the Bierbaum apparatus gave a scratch 2.0 microns in width. On heating, the hardness of the chromium deposit decreases suddenly at about 300° C. and then gradually at higher temperatures. This is attributed to the volatilization of hydrogen. The hardness of cast chromium was found to be: Brinell, 217-230, Mohs 4.6. No dependable relationships were found between the hardness of metals measured by the methods investigated. There seems, however, to be an approximate connection between the logarithms of the Brinell and Mohs' hardnesses.

—W. A. G. N.

**Stayrods and Firebox Plates—English and German Experience of Copper.** R. Kuhnel (*Metallurgia*, 1931, 5, 53-56).—Translated from *Z. Metallkunde*, 1931, 23, 1-7. See this *J.*, 1931, 47, 193.—J. W. D.

**Preparation of Pure Magnesium by Sublimation.** J. Hérouquel and G. Chaudron (*Génie civil*, 1931, 99, 533-534).—In order to study the corrosion properties of magnesium, metal of a high degree of purity is essential. Under a pressure of 0.01 mm. mercury magnesium volatilizes at 600° C., i.e. 50° C. below its melting point. The magnesium is heated in a calorized vessel and is sublimed on a water-cooled surface. Under the conditions used, 1 kg. of magnesium could be sublimed in 1 hr. When correctly carried out, the experiment will yield magnesium containing less than 0.001% of silicon. On the upper surface of the condenser sodium and magnesium chlorides were found to be present. The magnesium is deposited as dendrites several cm. long. The deposited metal is remelted under a pressure of a few cm. of mercury in an atmosphere of argon.—W. P. R.

**Determination of Some Physical Properties of Magnesium Crystals (Preliminary Communication).** E. Goens and E. Schmid (*Wiss. Abhandl. Physik.-Tech. Reichsanst.*, 1931, 15, 91).—Reprint from *Naturwiss.*, 1931, 19, 376-377. See this *J.*, 1931, 47, 418.—M. H.

**The Preparation of Pure Electrolytic Nickel. III.—Chemical and Physical Properties.** Colin G. Fink and F. A. Rohrman (*Trans. Electrochem. Soc.*, 1931, 59, 359-368; discussion, 368-369).—See this *J.*, 1931, 47, 323.—S. G.

**Contact Potential Difference between Iron and Nickel, and their Photoelectric Work Functions.** G. Norris Glasser (*Phys. Rev.*, 1931, [ii], 28, 1458-1496).—The contact p.d. between iron and nickel after prolonged heating at high temperatures (950° C. for iron, and 1100° C. for nickel) in a vacuum of

the order  $1 \times 10^{-8}$  mm. of mercury, was measured as  $\text{Fe-Ni} = +0.21 \pm 0.01$  v., the iron being positive. The photoelectric long wave-limits for the same specimens, as determined by extrapolation of the sensitivity-wave-length curves to zero current, were iron,  $2620 \pm 10$  A., nickel  $2500 \pm 10$  A. Expressed in equivalent volts, these give photoelectric work functions of  $4.71 \pm 0.02$  v. for iron, and  $4.93 \pm 0.02$  v. for nickel. The difference, 0.21, is thus equal to the contact potential in agreement with the Einstein photoelectric equation. The work-functions determined by Fowler's (*Phys. Rev.*, 1931, [ii], 38, 45) theoretical analysis of temperature-sensitivity curves are 4.77 and 5.01, the difference here being 0.24.—W. H. R.

**Heat of Absorption of Hydrogen by Palladium-Black at 0°.** Louis J. Gillespie and Henry A. Ambrose (*J. Physical Chem.*, 1931, 35, 3105-3110).—The loss of energy due to the absorption of hydrogen by palladium-black has been directly measured in an ice-calorimeter, and the results agree with those obtained by Mond, Ramsay, and Shields for compositions not exceeding that of the second solid phase ( $\text{Pd}_2\text{H} + \text{excess hydrogen}$ ). The loss of heat content accompanying the reaction  $\text{H}_2 + 4\text{Pd} = 2\text{Pd}_2\text{H}$  at 0° C. and 1 atm. pressure, where  $\text{Pd}_2\text{H}$  is the average composition of the two solid phases formed, is 9280 cal. (15° C.), which agrees within about  $\pm 3\%$  with the value recalculated from Gillespie and Hall's observations.—J. S. G. T.

**The Freezing Point of Platinum.** Wm. F. Roeser, F. R. Caldwell, and H. T. Wensel (*Met. Ind. (Lond.)*, 1931, 39, 411-412).—Abstract from *U.S. Bur. Stand. J. Research*, 1931, 6, 1119-1129. See this *J.*, 1931, 47, 469.—J. H. W.

**The Electrolytic Transfer of Platinum in Hydrochloric Acid Solution.** G. Grube, F. Oettel, and H. Reinhardt (*Festschrift zum 50-jährigen Bestehen der Platinschmelze G. Siebert G.m.b.H. Hanau*, 1931, 108-120).—Anodic current density-potential curves have been constructed for electrolytic platinum in hydrochloric acid solutions of hydrochloroplatinic acid. Electrolytic platinum dissolves more readily at the anode than does rolled platinum sheet. Anodic dissolution of active platinum begins at  $\epsilon_a = +1.0$  v., whilst chlorine begins to be evolved at passive platinum anodes at a potential of  $+1.2-1.4$  v. Platinum can be dissolved from the anode and deposited at the cathode at 75° C. in electrolytes comprising a 0.1M-solution of hydrochloroplatinic acid made 5N with hydrochloric acid; at low current densities anodic dissolution takes place into the tetravalent state, but part of the platinum dissolves in a divalent form at high current densities.—A. R. P.

**On the Action of Oxides on Platinum at High Temperatures.** E. J. Kohlmeier and I. W. Westermann (*Festschrift zum 50-jährigen Bestehen der Platinschmelze G. Siebert G.m.b.H. Hanau*, 1931, 193-214).—In 15 minutes at 1230-1240° C. in an electric furnace a platinum foil remained absolutely unattacked by bismuth oxide, but at 1300° C. about 1% of its weight of bismuth was absorbed and the surface became matte and covered with lustrous droplets of a fusible alloy, whilst at 1400° C. the platinum was quickly perforated. Similar results were obtained with lead oxide. Photomicrographs of characteristic structures produced in these tests are given. Platinum crucibles and wires heated in contact with alumina, magnesia, or "Marquardt mass" begin to roughen at about 1600° C. and generally fail completely below 1700° C. All these phenomena are attributed to dissociation of the oxides into metal and oxygen, the former then alloying with the platinum to produce brittle and fusible alloys.—A. R. P.

**Attack of Platinum and Tungsten by Iodine.** Gordon van Praagh and Eric Keightley Ridcal (*Proc. Roy. Soc.*, 1931, [A], 134, 385-404).—The attack of platinum by iodine is a two-stage process. At relatively low temperatures no surface attack occurs, but at about 1300° (abs.) dissociation of molecular iodine occurs, and at about 1400° (abs.) atomic iodine attacks the metal forming the volatile iodides  $\text{PtI}$  and  $\text{PtI}_2$ . The calculated heat of absorption of

atomic iodine by platinum is 53,700 cal./grm.-mol. Unlike platinum, tungsten is attacked by iodine at low temperatures, forming a non-volatile iodide. At high temperatures, dissociation of iodine into atoms occurs more readily on platinum than on tungsten. Atomic iodine formed at a tungsten surface at temperatures above 1860° C. does not attack the hot metal, but cooled parts of the metal are attacked. The mechanisms of the respective modes of attack are briefly discussed.—J. S. G. T.

**On the Precipitation of Platinum-Black.** A. Sieverts and H. Brüning (*Z. anorg. Chem.*, 1931, 201, 113–121).—A comprehensive study of the conditions of precipitation of platinum-black from chloroplatinic acid by means of formic acid, sodium formate, and formaldehyde. The nature and amount of contamination in platinum-black prepared in different ways have been examined. With a chloroplatinic acid : sodium formate ratio of 1 : 2 platinum-black is obtained free from gas.—M. H.

**The Adsorption of Hydrogen by Platinum-Black.** A. Sieverts and H. Brüning (*Z. anorg. Chem.*, 1931, 201, 122–143).—A portion of this paper has been published in *Festschrift zum 70. Geburtstag von Wilhelm Heraeus, 1930, 97–114*; see this *J.*, 1931, 47, 469.—M. H.

**Investigations on the Course of the Atomic Heat of Ruthenium, Rhodium, and Palladium and on the Coefficients of Expansion of Rhodium and Palladium at High Temperatures.** Hermann Holzmann (*Festschrift zum 50-jährigen Bestehen der Platinschmelze G. Siebert G.m.b.H. Hanau, 1931, 147–172*).—The coeff. of linear expansion of rhodium is given by the expression:  $\beta = 7.628 \times 10^{-6} + 4.537 \times 10^{-9} (t - 20)$  and that of palladium by the expression  $\beta = 10.637 \times 10^{-6} + 9.187 \times 10^{-9} (t - 20) - 4.564 \times 10^{-12} (t - 20)^2$ . Hence the value of  $\beta$  for rhodium increases linearly with rise in temperature, whereas for palladium the increase with rise in temperature gradually becomes smaller. The specific heat of ruthenium is  $0.057439 + 0.018921 \times 10^{-3}t$  and the atomic heat  $5.8415 + 1.9242 \times 10^{-3}t$ . The specific heat of rhodium is  $0.060467 + 0.018303 \times 10^{-3}t$  and the atomic heat  $6.221 + 0.00188834t$ . The specific heat of palladium is  $0.0584 + 0.015853 \times 10^{-3}t$  and the atomic heat  $6.2313 + 0.0016915t$ . The corresponding values for the atomic heats at constant volume have been determined for palladium and rhodium. The values agree with the Born-Brody theory, but not with those obtained by Jaeger and Rosenbohm (*Proc. K. Akad. Wet. Amsterdam, 1930, 33, 457–472*; this *J.*, 1930, 44, 457).—A. R. P.

**Experimental Studies on the Relation between Rolling Texture, Deep Drawing Properties, and Hardness of the Metals Silver, Copper, and Aluminium and a Silver-Copper Alloy.** Hermann Holzmann (*Festschrift zum 50-jährigen Bestehen der Platinschmelze G. Siebert G.m.b.H. Hanau, 1931, 121–148*).—The Erichsen value of silver and copper falls with increasing reduction in thickness to a minimum at 85–90% reduction, then rises sharply; with aluminium a flat minimum at 55–75% reduction is followed by a slow rise. In the case of the 835-fine silver-copper alloy there is a slow fall in Erichsen value to about a 50% reduction, followed by a very rapid fall, the value for a 90% reduction being only 0.4 mm. Cross-rolling reduces the Erichsen value of all the above metals very slowly, but little change occurs after a reduction of 60%, the Erichsen value then remaining constant at 5–6 mm. in all cases. Cross-rolling produces a smaller increase in hardness than does rolling in one direction; the maximum hardness increase in the latter case is 200% for silver, about 100% for copper and the silver-copper alloy, and less than 50% for aluminium. The Erichsen value of annealed silver, copper, and aluminium is independent of the degree of rolling when the metal has been cross-rolled, but falls with increasing reduction in thickness above 75% for copper, 95% for aluminium, and 80% for the silver-copper alloy when rolling has been done in one direction only.—A. R. P.

**Non-Metallic Films, which Remain as Residue on the Dissolution of Tin.** Artur Kutzelnigg (*Z. anorg. Chem.*, 1931, 202, 418-420).—When tin foil is dissolved in a 10% solution of ferric chloride or a saturated alcoholic solution of pink salt without stirring, a coherent thin skin remains behind which possesses the shape of the foil. 10 grm. of tin foil gave a residue of 1.76 mg. in weight. The residue which is soluble in hydrochloric acid is essentially a tin compound. The film has a striated structure, possibly owing to the presence of slip planes in the foil; residues from granulated tin have a net-like structure.

—M. H.

**Electrolytic Phenomena in Oxide-Coated Filaments.** Joseph A. Becker (*Trans. Electrochem. Soc.*, 1931, 59, 207-220).—See this *J.*, 1931, 47, 420, and following abstract.—S. G.

**Supplementary Remarks by the Author and Discussion on Becker's Paper on "Electrolytic Phenomena in Oxide-Coated Filaments."** Joseph A. Becker. R. A. Wolfe. Colin G. Fink. Benjamin Miller (*Trans. Electrochem. Soc.*, 1931, 59, 217-221).—Cf. preceding abstract. J. A. B. in introducing the paper at the meeting showed characteristic curves for  $\log_{10} i$  versus  $f$  for caesium, barium, and thorium on tungsten at 1100° K.; all three curves are of similar shape, and show that maximum activity occurs when the surface is covered with a monatomic layer and that the more electropositive the adsorbed material the greater is this maximum.  $\log i$  does not vary linearly with  $f$  between  $f = 0$  and  $f = 1$ . When barium is deposited on the surface of baryta or a mixture of baryta and strontia the thermionic emission at a fixed temperature varies in a similar manner, i.e. it passes through a maximum, then decreases somewhat, and finally approaches a steady value. Filaments coated with barium have a longer life if the barium is in the core or is fixed into the filament by a coating of baryta; the oxide considerably retards the evaporation of the barium from the filament.—A. R. P.

**The Relation between Uranium and Radium.** Frederick Soddy (*Phil. Mag.*, 1931, [vii], 12, 939-945).—The continued growth of radium, according to the square of the time, from uranium preparations purified in 1905-1909, confirms the value for the period of ionium previously obtained by this method, rather than the somewhat higher values obtained by S. Meyer and by Mmes. Curie and Cotelle. The results show that the average life period of ionium is  $1.06 \times 10^5$  years, that of radium being 2,300 years. The corresponding radioactive constant,  $\lambda_2$ , has the value  $3.0 \times 10^{-13}$  (sec.)<sup>-1</sup>.—J. S. G. T.

**On a Transformation Point of Zirconium.** R. Vogel and W. Tonn (*Z. anorg. Chem.*, 1931, 202, 292-296).—Cf. this *J.*, 1927, 37, 415. The transformation temperature of pure zirconium determined by means of cooling curves is  $862 \pm 5^\circ$  C. The heat of transformation is about 7.73 cal./gram. The transformation is accompanied by a contraction of 0.072% on heating and a corresponding expansion on cooling, i.e.  $\beta$ -zirconium has a higher density than  $\alpha$ -zirconium (hexagonal). According to microscopical investigations and X-ray analysis of samples quenched at 1200° C. and slowly cooled, respectively, the  $\beta \rightarrow \alpha$  transformation takes place with a very high velocity, and can be only incompletely suppressed, if at all, by quenching.—M. H.

**Heat-Resisting Metals.** J. C. Woodson (*Metallurgist* (Suppt. to *Engineer*), 1931, 7, 149-151).—A summary from *Amer. Soc. Mech. Eng. and Amer. Soc. Test Mat. Symposium on Effect of Temperature on Properties of Metals, Preprint*, 1931, 51-76. See this *J.*, 1931, 47, 424.—R. G.

**The Elastic Extension of Metal Wires under Longitudinal Stress.** L. C. Tyte (*Phil. Mag.*, 1932, [vii], 13, 49-68).—The effect of longitudinal stress on the extension of wires made of steel, iron, nickel, brass, copper, aluminium, zinc, tin, and lead is investigated. Even within the "elastic limit" all the materials investigated showed deviations from Hooke's law. The deviation differed widely for different materials, and for the same material it varied

considerably for different heat-treatments and cold-working. For annealed metals the deviation increases with increase of crystal size.—J. S. G. T.

**The Effect of Mechanical Working on the State of a Solid Surface.** R. F. Hanstock (*Phil. Mag.*, 1932, [vii], 13, 81–99).—The effects of mechanically working the surface of metals, e.g. zinc and copper, and insulators, e.g. ebonite, on the tribo-electric and photoelectric properties of the surfaces are investigated. The tribo-electric results indicate the existence of a definite Volta contact effect between the interfaces insulator/insulator and metal/insulator. This contact potential is influenced by changes produced by mechanically working the surfaces, and the variations arising therefrom may be caused to disappear by heating the materials to a definite relaxation temperature. The relaxation temperatures for both tribo- and photo-electric effects are approximately those at which plastic flow is incident in metals.—J. S. G. T.

**On Cracks and Fissures—their Physical Natures and Significances.** Torahiko Terada (*Sci. Papers Inst. Phys. Chem. Res. Tokyo*, 1931, 16, (321), 159–171).—[In English.] A general and rather speculative discussion of recent work on propagation of cracks in various materials. Analogies between fatigue cracks in metals and those on drying mud are pointed out.

—W. H.-R.

**Experimental Studies on Form and Growth of Cracks in Glass Plate.** Moriso Hirata (*Sci. Papers Inst. Phys. Chem. Res. Tokyo*, 1931, 16, (322), 172–195).—[In English.] In view of the importance of crack formation, this paper may be noted, although it does not deal directly with metals.

—W. H.-R.

**The Calculation of the Characteristic Frequency from the Coefficient of Compressibility.** J. B. Austin (*Phys. Rev.*, 1931, [ii], 38, 1788–1790).—A note. The Einstein formula,  $\nu = 2.8 \times 10^7 A^{-1/3} \rho^{1/6} \kappa^{-1/2}$ , where  $\nu$  is the characteristic frequency,  $A$  the atomic weight,  $\rho$  the density, and  $\kappa$  the coeff. of compressibility, involved a small error owing to the way in which  $\nu$ , the atomic volume, was eliminated in terms of  $d$ , the interatomic distance, by assuming an arbitrary structure. Using the values of  $d$  from X-ray crystal analysis, the constant in the equation is almost unaltered, being 2.9 instead of  $2.8 \times 10^7$ . Values of  $\nu$  obtained by different methods are tabulated for silver, aluminium, cadmium, copper, iron, and lead, and a relation for the coeff. of expansion is suggested.—W. H.-R.

**The Quantum Theory of the Metallic State.** Anon. (*Physics*, 1931, 1, 271–272).—Salient points in the development of the quantum theory of the metallic state are briefly referred to.—J. S. G. T.

**Theory of Metals. I.—Eigen Values and Eigen Functions of the Linear Atomic Circuits.** H. Bethe (*Z. Physik*, 1931, 71, 205–226).—A mathematical theory of the metallic state is developed, in which a metal is conceived as a “one-dimensional metal” consisting of a linear circuit of many atoms, each having, in addition to a number of closed electronic shells, one S-electron with spin. The theory is of importance in the discussion of ferromagnetism.

—J. S. G. T.

**The Exchange of Energy between Organic Molecules in a Molecular Beam and Metallic Surfaces.** F. O. Rice and H. T. Byck (*Proc. Roy. Soc.*, 1931, [A], 132, 50–66).—No decomposition is observed in a molecular beam of acetone or dimethyl mercury colliding with a heated platinum target at temperatures up to 1600° C. With a heated tungsten target no decomposition of the same two substances occurs up to 1085° C. At this and higher temperatures a surface reaction involving the formation of tungsten carbide and liberation of carbon monoxide and hydrogen occurs. A similar result is found with a tantalum target at and above 1400° C.—J. S. G. T.

**Cathodic Projection of Elements, and Some Applications.** F. Joliot (*Ann. Physique*, 1931, [x], 15, 418–436).—Principally an account of methods avail-

able for the production of thin films by cathodic projection. Details are given of the application of the method to the preparation of photographic plates without emulsion.—H. F. G.

**Electrical Properties of Metals in Thin Films Prepared by Thermal and Cathodic Projection.** F. Joliot (*Ann. Physique*, 1931, [x], 15, 437-454).—Thin films of a number of metals have been prepared. The resistance of such films is greater than that of the metal in bulk and increases with diminution of the thickness; the temperature coeff. is abnormally small and for certain very thin films becomes negative. Ohm's law is valid, and the film exhibits the Bridgman effect. The resistance increases with time to a steady value, the rate of change being especially rapid for films prepared thermally; the change is accelerated by increase of temperature. On heating, 2 periods may be recognized: in the first the changes of the electrical properties are reversible, and a definite temperature coeff. exists, whilst in the second, when the film attains a definite temperature, which depends on its history, the changes are irreversible; this transition is ascribed to recrystallization. The film absorbs gas readily. Occlusion of gas or water vapour retards the transition, and may cause an increase of the resistance. In explanation of the behaviour of the films it is suggested that the atoms of metal do not form a continuous layer, but are arranged in a series of more or less compressed films. In certain cases the film may be amorphous.—H. F. G.

**Observations on the Paper by Messrs. Seth, Gulati, and Singh on the [Contact] E.M.F. between Metals.** P. E. Shaw (*Phil. Mag.*, 1931, [vii], 12, 1110-1111).—Shaw directs attention to results of his previous work on this subject (*Proc. Roy. Soc.*, 1929, [A], 122, 42), which conform with those obtained by S., G., and S. In addition, voltages comparable with those between *unlike* metals were found to occur even with *like* metals in motion, e.g. with zinc/zinc, copper/copper, or brass/brass. It is suggested tentatively that light pressure between the metals with relatively few atoms bearing in contact will account for the charges, resistances, and pressures observed in the experiments.

—J. S. G. T.

**The Equilibrium Distribution of Potential and of Electrons Outside the Surface of a Conductor.** A. T. Waterman (*Phys. Rev.*, 1931, [ii], 38, 1496-1505).—Theoretical. The equilibrium distribution of potential due to space charge, and the electron concentration outside the surface of a plane electrode in the presence of retarding electric fields are calculated by solving Poisson's equation in conjunction with the Boltzmann distribution law (generalized so as to apply to the Fermi-Dirac statistics), as was done for the classical case by Langmuir (*Phys. Rev.*, 1923, [ii], 21, 419). The results are discussed in connexion with the space charge and image force views of thermionic emission.

—W. H.-R.

**Superconductivity and Polarization Phenomenon.** J. C. McLennan (*Nature*, 1931, 128, 373).—A preliminary note of experiments which seem to show that an orientation effect of some kind must be involved in superconductivity phenomena.—E. S. H.

**Changes in the Resistance of Ferromagnetic Materials in Magnetic Fields.**—II. O. Stierstadt (*Metallwirtschaft*, 1931, 10, 554-556, 573-577).—Cf. this *J.*, 1931, 47, 332. Continuation of the report on recent work and theories.—v. G.

**Electrical and Magnetic Properties of Metals.** R. Becker (36. *Hauptversammlung Deut. Bunsen-Ges.*: "Fortschritte der Metallkunde und ihre Anwendungen auf Leichtmetalle," 1931, 11-12).—A mathematical explanation of the electrical conductivity and magnetic properties of metals.—A. R. P.

**Thermoelectromotive Forces Produced by a Magnetic Field.** S. R. Williams (*Science*, 1931, 74, 75-77).—A general description of the work of Ross (*Phys. Rev.*, 1931, [ii], 38, 179-181; see this *J.*, 1931, 47, 643) on the thermoelectromotive forces developed between longitudinally and transversely magnetized



elements of nickel and iron. A modification is described where the part of the wire which in Ross' experiment was magnetized longitudinally is magnetized transversely, and the direction of the current is opposite to that found by Ross.

—W. H.-R.

**Thermocouples Whose Elements are Longitudinally and Transversely Magnetized Ferromagnetic Substances.** Stewart Seass (*Phys. Rev.*, 1931, [ii], 38, 1254-1257).—Cf. preceding abstract. Wires of nickel and iron were bent to form a right-angled  $\sqcup$ . The two bends were kept at different temperatures, and the section between the two corners was magnetized transversely, and the parts leading to the right angles were magnetized longitudinally. Under these conditions an e.m.f. was set up between the bends, the direction of the current being from a transverse to a longitudinal magnetization through the hot junction. For iron there was a small range of field strengths where the direction of the current was reversed. In the experiments of Ross (*Phys. Rev.*, 1931, [ii], 38, 179-181; this *J.*, 1931, 47, 643) the magnetizations of the different bends of the  $\sqcup$  were in the opposite directions, and the direction of the current in the  $\sqcup$  was reversed, although still from transverse to longitudinal magnetization through the hot junction. The relation of these effects to the Nernst-Ettinghausen effects is discussed.—W. H.-R.

**Thermocouples of Longitudinally and Transversely Magnetized Wires.** C. W. Heaps (*Phys. Rev.*, 1931, [ii], 38, 1391).—Cf. preceding abstracts. A note. In the experiments on thermocouples of longitudinally and transversely magnetized wires, the conditions are more complex than has been imagined. Apart from the longitudinally and transversely magnetized wires, there is unmagnetized metal where the wires leave the electromagnet, and an e.m.f. may be expected from the junctions of magnetized and unmagnetized wires, since the two junctions will not in general be at the same temperature owing to conduction of heat along the wires. The longitudinal thermomagnetic p.d. in the transverse sections of the wire must also be considered. Some of the experimental results are conflicting, and it is essential to keep the different factors distinct.—W. H.-R.

**Theory of Magnetostriction.** Takesi Hayasi (*Z. Physik*, 1931, 72, 177-190).—It is shown mathematically that the lattice energy of a magnetized crystal is dependent on the external shape of the crystal, and the consequent dependence of magnetostriction on this shape is illustrated by an example.

—J. S. G. T.

**Magnetostriction of Ferromagnetic Materials.** M. Kersten (*Z. Physik*, 1931, 72, 500-504).—K. shows that, making certain assumptions, a reversal of the sign of the magnetostriction effect, as experimentally observed by Dietsch (*Z. tech. Physik*, 1931, 12, 380), is to be anticipated.—J. S. G. T.

**The Transverse Magnetostriction Effect.** G. Dietsch and W. Fricke (*Physikal. Z.*, 1931, 32, 640).—Two methods for the measurement of the transverse magnetostriction effect, i.e. the change of transverse dimensions of polycrystalline ferromagnetic materials in a magnetic field, are described. Both methods depend on a determination of the change of electrostatic capacity of a condenser of which the material being examined forms one of the plates. Experiments with a sample of electrolytic iron show that with increasing field strength the transverse- and longitudinal-effects are roughly opposite in sign. The former is initially negative, i.e. the transverse dimensions decrease; after attaining a minimum negative value, its value increases, becoming finally increasingly positive. The minimum and maximum on the respective curves do not occur at exactly the same field strength, the maximum on the curve relating to the longitudinal effect occurring at a somewhat higher field strength. The respective Villari points, i.e. the field strengths corresponding respectively with  $dl = 0$ ,  $dr = 0$ , are not the same, so that for all field strengths there is some change of volume.—J. S. G. T.

**Transverse Barkhausen Effect in Iron.** R. M. Bozorth and J. F. Dillinger (*Phys. Rev.*, 1931, [ii], 38, 192-193).—A note. Previous work on the Barkhausen effect has been confined to determining the changes in magnetization in the direction of the magnetic field, but the transverse effect at right angles to the field may give more detailed knowledge of the reversal of the elementary regions. If the magnetization is closely aligned with the field before and after the reversal (parallel and antiparallel) there will be little transverse effect, but if the magnetization is inclined to the field at a considerable angle, and the reversal is  $180^\circ$  or less, the transverse effect will be relatively large. Results for iron indicate that when the magnetization is small (at the coercive force) the reversals are chiefly of the former kind, but that the latter type become increasingly important when the magnetization is large (over one half of saturation). In these experiments an iron tube was magnetized circularly by passing a current through a copper wire along the axis of the tube.—W. H. R.

**Relationship between the Barkhausen and Wiedemann Effects.** Walter Brandt (*Z. Physik*, 1931, 73, 201-202).—B. discusses very briefly the inter-relationship between longitudinal magnetization, circular magnetization, and torsion in ferromagnetic materials, the effects referred to being concerned with discontinuities observed in these phenomena when the exciting cause is continuous in character. The effects can be observed in nickel wires.

—J. S. G. T.

**Electrical and Magnetic Effects Produced in Metallic Wires Associated with Structural Changes Produced Thermally, Magnetically, or Acoustically.** A. v. Hippel and O. Stiertadt, with an addendum by O. v. Auwers (*Z. Physik*, 1931, 72, 266-274).—v. H. and S. supplement experimental work contained in their previous paper (*Z. Physik*, 1931, 69, 52-55; this *J.*, 1931, 47, 331). v. A. investigates the production of an e.m.f. at the ends of a ferromagnetic wire due to alteration of its magnetization and the electronic centrifugal effect produced by the incidence of longitudinal waves of sound.—J. S. G. T.

**"Nachwirkung" (After-Effect)—Phenomena in Hysteresis Loops at High Temperatures.** Heinrich Kühlewein (*Physikal. Z.*, 1931, 32, 860-864).—Read at the Deutscher Physikertag. Forrer has pointed out that iron and nickel and their alloys possess two Curie points—the ferromagnetic Curie point,  $\Theta_f$ , at which the spontaneous magnetization, or remanence, is zero, and the paramagnetic Curie point,  $\Theta_p$ , deduced in accordance with the Curie-Weiss equation, and corresponding, according to Forrer, with zero value of the coercive force.  $\Theta_p$  is accordingly  $10^\circ$ - $50^\circ$  above  $\Theta_f$ . The reverse is found to be the case in some iron-cobalt alloys. Forrer's conclusions are confirmed by measurements on iron, nickel, and iron-nickel and iron-cobalt alloys in the  $\gamma$ -phase. The anomaly in the case of the iron-cobalt alloys is attributable, according to Forrer, to phenomena which are incompatible with ferromagnetic induction. Forrer's conclusions are not confirmed in the case of iron-nickel and iron-nickel-cobalt alloys in the  $\alpha$ -phase.—J. S. G. T.

**Magnetic Spectra Due to Magnetic After-Effect ("Nachwirkung").** W. Arkadiew (*Z. Physik*, 1931, 72, 116-124).—Magnetic "Nachwirkung," also called magnetic viscosity, is a phenomenon the fastest part of which is over in a period of the order  $1/1,000,000$  second. It is suggested that in alternating magnetic fields of period of this order the value of the magnetic permeability of the specimen subjected to the fields should decrease. A theory of the effect is developed, and experimental results relating to iron confirm to some extent this theory.—J. S. G. T.

**Ferro-Magnetic Saturation of Elements other than Iron, Nickel, and Cobalt.** Ch. Sadron (*Compt. rend.*, 1931, 192, 1311-1313; and (abstract) *Génie civil*, 1931, 98, 577).—Many atoms possess magnetic moment, but only those of iron, cobalt, and nickel are spontaneously orientated—a condition of ferromagnetism. It is, however, possible to impress on these other atoms an

orientation by associating them in a simple solid solution of nickel and cobalt. The magnetic moment is measured by determining the saturation at room temperature and at that of liquid air and extrapolating for the absolute saturation. This method has been used to determine the atomic moments of elements occurring in the same column of the periodic table. It was found that the atomic moments for chromium-molybdenum-tungsten were the same, i.e. 19 magnetons, and also for the series nickel-palladium-platinum, in this case 3 magnetons.—J. H. W.

**The Effect of Internal Stress on Magnetic Susceptibility.** C. W. Heaps and H. E. Banta (*Phys. Rev.*, 1931, [ii], 38, 195-196).—A note. Honda and Shimizu (*Nature*, 1930, 126, 990; this *J.*, 1931, 47, 134), and Bitter (*Phys. Rev.*, 1930, [ii], 36, 978; this *J.*, 1931, 47, 6) found that copper and silver suffered a decrease in magnetic susceptibility on severe cold-working, but this was not confirmed by Banta (*Phys. Rev.*, 1931, [ii], 37, 634; this *J.*, 1931, 47, 321). Examination shows that the discrepancy cannot be due to insufficient strains, or failure to detect magnetostriction in the work of Banta. Kussmann and Seeman (*Naturwiss.*, 1931, 19, 309; this *J.*, 1931, 47, 333) suggest that cold-working copper causes iron impurities to crystallize out, with a fall in diamagnetism of the mixture, and this would account for the discrepancy if Banta's copper contained no iron.—W. H.-R.

**Theory of Ferromagnetism.** Tokutarô Hirone and Tadayosi Hikosaka (*Z. Physik*, 1931, 73, 62-73).—A modification of Heisenberg's theory of ferromagnetism, in which the magnetizability is shown to depend markedly on the number of coupled atoms forming a closed system within the crystal structure, is developed. The dependence of magnetization on temperature deduced from the theory agrees well with experimental results obtained by Weiss and Forrer.—J. S. G. T.

**On Inhomogeneities in the Magnetization of Ferromagnetic Materials.** F. Bitter (*Phys. Rev.*, 1931, [ii], 38, 1903-1905).—A note. When large grained samples of iron, iron-silicon alloy, nickel, and cobalt were magnetized and treated with a suspension of small  $\text{Fe}_2\text{O}_3$  particles, definite patterns were formed. With iron and cobalt one series of straight lines was observed, usually more or less perpendicular to the magnetization, but varying slightly from grain to grain. With nickel more complicated patterns were observed, the detail of which changed with the degree of magnetization. The results may be connected with the presence of standing waves such as the spin waves of the Bloch theory.—W. H.-R.

**Permanent Electric and Magnetic Moments of Crystals.** F. Zwicky (*Phys. Rev.*, 1931, [ii], 38, 1772-1781).—Discusses the foundations of the theory of secondary (block) structure of crystals with special reference to the conditions for the existence of self-perpetuating electric moments in crystals. The energy of a crystal of the sodium chloride type is written in the form  $\epsilon = -Be^2/r + \gamma A/r^p$ , and the lattice of the positive ions is supposed to undergo an infinitesimal displacement  $\xi$  in the direction of the (100) axis. The total change in energy per molecule,  $\Delta u$ , is then found to be negative when  $p$  becomes slightly smaller than 6. The ideal crystal may thus be stable under uniform pressure, a linear extension or shear, but unstable against a relative motion of the positive and negative lattices, and so it will tend to jump into a state of permanent electric polarization. The building up of an electric moment may be prevented by the development of a secondary structure during crystal growth, and examples are discussed. For metals the same conception is applied to a dynamic electron lattice of the Haber type, and it is shown that this is in agreement with the comparatively large units of the secondary structure. The question of permanent magnetic moments is also discussed.—W. H.-R.

**The Structure Sensitiveness of Magnetism in Metals.** F. E. Lowancke and

F. W. Constant (*Phys. Rev.*, 1931, [ii], 38, 1547-1551).—Using the Gouy method, the magnetic susceptibilities of wires of high-purity copper, silver, platinum, and bismuth were measured in the annealed and cold-worked states; the cold-work consisted of twisting, stretching, and "pounding." In each case the cold-work makes the susceptibility more positive, *i.e.* decreases the diamagnetism in copper, silver, and bismuth, and increases the paramagnetism in platinum. Cold-work increases the mechanical hardness, suggesting greater binding or interaction between the atoms. It also increases the electrical resistance. Both phenomena suggest that cold-work produces fewer free and more partly bound electrons, and the change in magnetic susceptibility is probably due to the same cause.—W. H.-R.

**Anisotropy in Magnetic Materials.** O. Dahl and J. Pfaffenberger (*Z. Physik*, 1931, 71, 93-105).—The property of magnetic anisotropy in regular crystalline metals is employed to determine the production of fibrous structures due to working and recrystallization in these materials, especially iron, nickel, and nickel-iron alloys.—J. S. G. T.

**The Emission of Positive Ions from Copper and Silver.** H. B. Wahlin (*Phys. Rev.*, 1931, [ii], 38, 1074).—A note. With metals heated in a resistance-wound vacuum furnace, the emission of  $\text{Cu}^+$  and  $\text{Ag}^+$  ions from copper and silver has been detected in the neighbourhood of the melting points. No sudden change in the emission was noticed at the melting point.—W. H.-R.

**The Reflection of Long X-Rays.** C. B. O. Mohr (*Proc. Roy. Soc.*, 1931, [A], 133, 292-303).—The critical angles of reflection of X-rays of long wave-length (8.32 Å. and 13.3 Å.) are determined for quartz, calcite, glass, steel, silver, and gold, and compared with the values given by the Drude-Lorentz dispersion formula. Results for the 3 former agree with theoretical deductions, but for steel, silver, and gold increasingly large discrepancies were found to occur with increasing density of the reflector.—J. S. G. T.

## II.—PROPERTIES OF ALLOYS

(Continued from pp. 10-21.)

**Thermal Expansion of Some Aluminium Alloys.** E. E. McCollough (*Physics*, 1931, 1, (5), 334-339).—The effect of alloying copper, iron, magnesium, nickel, silicon, and manganese with aluminium on the thermal expansion of aluminium over the temperature range 25°-100° C. is investigated. All the alloying elements produce an effect, and it is shown that an empirical equation for such effect based on the assumption that the coeff. of thermal expansion is the arithmetic mean of the coeffs. of expansion of aluminium and the alloying element, is valid only for smooth portions of the composition-expansion curves, and does not hold over portions including maximum or minimum points.—J. S. G. T.

[M.G. 7] **A New Light Alloy.** Anon. (*Met. Ind. (Lond.)*, 1932, 40, 14).—A short note describing a new light alloy, M.G. 7, marketed by Messrs. James Booth & Co. (1915), Ltd. The sp. gr. of the alloy is 2.63 and its mechanical properties are similar to those of Duralumin (B.E.S.A. specifications). It is softened by annealing at 380° C., and can then be readily pressed, spun, and forged. The yield-point for soft sheets varies from 11 to 14 tons/in.<sup>2</sup> and for very hard-rolled sheets from 20 to 28; the ultimate stress is 22-24 and 26-30 tons/in.<sup>2</sup>; the elongation on 2 in. 20-26 and 4-12%, and reverse bends 8-10 and 2-3, respectively. The forging temperature is 400°-420° C.; the fatigue range  $\pm 9.5$  to  $\pm 10.25$  tons/in.<sup>2</sup>; Brinell hardness 90-115 and Izod impact value 17 ft.-lb. It is said to be highly resistant to corrosion and to be easily welded.—J. H. W.

[R.R. 50] A New Aluminium Alloy. Anon. (*Indian and Eastern Eng.*, 1930, 66, 125).—The light alloy R.R. 50 is described. No fresh matter is introduced.—P. M. C. R.

**Further Studies on Chromium-Nickel-Iron and Related Alloys.** Vsevolod N. Krivobok, with E. L. Beardman, H. J. Hand, T. O. A. Holm, A. Reggiori, and R. S. Rose (*Amer. Soc. Steel Treat. Preprint*, 1931, Sept., 1-39).—This is a theoretical study of the chromium-nickel-iron-carbon diagram. Among other matters discussed are the factors which influence the existence or non-existence of metastable phases and the phenomenon of disintegration shown by these alloys. A change from a non-magnetic to a magnetic phase accompanies the latter, and embodies the precipitation of a constituent. It is suggested that this constituent is not necessarily a carbide, as was once supposed, but its nature is certainly dependent on the carbon content of the alloy. Magnetic analyses, microscopic observations, and corrosion tests were employed. Alloys with low carbon content are immune from decomposition; but in those with more than a certain amount the changes are independent of the carbon content. The effect of additions of cobalt, molybdenum, silicon, and copper to these alloys has been noted. Changes in the relative proportions of chromium and nickel did not appear to improve the alloys from the point of view of decomposition. Original quenching temperature has, however, a very material influence.—W. A. C. N.

**The System Copper-Lead and Related Heterogeneous Systems.** W. Claus (*Kolloid-Z.*, 1931, 57, 14-16).—The separation of a melt of copper and lead into two phases on cooling is considered in the light of Stokes' law, which provides an explanation of the different values obtained by various observers for the temperature at which the separation occurs. The explanation holds also for other systems of a similar type, where discordant results have been obtained by different methods.—E. S. H.

**Special Copper-Nickel Alloys.** M. Ballay (*Fonderie mod.*, 1931, 25, 425-426).—Abstract of a paper presented at the 6c. Congrès Internationale de Fonderie. Describes the properties and applications of the copper-nickel alloys in 3 groups: (1) nickel 25-30%, (2) nickel 45%, and (3) nickel 65-70%.—J. H. W.

**Researches on Non-Ferrous Alloys for Marine Engineering Purposes.** Tokiji Ishikawa (*Proc. World Eng. Congress, Tokyo, 1929*, 1931, 30, 289-320).—See this *J.*, 1930, 43, 469.—S. G.

**Copper-Titanium Alloys.** F. R. Hensel and E. I. Larsen (*Metallurgist (Suppt. to Engineer)*, 1931, 7, 157-158).—A summary of *Amer. Inst. Min. Met. Eng. Tech. Publ.*, No. 432, 1931, 1-11. See this *J.*, 1931, 47, 652.—R. G.

**Special Brasses.** Auguste Le Thomas (*Metallurgist (Suppt. to Engineer)*, 1931, 7, 168-169).—A summary and discussion of a paper by Le T. in *Rev. Mét.*, 1931, 28, 518-523. See *J.*, this volume, p. 15.—R. G.

**The Constitution of the Alloys of Copper, Zinc, and Tin.** O. Bauer and M. Hansen (*Metallurgist (Suppt. to Engineer)*, 1931, 7, 154-156).—A summary of a paper by B. and H. in *Z. Metallkunde*, 1930, 22, 387-391, 405-411. See this *J.*, 1931, 47, 12.—R. G.

**Studies on the Age-Hardening of Alloys of the System Gold-Platinum by Small Additions of a Third Component [Iron].** Wilhelm Goedecke (*Festschrift zum 50-jährigen Bestehen der Platinschmelze G.m.b.H. Hanau*, 1931, 100-107).—Alloys of gold with more than 20% platinum can be hardened by quenching from 1000° C. and ageing at 550° C., but the increase in hardness produced by ageing is not very great unless at least 25% platinum is present. By adding small quantities of iron to the alloys age-hardening occurs when 2% platinum and 0.2% iron are present, a maximum hardness of 130 being obtained with 6% platinum (0.2% iron). Increasing the iron content accelerates the ageing process without appreciably increasing the hardness obtained. Time-hard-

ness curves of alloys with 20% platinum and 0.2-1% iron show two well-marked maxima at ageing temperatures above 500° C. The mechanism of this ageing effect is difficult to understand, as up to 20% platinum and 18% iron are soluble in gold.—A. R. P.

**An Investigation of Type Metals. VI.—The Microstructure of the Lead-Antimony-Tin Alloys.** Nobutoshi Aoki, Shojiro Waki, and Jiro Ikeda (*Naikaku Insatsu-kyoku Kenkyujo Chosa Hokoku (Reports of the Government Research Laboratory, Government Printing Bureau, Japan)*, No. 21, 1930, 37-45; *C. Abs.*, 1931, 25, 5382).—[In Japanese.] 55 photographs of the ternary alloys of the system lead-antimony-tin, chiefly those of the composition range of actual type metals, such as 50-100% lead, 0-30% antimony, and 0-20% tin, are shown, and the structural constituents of each alloy are elucidated. The equilibrium diagram of this ternary system constructed by the present authors was ascertained by the microstructures. The primary crystals,  $\alpha$ -,  $\beta$ -,  $\gamma$ -, and  $\delta$ -ternary solid solutions are well etched by a water solution of 5% ferric chloride and 45% hydrochloric acid, and also by an alcoholic solution of 5% hydrochloric acid. In particular,  $\alpha$ - and  $\beta$ -crystals are more etchable by the alkaline solutions of potassium ferricyanide. In the ternary eutectic structure the closely coexisting  $\alpha$ -,  $\beta$ -, and  $\delta$ -solid solutions are well observable. The primarily separated  $\alpha$ - and  $\beta$ -solid solutions tend to segregate at the upper part of the melt.—S. G.

**The Lead-Zinc Eutectic.** J. M. Hodge and R. H. Heyer (*Metals and Alloys*, 1931, 5, 297-301, 313).—A careful re-determination of the eutectic temperature and composition of the lead-zinc system has been made by thermal analysis, hardness tests, and microscopic examination. The results indicate that the eutectic at the lead end contains 0.50% zinc and melts at 318.2° C. In hypo-eutectic alloys zinc crystallizes in thin plates, and in hyper-eutectic alloys in large hexagonal plates in a very fine-grained eutectic ground mass. Very severe segregation occurs in slowly cooled hyper-eutectic alloys. Cooling curves and typical microstructures are shown. The specimens were prepared for the microscope by polishing on 1, 0, and 00 French emery papers using a solution of paraffin wax in kerosine as a lubricant, then cleaned with alcohol and naphtha and rough polished on a felt wheel wetted with levigated alumina and soap solution to remove all the emery. The final polish was given on silk velvet using a very fine suspension of alumina in soap solution, and the specimens were then etched with a mixture of 60 c.c. of glycerine, 20 c.c. of glacial acetic acid, and 20 c.c. of nitric acid (*d* 1.4).—A. R. P.

**[Elektron] New Alloy.** Anon. (*Indust. Australian*, 1931, 86, 60).—A brief account of Elektron and its possibilities in automobile work.—P. M. C. R.

**Elektron, a Remarkable Alloy.** Anon. (*Machinery (Lond.)*, 1930, 35, 640).—A brief note on the principal characteristics of the Elektron alloys, which, although placed on the market in Germany in 1909, are said to be little known, as yet, in Britain.—H. F. G.

**Alloys of Iron, Manganese, and Carbon. I.—Preparation of Alloys.** Francis M. Walters, Jr. (*Amer. Soc. Steel Treat. Preprint*, 1931, Sept., 1-13).—The alloys were made from distilled manganese and electrolytic iron and were melted *in vacuo*. For investigation purposes the prepared alloys were melted in an atmosphere of purified argon in an induction furnace. The crucibles used were made of pure magnesium oxide and were fired in the induction furnace. See following abstracts.—W. A. C. N.

**Alloys of Iron, Manganese, and Carbon. II.—Thermal Analysis of the Binary Alloys.** Francis M. Walters, Jr., and Cyril Wells (*Amer. Soc. Steel Treat. Preprint*, 1931, Sept., 14-22).—A gradient furnace as modified by the Bureau of Standards was employed. In this the furnace is moved relatively to the sample. When the galvanometer reaches the null position it illuminates a vacuum type photoelectric cell, the response of which is amplified by a grid-

glow tube, which, in turn, actuates the chronograph relay. The effect of manganese is to render the  $\gamma$ -phase more stable. The transformations become less sharp and spread over a greater temperature range as the manganese content increases to 10%. At 13% they are again sharp. The low-temperature transformations were found in 13–20% manganese alloys on both heating and cooling. The  $\alpha$  to  $\gamma$  transformation in the 13% alloy takes place above 600° C.—W. A. C. N.

**Alloys of Iron, Manganese, and Carbon. III.—An X-Ray Study of the Binary Iron-Manganese Alloys.** M. Gensamer, John F. Eckel, and F. M. Walters, Jr. (*Amer. Soc. Steel Treat. Preprint*, 1931, Sept., 23–31).—The work of previous investigators is in general confirmed. The application of stress favours the formation of the hexagonal close-packed phase. In some alloys the latter appears on quenching, but is absent when they are slowly cooled. Two methods of investigation were employed. In the first, powder photographs were obtained using the specimen in the form of a very fine needle. In the second, the so-called edge method was adopted, which permitted the use of the same specimens which had been examined metallographically and obviated the use of severely cold-worked specimens. It also enabled the effect of heat-treatment to be studied.—W. A. C. N.

**Alloys of Iron, Manganese, and Carbon. IV.—A Dilatometric Study of Iron-Manganese Binary Alloys.** Francis M. Walters, Jr., and M. Gensamer (*Amer. Soc. Steel Treat. Preprint*, 1931, Sept., 32–45).—The advantages of dilatometric study, of being able to correlate in many instances the observations made by X-rays of the phases present at high temperatures or the measurement of lattice dimensions at room temperatures with expansion properties are discussed theoretically. The dilatometer used in these experiments was a modification of one used by the U.S. Bureau of Standards, and could be used over a range from  $-200^{\circ}$  C. to  $1000^{\circ}$  C. Indications of phase changes observed by thermal analysis have been confirmed and extended. In particular the low-temperature transformations on cooling the alloys with more than 13% manganese are ascribed to the  $\epsilon$ -phase. It is suggested that the rate of heating or cooling makes little difference in the temperature at which the transformation begins, but has a marked effect in the transformation range.—W. A. C. N.

**The Composition of Manganese-Silver Alloys in Relation to the Electrode Potential of Manganese.** Harvey D. Royce and Louis Kahlenberg (*Trans. Electrochem. Soc.*, 1931, 59, 121–133).—See this *J.*, 1931, 47, 268.—S. G.

**Nickel-Cobalt-Iron Alloys.** C. R. Austin and G. P. Halliwell (*Metallurgist* (Suppt. to *Engineer*), 1931, 7, 153–154).—A summary of a paper in *Amer. Inst. Min. Met. Eng. Tech. Publ. No. 430*, 1931. See *J.*, this volume, p. 18.  
—R. G.

**Endurance and Other Properties at Low Temperatures of Some Alloys [Monel Metal and Steels] for Aircraft Use.** H. W. Russell and W. A. Welcker, Jr. (*U.S. Nat. Advisory Cttee. Aeronautics, Tech. Note No. 381*, 1931, 1–24; *Bull. B.N.F.M.R.A.*, 1931, (38), 20).—Discusses endurance, tensile, impact, and hardness tests, of Monel metal and steels, down to  $-40^{\circ}$  C. In general, the results show an increase in endurance limit, tensile strength, and hardness as the temperature falls, and a decrease of impact strength.—S. G.

**The Development of an Electron Emitting Alloy.** O. S. Duffendack, R. A. Wolfe, and D. W. Randolph (*Trans. Electrochem. Soc.*, 1931, 59, 181–197).—See this *J.*, 1931, 47, 269 and 378, and following abstract.—S. G.

**Discussion on Duffendack, Wolfe, and Randolph's Paper on "The Development of an Electron Emitting Alloy."** J. A. Becker. R. A. Wolfe (*Trans. Electrochem. Soc.*, 1931, 59, 197–198).—Cf. preceding abstract. Platinum-iridium alloy filaments coated with barium oxide show after prolonged use in thermionic emission tubes that considerable quantities of metallic barium

enter into the alloy wire; up to 1% barium has been observed in some wires. —A. R. P.

**On the Alloys of Palladium with Platinum and Rhodium.** G. Tammann and H. J. Rocha (*Festschrift zum 50-jährigen Bestehen der Platinschmelze G. Siebert G.m.b.H. Hanau, 1931, 309-320*).—The ball-hardness of platinum-palladium alloys annealed at 600° C. for 12 hrs. rises with increasing palladium content to a maximum at about 50% palladium; for alloys that have been annealed at 1200° C. and quenched there is a flat maximum at 10-40% palladium, followed by a steep fall, and for alloys that have been quenched from 1400° maximum hardness is obtained with 10-20% palladium. The hardness of platinum, palladium, and the 50 : 50 alloy is unaffected by heat-treatment. The solubility of hydrogen in palladium-platinum alloys is very small up to 50 atomic-% palladium, then increases rapidly with rise in palladium content, the relation being linear with more than 75 atomic-% palladium; the solubility is greater in alloys quenched from 1300° C. than in alloys annealed at 700° C. Palladium-platinum alloys with more than 74 atomic-% palladium become coated with gold when immersed in gold chloride solution, and those with more than 50 atomic-% palladium are blackened by alcoholic iodine solution. The structure of alloys with 30% or less palladium is granular, whereas that of alloys with 40% or more palladium is dendritic. The above results indicate that the palladium-platinum system is not simply a continuous series of solid solutions. Maximum hardness of palladium-rhodium alloys occurs with 50-60 atomic-% rhodium; the hardness curve, unlike that of the platinum alloys, shows no discontinuities. Maximum solubility of hydrogen occurs in the alloy with 10 atomic-% of rhodium and the reaction limit with alcoholic iodine at about 75 atomic-% of palladium.—A. R. P.

**Silicon as an Alloying Element.** J. Arnott (*Mech. World, 1931, 90, 147-149*).—Abstract of a paper read before the Institute of British Foundrymen. See this *J.*, 1931, 47, 431.—F. J.

**On the Viscosity of Molten Metals and Alloys. IV.—The Viscosity of Silver and Silver-Copper Alloys.** W. Radecker and F. Sauerwald (*Z. anorg. Chem.*, 1931, 203, 156-158).—Cf. this *J.*, 1926, 35, 549; 1927, 37, 455; 1927, 38, 417. The viscosity of molten silver-copper alloys with 80%, 44%, and 20% silver is nearly the same as that of silver (0.0302 gm./cm. seconds at 1167° C. and 0.0298 gm./cm. seconds at 1200° C.) and copper. The isotherms for 1050°, 1100°, and 1188° C. are practically straight lines, owing to the absence of molecules of intermetallic compounds in the molten state.—M. H.

**Further Contributions to Our Knowledge of the Electrolysis of Ternary Alloys.** Robert Kremann and Harald Scheibel (*Monatsh.*, 1931, 57, 241-252).—When copper-tin alloys containing bismuth, and sodium amalgams containing tin are subjected to electrolysis in a molten condition in capillary tubes the third metal is transported to the appropriate electrode in a relatively greater proportion the smaller the percentage of added metal.—A. R. P.

**Further Researches on the Electrolysis of Sodium Amalgams and the Calculation of Transport Numbers for Sodium, Potassium, Lithium, Barium, and Bismuth in their Amalgams.** Robert Kremann, Alfred Vogrin, and Harald Scheibel (*Monatsh.*, 1931, 57, 323-374).—Cf. Springer and Frena, this *J.*, 1931, 47, 379.—Further investigations have been made into the irregularities previously observed in the electrolysis of 30% sodium amalgam. By progressively decreasing the diameter of the capillary tube in which the electrolysis is carried out the transport effect becomes smaller and asymptotically approaches a minimum value. A similar minimum value is obtained in the electrolysis of other alloys, but the diameter at which it occurs varies with the alloy. With amalgams containing up to 2.1% sodium the sodium migrates towards the anode, but at higher concentrations it migrates towards the cathode; a middle region of unchanged concentration occurs only when the



tube is at least 120 cm. long. The relative transport numbers of sodium, potassium, lithium, barium, and bismuth dissolved in mercury increase with increasing tube length, as the system then more closely approaches the ideal case with an unchanged concentration in the middle of the tube. The transport number of sodium decreases with increasing time of electrolysis, other factors being constant. With increasing sodium content the transport number of sodium towards the anode first increases, then decreases, reaching zero at 2.1%, and finally increases with an opposite sign (migration towards the cathode). Similar results are obtained for potassium, but for lithium the transport number increases regularly with rising concentration, the lithium always migrating towards the cathode. Barium behaves like sodium, zero transport number being obtained with 2.6% barium. Bismuth behaves like lithium, except that it always migrates towards the anode. The numerical values of the transport numbers of the various metals in mercury are all of the same order of magnitude—about  $10^{-5}$ .—A. R. P.

**Cemented Tantalum Carbide.** Floyd C. Kelley (*Amer. Soc. Steel Treat. Preprint*, 1931, Sept., 1-10).—This research is a development of work done on cemented tungsten carbide. The chemical and physical properties of tantalum are summarized. The carbide has been made from the element and its oxide in substantially the same way as tungsten carbide. Crushed metal, the particles of which all pass 100-mesh sieve, is mixed with the requisite quantity of carbon and heated in an atmosphere of hydrogen to 1500°-1600° C. for 5-8 hrs. It is thought that the hydrogen takes a definite part in the process, by forming hydrocarbons with the carbon which react more rapidly with the metal than the carbon alone. When the oxide is used as the starting material an excess of carbon has to be added to reduce the oxide first. Traces of columbium introduce difficulties. The effects of various binders, such as iron, cobalt, molybdenum, and nickel, are discussed. A comparison of cemented tungsten and tantalum carbides under standard conditions in cutting tools is very favourable to the latter.—W. A. C. N.

**Studies on Zinc and Barium Ferrites.** Joseph Guillissen and Pierre J. Van Rysselberghe (*Trans. Electrochem. Soc.*, 1931, 59, 95-105; discussion, 106).—See this *J.*, 1931, 47, 338.—S. G.

**Precious Metal Alloys.** R. C. Brumfield (*Amer. Soc. Steel Treat. Preprint*, 1931, Sept., 1-23).—A general survey of the alloys used in dental work is given. There are many such alloys which exhibit a wide range of useful properties, good resistance to corrosion, and amenability to heat-treatment. The effects of additions of various elements to these alloys are discussed. A method is illustrated by which the influence of different alloying metals on the fusion temperature may be predicted. Procedure to be followed in heat-treatment is given in outline. Standard methods of wire testing are described. Special mention is made of a strain-gauge for undertaking tensile tests and of a new apparatus for torsion tests. A short bibliography is appended.—W. A. C. N.

**Considerations and Tests for Cast Materials for High-Temperature High-Pressure Service.** L. W. Spring (*Trans. Bull. Amer. Found. Assoc.*, 1931, 2, (10), 13-55).—Higher operating temperatures and pressures for power plants, oil refineries, and equipment for other chemical industries have brought about changed conditions and requirements in the way of materials of which equipment is built. Many metallurgical and engineering articles have discussed various chemical and physical properties of engineering materials, usually, however, for low-temperature service. Whereas formerly castings of brass, bronze, cast iron, the steels, &c., were largely used for the lower temperature or saturated steam service, the stronger and more highly refined of these alloys came to be used during the 3 decades just past. Recently, because of the quite extreme temperatures of 850°-1000° F. (454°-537° C.) and the high pressures of 650, 1500, and more lb./in.<sup>2</sup> which have come

in, together with X-ray examination, there has been a noticeable trend from castings to forged and to welded materials, which latter were thought by some to have less likelihood of blow-holes and other cavities and to have perhaps more reliability in service. S. points out that castings have certain inherent qualities which other materials do not appear to possess. Castings are somewhat stiffer, and particularly are more resistant to "creep" at temperatures above the strain-hardening range (1000° F. (537° C.) and above). They seem to be more resistant to corrosive conditions and more immune to scoring or galling when rubbed against each other under heavy pressures, as in valve seats, than are forged or rolled metals. Other considerations are also given, concerning the various factors which have to be taken into account in the development of materials for high-temperature, high-pressure service.—S. G.

**Temperature Coefficient of Modulus of Rigidity of Aircraft Instrument Diaphragm and Spring Materials.** W. G. Brombacher and E. R. Melton (*U.S. Nat. Advisory Cttee. Aeronautics, Report No. 238, 1930, 1-16; Bull. B.N.F.M.R.A., 1931, (38), 20*).—Gives experimental data on variation of modulus of rigidity, between - 20° C. and + 50° C., of various metals which are of possible use for elastic elements for aircraft and other instruments. Aluminium, Duralumin, Monel metal, brass, phosphor-bronze, coin silver, nickel-brass, and ferrous materials are dealt with. The effect of heat-treatment on the coeff. was also determined.—S. G.

### III.—CORROSION AND PROTECTION

(Continued from pp. 21-32.)

#### CORROSION

**Review of the Behaviour of Aluminium Towards Substances of the Chemical and Food Industry.** H. Bohner and H. Buschlinger, with a foreword by H. Röhrig (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium, 1931, 3, 301-346*).—The behaviour of aluminium towards corrosive influences by nearly 300 inorganic and organic substances, based on laboratory and works experiments and experiences, is indicated. In many cases the loss in weight in grm./m.<sup>2</sup> surface is given over various periods. Typical uses of aluminium and its light alloys in the construction of apparatus for the chemical and related industries are illustrated in photographs.—M. H.

**On the Causes of Corrosion Phenomena which Occasionally Occur in Aluminium Kettles for Linseed Oil.** G. Eckert (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium, 1931, 3, 351-354*).—(1) Linseed oil at above 350° C. produces severe local corrosion in aluminium kettles which remain quite unattacked at the normal "boiling" temperature of 250°-300° C. (2) Corrosion sometimes occurs in aluminium kettles with a copper bottom, even at normal "boiling" temperature, owing to the formation of a fine copper suspension (by the attack of the hot oil on the copper bottom).—M. H.

**The Corrosion of Light Alloys.** Anon. (*Found. Trade J., 1931, 45, 324-326*).—The test methods which firms who are members of the Aluminium Association have mutually agreed to adopt have been selected by a committee of the heads of the different research laboratories, acting in conjunction with the Bureau Internationale de l'Aluminium, 23, rue de Balzac, Paris. The differences between the results obtained by the various workers are commented on and general considerations of the tests of corrosion resistance are made. The modified Mylius test (sodium chloride + hydrogen peroxide), salt spray test, immersion test, and alternate immersion test are described and the nature of the results obtained is discussed.—J. H. W.

Result of the Inquiry into Experiences with the Application of Aluminium in Chemical Plants.—VII. Anon. (*Z.V.d. Kupferschmied*, 1931, 43, 235-241).—See abstract from *Apparatebau*, 1929, 41, 205-208, 220-222; this *J.*, 1929, 42, 478.—M. H.

[Resistance of] Copper and its Alloys to Corrosion. A. Matagrín (*Industrie chimique*, 1931, 18, 466-468, 542-544).—Cf. this *J.*, 1931, 47, 273, 434. Discusses properties of nickel-brasses and of bronzes.—E. S. H.

Milk and Metals. W. L. Davies (*Agricultural Progress*, 1930, 7, 108-112; *C. Abs.*, 1931, 25, 5472).—The corrosion of metals by milk and the relation of metallic contamination to the discoloration, flavour, vitamin content, and chemical changes in milk are discussed.—S. G.

Periodic Physico-Chemical Phenomena. Ernest S. Hedges (*Nature*, 1931, 128, 398-401).—The work summarized includes investigations on the periodic dissolution of metals in acids, alkalis, &c., and the formation of anodic films in electrolytic dissolution of copper, silver, magnesium, zinc, cadmium, mercury, tin, lead, iron, nickel, cobalt, and aluminium. A theory of periodic phenomena in these systems is advanced.—E. S. H.

The Topochemistry [Topochemie] of Corrosion and Passivity. Erich Pietsch and Edith Josephy (*Z. Elektrochem.*, 1931, 37, 823-838).—A comprehensive review of the factors which influence corrosion and passivity is undertaken. The factors concerned with the metal are: (1) the solution pressure of the metal; (2) impurities; (3) character and homogeneity of the surface; (4) mechanical properties; (5) contact potential of the metal with other materials; (6) passivity; (7) hydrogen overvoltage; (8) applied potential difference; (9) anode surface area. Those concerned with the solution are: (1) concentration of metal ions in the solution; (2) hydrogen-ion concentration; (3) concentration differences in the solution; (4) conductivity; (5) chemical composition; (6) presence of oxidizing agents other than oxygen. Independent factors are: (1) temperature; (2) duration of the corrosion attack; (3) effect of radiation; (4) effect of stirring.—J. H. W.

Faraday's Views on Passivity in the Light of Recent Research. Ernest S. Hedges (*Chem. and Ind.*, 1931, 50, 750-751).—Faraday's writings on passivity in 1836 contain the rudiments of lines along which research has subsequently developed.—E. S. H.

Some Effects of Impurities in Feed-Water. C. C. Pounder (*Mech. World*, 1931, 89, 558-561).—Feed-water difficulties may be due to (a) unavoidable solid, liquid, or gaseous impurities, usually soluble, or to (b) oil (an extraneous impurity). The design and arrangement of any feed system should, therefore, include devices for safeguarding the boilers against the entrance of fuel or lubricating oil on the one hand, and corrosive agents and precipitates on the other. A few difficulties arising in P.'s experience are described.—F. J.

Steam Purifiers. Anon. (*Indian and Eastern Eng.*, 1930, 67, (6), 752).—It is claimed that the Tracy steam purifier, besides effecting by its drying action a rise of 40° F. (22° C.) in superheat temperature, greatly reduces both corrosion and erosion of turbine blading.—P. M. C. R.

Heat- and Corrosion-Resistant Alloys. T. Holland Nelson (*Engineers and Engineering*, 1931, 48, 262-266).—N. discusses some elementary phenomena of corrosion, emphasizes the importance of homogeneity and the possibility of ensuring this by suitable heat-treatment, and subsequently considers the "stainless" alloys. No fresh matter is introduced.—P. M. C. R.

Corrosion-Resisting Pumps. Anon. (*Chem. and Met. Eng.*, 1931, 38, 418).—The standard high-pressure, single-stage turbine pump made by the Westco Pump Corporation, Davenport, Iowa, U.S.A., is briefly described. It is now made in a variety of corrosion-resisting materials, including stainless steel, Monel metal, Ni-Resist metal, Ascology, Everdur, Ilium, and special bronze.

—F. J.

## PROTECTION

**New Methods of Protecting Metallic Surfaces.** H. Reininger (*Science et Industrie*, 1931, 15, 309-310).—Abridged from *Maschinenbau*, 1930, 9, 649-655. See this *J.*, 1931, 47, 86.—P. M. C. R.

**Colour Finishes for Aluminium.** Anon. (*Compressed Air Mag.*, 1931, 36, (8), 3559).—Anodic oxidation affords protection to light alloys exposed to weathering; the surface texture of the coating can be varied by modifying that of the metal, and its colour can be almost infinitely modified by the use of organic dyes, with which alumina readily combines. The coatings are resistant to wear, and if sufficiently thin show no cracking on bending.—P. M. C. R.

**New Rustless Iron [Colorizing].** A. E. B. (*Sci. American*, 1931, 145, 55).—A new method of colorizing iron at a temperature of 900° C. has been developed. The method results in aluminium penetrating into the iron, as well as forming merely a protective coating.—W. P. R.

**Homogeneous Lead Deposition with the Aid of the Oxy-Acetylene Blowpipe.** Anon. (*Welding News*, 1931, 2, 20-21).—Reprinted from the *Rev. Soudure Autogene*. Where it is impracticable to use sheet lead, an adherent lead coating can be applied to surfaces which have to be protected, usually steel, by means of the blowpipe. The surfaces are cleaned and then "tinned" with a 50:50 lead-tin alloy. The lead is then deposited in a manner similar to welding, but with rather special technique.—H. W. G. H.

**The Surface Treatment and Galvanizing of Aluminium.** Anon. (*Chem.-Zeit.*, 1931, 55, 579-580).—The surface is cleaned in caustic soda solution containing sodium chloride, then polished with special pastes on soft polishing discs or by rumbling with steel balls. Prior to plating the oxide film is removed by pickling in dilute hydrochloric acid containing manganese or ferrous chloride. The articles are then plated in an alkaline zinc bath and finally given a chromium coating in a hot solution containing potassium chromate, caustic soda, and sodium carbonate. Aluminium can be plated directly in nickel baths containing a high percentage of glycerin. Copper coatings are produced from baths containing copper sulphate, sodium carbonate, and potassium chromate.—A. R. P.

**Modern Galvanizing.** I. Arndt (*Z. ges. Giesserei-Praxis: Eisen-Zeit.*, 1931, 52, 395-397).—There are 2 hot-galvanizing processes: the wet or ammoniac process, and the dry process, and these are described. Good galvanizing does not depend only on high purity of the metal, but also on the cleaning; the stronger and longer the pickling, the cleaner and more thorough is the galvanizing. Aluminium up to 2% is added to the zinc bath to improve the corrosion resistance. Other metals such as tin, bismuth, and antimony are added to give a watered appearance to the zinc coating. For a matte surface, the bath is kept at 440° C., and for a glossy surface at 491.5° C.; it should never be heated above 510° C. The composition, operation, and mechanism of alkali and cyanide galvanizing baths are discussed.—J. H. W.

**The Parkerizing and Boudering Rust-Proofing Processes.** Anon. (*Engineering*, 1931, 132, 475).—Apart from the question of the efficiency of any process from the point of view of rust prevention, the success of the process in industry depends on such factors as first cost, the ease with which it can be carried out, and the time required for operation of rust-proofing. The Parkerizing process is simple and easily carried out. It consists of suspending the cleaned articles in a tank containing a solution of manganous phosphate at approximately 100° C. for a period of 1 hr. When removed from the phosphate bath the articles are covered with a greyish coating less than 0.0002 in. thick. They are given a more pleasing finish by dipping in a black

aniline dye, drying, and finally dipping into oil. The process of Bouderezizing is similar to that of Parkerizing, but it is intended to serve as a priming coat which absorbs paint or enamel and gives a more lasting finish.—W. P. R.

[Parkerizing] **New Method of Rust Prevention.** Anon. (*Indian Eng.*, 1931, 89, (25), 534).—The Parkerizing process claims to render the surface of iron and steel practically rustproof without electrodeposition of metals, and without appreciable changes in dimensions or physical properties.—P. M. C. R.

**The Protection of Metals by Metallic Films.** Ernest S. Hedges (*Chem. and Ind.*, 1931, 50, 768-772).—Cf. this *J.*, 1931, 47, 274. A review of the methods of allaying corrosion by plating metals with films of protective metals applied by hot-dipping, electroplating, spraying, and cementation. The properties and special advantages of coatings of zinc, tin, lead, cadmium, copper, nickel, chromium, and aluminium are described from the point of view of resistance to both corrosion and mechanical deformation.—E. S. H.

**Metal-Lined Tubing.** Anon. (*Chem. and Met. Eng.*, 1931, 38, 297).—For the production of corrosion-resisting linings and bearings, a method has been developed by the Detroit Seamless Steel Tubes Co., Detroit, Mich., U.S.A., for lining steel tubing with a variety of metals and alloys by a centrifugal process. The lining is united by fusion to the tube, so that when a lathe-cut is taken, a spiral of the two metals is obtained as a continuous strip, showing no fracture at any point. Tubes are now being lined up to 16 ft. in length and from  $\frac{1}{2}$  in. to 12 in. outside diameter.—F. J.

**Factors which Influence the Efficiency of Cadmium Plating as a Rust Preventor.** S. Wernick (*Z. Elektrochem.*, 1931, 37, 815-820).—The nature of the protection afforded by cadmium plating and previous work on the subject are reviewed, a bibliography being included. A comparison between cadmium and zinc plating is made. The thickness of the deposit and the fineness of the crystal structure, which are inter-related, are important factors. It appears from theoretical considerations that cadmium affords anodic protection only when it is the more electronegative metal; otherwise, such protection as it affords is purely mechanical. The ferricyanide test is not considered reliable for anodic deposits such as zinc and cadmium. The surface of the base metal must be smooth, and degreasing is done in a strong caustic soda solution containing a little sodium or cadmium cyanide at high current density. The cadmium content of the bath should be about 3% for a fine crystal structure, and the alkali content between 1.5% and 3%. Increasing the cyanide concentration reduces the grain size, and 100% free cyanide is recommended. A current density of 100-200 amp./dm.<sup>2</sup> is generally used, the temperature of the bath being 30°-40° C. The minimum thickness of the deposit should be 600 mg./dm.<sup>2</sup>.—J. H. W.

**Rust Protection of Wire Products with Cadmium.** C. M. Hoff (*Wire and Wire Products*, 1931, 6, 427, 429, 431-434, 447).—Read before the Wire Association. Describes the properties of cadmium in comparison with those of zinc, methods of application to wire production, equipment required, and recent developments in connection with inhibitors.—J. H. W.

**Corrosion Protection by Chromium Plate and Methods of Testing It.** Heinrich Leiser (*Metallwaren Ind. u. Galvano-Tech.*, 1931, 29, 431-432).—The ferricyanide, copper sulphate, and salt-spray tests for porosity in chromium plate are briefly described.—A. R. P.

**Nickel-Clad Steel.** Anon. (*Chem. and Met. Eng.*, 1931, 38, 419).—Nickel-clad steel plates of the type described in conjunction with the recent development of a nickel-lined tank car by the General American Tank Car Corporation (*Chem. and Met. Eng.*, 1931, 38, 104; this *J.*, 1931, 47, 399) have now been made available generally by the Lukens Steel Company, Coatesville, Pa., U.S.A. The nickel varies from 10% to 20% of the total plate thickness, which is  $\frac{1}{16}$  in. thick and upwards.—F. J.

**A Method for Recording the Effectiveness of Pipe Coatings.** S. H. Graf (*Amer. Gas J.*, 1929, 131, (1), 32-33).—Corroded areas are painted with white paint and the pipe is surrounded with tracing-paper, and the white or black areas are traced out in India ink.—J. S. G. T.

**Tests of Coated Pipe.** Scott Ewing (*Amer. Gas J.*, 1930, 132, (5), 52-58).—Particulars are given of pipe coatings being tested by the American Gas Association and the Bureau of Standards, details being supplied as to the preparation of the specimens, method of burial of the protected pipe in soil, and laboratory tests.—J. S. G. T.

#### IV.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 32-39.)

**Automatic Polishing of Metal Specimens.** R. G. Guthrie and J. A. Comstock (*Metal Progress*, 1931, 20, (6), 59-63).—G. and C.'s method of preparing metallic specimens for microscopic examination is entirely automatic after the rough-grinding stage. Magnetic holders admit of combined oscillatory and rotary movement of the specimen, and thus obviate faceting and rounding; the polishing discs, carrying fine emery and magnesia, respectively, are lubricated with soap and water. The authors claim rapidity and ease of preparation combined with superiority of finish, absence of "buffing" and of relief-polish, shorter etching time, and improved photomicrographs, together with uniformity of preparation.—P. M. C. R.

**The Crystal Structure of Copper Electrodeposited in the Presence of Gelatine.** H. Kersten (*J. Physical Chem.*, 1931, 35, 3644-3646).—It is shown that the length of the unit lattice of copper electrodeposited on stainless steel differs by less than 0.01 A. whether the bath contains gelatine or not.—J. S. G. T.

**X-Ray Investigation of the Gold-Platinum System.** W. Steuzel and J. Weerts (*Festschrift zum 50-jährigen Bestehen der Platinschmelze G. Siebert G.m.b.H. Hanau*, 1931, 300-308).—The lattice parameter of gold-platinum alloys quenched from within the homogeneous range changes linearly with the composition from  $a = 4.0700$  A. for pure gold to  $a = 3.9151$  A. for pure platinum (measured at 20° C.). The gap of miscibility reaches a maximum at 1180° C. with 60 atomic-% platinum, i.e. all alloys are homogeneous above this temperature. The solid solubility of platinum in gold at 1100°, 900°, and 700° C. is 43, 30, and 25 atomic-%, respectively, and that of gold in platinum 19, 7, and 3.5 atomic-%, respectively. These results agree reasonably well with those recently published by Johansson and Linde (see this *J.*, 1930, 44, 502).—A. R. P.

**The Lattice Constants of Silver-Palladium and Gold-Palladium Alloys.** W. Steuzel and J. Weerts (*Festschrift zum 50-jährigen Bestehen der Platinschmelze G. Siebert G.m.b.H. Hanau*, 1931, 288-299).—The lattice parameter of pure palladium is  $a_{1000} = 3.8809 \pm 0.0005$  A., that of gold-palladium alloys is a linear function of the atomic composition, and that of silver-palladium deviates slightly from the linear, the maximum contraction in  $a$  of 0.007 A. occurring in the 50:50 alloy.—A. R. P.

#### V.—ANALYSIS

(Continued from p. 39.)

**Quantitative Analysis of Alloys by X-Ray Spectroscopy.** C. E. Eddy and T. H. Laby (*J. Physical Chem.*, 1931, 35, 3635-3638).—The technique employed by Teddy and Barrett for quantitative analysis by the method of X-ray emission spectra is adversely commented on, and it is pointed out that the

accuracy of this method of analysis has been established by results obtained by a number of investigators. Illustrative examples of the accuracy obtained by E. and L. in the analysis of alloys of elements of nearly equal atomic numbers with widely varying concentrations are given.—J. S. G. T.

**The Use of Solid Electrodes in Electrometric Analysis with Precipitation Reactions.** J. A. Atanasiu and A. J. Velculesco (*Z. anal. Chem.*, 1931, 85, 120-138).—For titration of Zn, Cd, Pb, Cu, Ce, Th, La, Ni, and Co with  $K_4Fe(CN)_6$  electrodes of Pt and platinumized Pt or of Pt and graphite give sharp potential changes at the end-point, and are more satisfactory than Pt-N-HgCl<sub>2</sub> electrodes. For titration of Ag as well as the above metals with  $K_4Fe(CN)_6$ , Pt-Ni and Pt-carborundum pairs give very satisfactory results.—A. R. P.

**The Use of Chromium Steel Vessels in Analysis.** A. Krüger (*Chem.-Zeit.*, 1931, 55, 682-683).—For the separation of Fe from Al by digestion of the  $NH_4OH$  precipitate with NaOH, Cr steel vessels are preferable to glass or porcelain; they may also be used in handling solutions containing  $Na_2S$ .

—A. R. P.

**The Use of Bromate in Volumetric Analysis. V.—Internal Indicators Suitable for Use in Direct Titrations.** G. Frederick Smith and H. H. Bliss (*J. Amer. Chem. Soc.*, 1931, 53, 2091-2096).—A group of 16 organic dyes suitable for use as internal indicators is described. The mono-azo dyes and those of the triphenylmethane series are most represented; all are suitable for use in the quantitative estimation of  $As^{+++}$ .—R. G.

**Dip-Sampling Cyanide Gold Bullion at the Sons of Gwalia Gold Mine, Gwalia, Western Australia.** Charles O. A. Thomas (*Australasian Inst. Min. Met.*, No. 81, 1931, 17-22; *C. Abs.*, 1931, 25, 5365).—Comparisons of dip samples from the molten bullion and boring samples from 32 ingots show that in most cases the borings assay higher in Au.—S. G.

**Tetramethyldiaminodiphenylmethane [as Analytical Reagent].** J. B. Ficklen (*Chem. and Ind.*, 1931, 50, 869).—Cf. Harry, *ibid.*, 1931, 50, 796; see *J.*, this issue, p. 89. It seems probable that tetramethyldiaminodiphenylmethane could be used to detect small quantities of any one of a large number of metals which have at least two relatively stable valence forms and which have higher oxides or hydroxides which are insoluble in the oxidizing solution. Since this reagent and its reaction are not specific for one metal, but rather depend on an oxidation-reaction, care must be taken to eliminate or correct for other metals.—E. S. H.

**Detection of Bismuth.** G. Lochmann (*Z. anal. Chem.*, 1931, 85, 241-242).—The  $Bi(OH)_3$  precipitate obtained in the usual group analysis is dissolved in 10%  $HNO_3$  and 1 drop of the solution is placed in the centre of a large drop of 5% KI solution on a piece of filter-paper; a black spot confirms the presence of Bi. On washing with hot water the black spot becomes bright red.—A. R. P.

**Comparison of Solubilities of Calcium and Strontium *p*-Bromobenzoates in Acetone-Water Mixtures.** John C. Bailar, Jr. (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1931, 3, 362-363).—Solutions containing 1 mg. of  $Sr(NO_3)_2$  per c.c. yield a distinct crystalline precipitate with  $NH_4 p$ -bromobenzoate in 94% acetone solution; under the same conditions Ca solutions containing 50 mg./c.c. give no precipitate, but presence of Ca interferes with the Sr reaction. Ba, Sr, and Ca *p*-iodobenzoates are almost completely insoluble in 94% acetone.—A. R. P.

**Catalysis and Microchemistry.** F. Feigl [with L. Weidenfeld, E. Fränkel, and H. J. Kapulitzas] (*Z. angew. Chem.*, 1931, 44, 739-742).—Traces of Cr may be detected in acid solutions by oxidation with  $K_2S_2O_8$  in the presence of  $AgNO_3$  followed by the application of Cazeneuve's colour reaction. Traces of Ag may be detected by adding  $HgCl_2$ ,  $CH_3CO_2Na$ , and phenylhydrazine; an immediate black colour appears in the presence of 0.016  $\mu$  grm. of Ag.—A. R. P.

**Gravimetric Determination of Aluminium by the Cyanate Method (Separation from Manganese and Zinc).** A. Okáč (*Publ. Fac. Sci. Univ. Masaryk*, 1931, (135), 4 pp.; *Chem. Zentr.*, 1931, 102, II., 3020).—The Al solution is boiled with 2 c.c. of 2N-NH<sub>4</sub>Cl solution and 0.1–0.3 gm. of KCNO, whereby Al(OH)<sub>3</sub> is quantitatively precipitated. In the presence of Zn more NH<sub>4</sub>Cl must be used. Good separations of Al from Mn and Zn are obtained.

—A. R. P.

**Contribution to the Qualitative Determination of Antimony in the Presence of Tin.** D. Barkovic (*Archiv Hem. Farm.*, 1931, 5, 236–238; *Chem. Zentr.*, 1931, 102, II., 2186).—The mixed sulphides are dissolved in hot 20% HCl, and water saturated with H<sub>2</sub>S is added until a slight permanent precipitate begins to form. On cooling, a red precipitate of Sb<sub>2</sub>S<sub>3</sub> separates. The test detects 0.01 mg. Sb in the presence of 100 times as much Sn.—A. R. P.

**Titanium Chloride in the Determination of Arsenic, Antimony, and Bismuth.** A. Oliverio (*Annali chim. applicata*, 1931, 21, 211–216; *C. Abs.*, 1931, 25, 5364).—As and Sb can be determined fairly accurately by adding TiCl<sub>3</sub> solution and titrating the excess with standard Fe<sup>+++</sup> solution. The reduction should take place in a hot solution under CO<sub>2</sub>. The trivalent As or Sb is reduced to metal. Bi cannot be determined satisfactorily in this way.—S. G.

**On the Gravimetric Determination of Beryllium and its Separation from Aluminium by Means of Guanidine Carbonate.** A. Jilek and J. Kova (*Coll. Trav. chim. Tchécoslov.*, 1931, 3, 336–353).—The warm slightly acid chloride solution of Be and Al is treated with a slight excess of guanidine carbonate solution whereby 2BeCO<sub>3</sub>·Be(OH)<sub>2</sub>.aq. is precipitated; reprecipitation is necessary to separate Al completely. In the presence of NH<sub>4</sub> salts (NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub> is formed which dissolves the Be salt; this difficulty is overcome by adding H-CHO to convert the NH<sub>4</sub> salt into (CH<sub>2</sub>)<sub>6</sub>N<sub>4</sub>.—A. R. P.

**Electrolytic Determination of Cobalt.** Dorothy H. Brophy (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1931, 3, 363–365).—The solution is adjusted to contain 50 c.c. of NH<sub>4</sub>OH, 5 gm. of NH<sub>4</sub>Cl, and 0.3–0.4 gm. of NaHSO<sub>3</sub> in 80–100 c.c. and electrolyzed with a gauze cathode rotating at 800–1000 r.p.m. using a c.d. of 4–7 amp./dm.<sup>2</sup>. The addition of 0.1–0.5 mg. of gelatin is advisable if the Co present is less than 80 mg. Deposition is complete in 30 minutes and the deposit is bright and adherent, but generally contains traces of S, which give a positive error of 0.1–0.4 mg. Electrolytes containing hydrazine or hydroxylamine salts are unsatisfactory.—A. R. P.

**A New Method for the Colorimetric Determination of Cobalt Alone and in the Presence of Nickel.** E. S. Tomula (*Suomen Kemistilehti*, 1929, 2, 72–80; *Chem. Zentr.*, 1931, 102, II., 2036–2037).—Cf. this J., 1931, 47, 209. The method involving the development of a blue colour by the interaction of Co salts with alkali thiocyanates has been fully investigated. Acetone is recommended as a stabilizer for the colour. The method can be used when the Co concentration is as low as 0.02 mol./litre.—A. R. P.

**The Use of Zinc Oxide in Determinations of Cobalt and Manganese.** James I. Hoffman (*U.S. Bur. Stand. J. Research*, 1931, 7, 883–892; *Research Paper No. 380*).—Presents data on the behaviour of the constituents of steel in precipitations by zinc oxide and gives directions for the determination of Co. The use of precipitations with zinc oxide in determinations of Mn and Ni and the purity of the zinc oxide reagent are also discussed.—S. G.

**On the Separation and Determination of Gallium. III.—The Separation of Gallium from Bivalent Elements and Those of the Rare Earths, and the Determination of All These Elements.** Sunao Ato (*Sci. Papers Inst. Phys. Chem. Res. Tokyo*, 1931, 15, (304), 289–301).—[In English.] Cf. this J., 1930, 44, 580; 1931, 47, 350. Ga can be separated quantitatively from Zn, Cd, Pb, Mn, Ni, Co, Mg, Ca, Sr, Ba, La, Ce, Pr, and Nd in CH<sub>3</sub>·CO<sub>2</sub>H solutions by precipitating Ga with camphoric acid or sodium camphorate solution, and is



then determined by ignition to  $Ga_2O_3$ . The divalent elements of the  $H_2S$  group (Pb, Cd, &c.) can also be separated by precipitation with  $H_2S$  in acid solutions. The experimental details are discussed, and the completeness of the separation has been tested. The adherence of the Ga precipitate to the wall of the vessel can be prevented by adding 20 c.c. of 10%  $NH_4NO_3$  before adding the camphoric acid.—W. H.-R.

**Anodic Precipitation of Lead Peroxide.** M. L. Nichols (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1931, 3, 384-385).—The mechanism of the deposition of  $PbO_2$  on the anode in the electrolytic determination of Pb has been investigated. Deposition occurs by anaphoresis, hence a roughened anode gives the best results; since negatively charged  $PbO_2$  is probably hydrated, the difficulty of removing the last traces of  $H_2O$  in drying is readily understood.—A. R. P.

**Volumetric Determination of Manganese after Oxidation by Periodate [Determination of Manganese in Bronze].** Hobart H. Willard and J. J. Thompson (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1931, 3, 399-401).—The method, which is applicable to quantities up to 30 mg. of Mn, depends on the oxidation of Mn in  $H_3PO_4$  solution to  $HMnO_4$  by boiling with  $NaIO_4$ , removal of excess of the latter by means of  $Hg(NO_3)_2$ , reduction of the  $HMnO_4$  with  $FeSO_4$ , and titration of the excess  $Fe^{2+}$  with  $KMnO_4$ . For the determination of Mn in bronze 1 grm. of turnings is dissolved in 3 c.c. of  $HNO_3$  (*d* 1.4), 10 c.c. of 85%  $H_3PO_4$ , and 7-8 c.c. of  $H_2O$ ; the solution is diluted to 50-75 c.c., boiled for 15 minutes with 0.3 grm. of  $NaIO_4$ , diluted to 150 c.c. with cold  $H_2O$ , treated with 4-5 grm. of  $Hg(NO_3)_2 \cdot 2H_2O$ , and filtered through asbestos. The filtrate is treated with an excess of standard  $FeSO_4$  and the excess is titrated with  $KMnO_4$  either electrometrically or by using alphasurine as indicator.—A. R. P.

**On a Modification of the Silver Salt-Persulphate Method for the Determination of Large Quantities of Manganese.** R. Lang and F. Kurtz (*Z. anal. Chem.*, 1931, 85, 181-185).—The solution free from heavy metals and chlorides is made *N* with respect to  $H_2SO_4$  and boiled with 10 grm. of  $H_3PO_4$ , 3-5 c.c. of 0.1*N*- $AgNO_3$ , and 2 grm. of  $K_2S_2O_8$ . When the excess of the last-named has been decomposed (25 minutes) the solution is cooled and titrated with  $FeSO_4$  to a pale rose tint ( $Mn^{3+}$ ), 3 drops of a 1% solution of diphenylamine in  $H_3PO_4$  are added, and titration is continued until the colour changes from violet to yellowish-green.—A. R. P.

**A New Method for the Colorimetric Determination of Manganese.** Ralph G. Harry (*Chem. and Ind.*, 1931, 50, 796).—When tetramethyldiaminodiphenylmethane is added to a solution containing  $Mn(OH)_2$  in  $CH_3 \cdot CO_2H$  a deep blue coloration is produced. Details are given of a procedure by which the reaction serves as a satisfactory method for the determination of small quantities of Mn. The colour standard is reasonably stable, but slowly fades. It may be replaced, however, by a set of colour standards which keep for a long time and which match excellently the colours produced (ranging from pale blue to purple). The extremes of the standard set are prepared from methylene-blue and crystal-violet, respectively, intermediate shades being obtained by mixing the two dyes.—E. S. H.

**On the Precipitation of Manganese as  $MnNH_4PO_4 \cdot H_2O$ .** P. Nuka (*Acta Univ. Latviensis, Chem. Ser.*, 1931, 2, 1-23; *Chem. Zentr.*, 1931, 102, II., 2906).—The Mn solution should be free from  $SO_4^{2-}$ ; precipitation from a hot solution yields the best results, as the precipitate forms immediately in a crystalline condition, whereas in a cold solution amorphous  $Mn_3P_2O_8$  is first formed, and this has a tendency to adsorb Na salts which may be present.  $NaCl$  retards the conversion of  $Mn_3P_2O_8$  into  $MnNH_4PO_4 \cdot H_2O$ , hence  $(NH_4)_2HPO_4$  should be used as precipitant. A 1% solution of the latter salt is best for washing the precipitate, as it has the minimum solvent action thereon. Final washing is done with 60%  $C_2H_5OH$ .—A. R. P.

**Volumetric and Gravimetric Determination of Mercury as Periodate.** Hobart H. Willard and J. J. Thompson (*Indust. and Eng. Chem. [Analyt. Edn.]*, 1931, 3, 398-399).—The solution containing the Hg as  $\text{Hg}(\text{NO}_3)_2$  or  $\text{HgSO}_4$  is adjusted to 150 c.c. and made 0.15*N* with  $\text{HNO}_3$  or 0.1*N* with  $\text{H}_2\text{SO}_4$ , and the Hg is precipitated from the boiling solution by addition of 2 gm. of Na or K periodate dissolved in 50 c.c. of  $\text{H}_2\text{O}$ . The precipitate of  $\text{Hg}_5(\text{IO}_6)_2$  is collected, after cooling, on a porous crucible, washed with warm  $\text{H}_2\text{O}$ , dried at 100° C. for 2-3 hrs., and weighed. Alternatively the precipitate is dissolved from the crucible with 2-3 gm. of solid KI and 10-15 c.c. of  $\text{H}_2\text{O}$ , the solution acidified with 10 c.c. of 2*N*-HCl, and the liberated I titrated with  $\text{Na}_2\text{S}_2\text{O}_3$ . The precipitate may also be dissolved in standard  $\text{Na}_2\text{HAsO}_3$  solution; 35 c.c. of HCl are then added, and the solution is diluted to 100 c.c. and titrated with  $\text{KIO}_3$ , using  $\text{CHCl}_3$  as indicator. Al, Zn, Cd, Ni, Cu, Ca, and Mg do not interfere in the precipitation, but  $\text{Fe}^{+++}$  salts and halides must be absent.—A. R. P.

**Quantitative Determination of Mercury, Copper, and Arsenic in the Presence of One Another and in the Presence of Iron Salts.** M. Foerster (*Ann. chim. analyt.*, 1931, [ii], 13, 225-228).—The chloride solution of the metals is treated with NaCl and HCl and the Hg precipitated as  $\text{Hg}_2\text{Cl}_2$  by careful addition of 0.1*N*- $\text{Na}_2\text{HPO}_4$  solution (excess converts  $\text{Hg}_2\text{Cl}_2$  into Hg). The precipitate is dried and weighed or, better, its  $\text{Cl}_2$  content is determined argentometrically. Cu and As are determined in the filtrate by the usual methods.—A. R. P.

**An Oxidimetric Determination of Sodium.** H. Gall and K. H. Heinig (*Z. anorg. Chem.*, 1931, 202, 154-160).—The Na is precipitated as  $(\text{UO}_2)_2\text{ZnNa}(\text{CH}_3\text{CO}_2)_6 \cdot 6\text{H}_2\text{O}$ , the precipitate collected in a glass filter, washed with concentrated  $\text{CH}_3\text{CO}_2\text{H}$ , and dissolved in 5*N*- $\text{H}_2\text{SO}_4$  and the solution reduced with electrolytic Cd and titrated with 0.1*N*- $\text{KMnO}_4$ . Less than 50% K does not interfere.—M. H.

**The Volumetric Determination of Tin in White Bearing Metal Alloys.** D. Lombardo (*Fonderie mod.*, 1931, 25, 426-427).—Abstract of a paper presented at the 6e Congrès Internationale de Fonderie. Describes a method of determining Sn volumetrically in white bearing metal alloys, based on the reduction of  $\text{Sn}^{+++}$  to  $\text{SnCl}_2$  followed by oxidation and titration with I. Reduction can be effected with Pb or Fe, and the latter is recommended provided that an empirical factor is used to calculate the Sn, the theoretical factor giving too low a result (about 0.92%). Using a factor of 0.00599, accurate results for alloys containing up to 38% Pb were obtained. For alloys containing more Pb than this, the results will be 0.20-0.35% too low, but still well within the limits of experimental error.—J. H. W.

**A Note on the Estimation of Tin in Steel and on Tinplates.** Alice T. Godsell (*Swansea Tech. Coll. Met. Soc. Papers, Session 1926-29*, 1-9).—The paper deals with an investigation on the accuracy of the estimation of Sn in steel and on tinplates by solution in HCl or  $\text{H}_2\text{SO}_4$  and titration with standard I solution. In the estimation of Sn in mild steel, it was found that when using  $\text{H}_2\text{SO}_4$  for dissolution, there was less variation than with HCl. With  $\text{H}_2\text{SO}_4$ , the "blue" end-point remained permanent, but with HCl the colour was very reddish and transient. A dilute solution of I for small amounts of Sn was found to be beneficial. A suitable solution of I for the determination of Sn on tinplate, is one containing 3.89 gm. of I per litre, 1 c.c. of which is equivalent to 1 oz. of Sn per standard box, when the determination is carried out on 2 in.<sup>2</sup> of tinned sheet.—R. Gr.

**The Electrometric Titration of Uranium with Ceric Sulphate.** Dwight T. Ewing and Mabel Wilson (*J. Amer. Chem. Soc.*, 1931, 53, 2105-2110).—The hot  $\text{H}_2\text{SO}_4$  solution of uranium sulphate is reduced in a Jones reductor and titrated in a special cell under nitrogen with ceric sulphate. Two end-points

are obtained, marking the oxidation from trivalent to tetravalent and from tetravalent to hexavalent. The acetate in HCl solution also gives two end-points, but not so sharply as in  $H_2SO_4$  solution.—R. G.

## VI.—LABORATORY APPARATUS, INSTRUMENTS, &c.

[See also "Testing" and "Pyrometry."]

(Continued from pp. 40-41.)

**A Portable Instrument Set for General Laboratory Use and for Electrolysis.** — (*Siemens Rev.*, 1931, 7, 283).—Introduces a new portable unit for converting normal pressure supplied from a.c. mains, into d.c. of any pressure down to 6 v. The apparatus is suitable for electrolytic quantitative analysis of metals, and is portable. It consists of an air-cooled single-phase transformer, the secondary of which is connected to a metal rectifier and a voltage divider. A suitable ammeter and voltmeter are incorporated in the instrument.—R. Gr.

**High-Voltage Cathode-Ray and X-Ray Tubes and their Operation.** W. D. Coolidge, L. E. Dempster, and H. E. Tanis (*Physics*, 1931, 1, (4), 230-244).—The design of high-voltage discharge tubes is outlined and a complete induction coil X-ray outfit operating at 900,000 v. and 5 m. amp. is described.

—J. S. G. T.

## VII.—PHYSICAL AND MECHANICAL TESTING AND RADIOLOGY

(Continued from pp. 41-43.)

**The Polarizing Metallurgical Microscope.** C. Reichert (*Metallurgia*, 1931, 5, 39).—A letter to the Editor referring to Schwarz's paper on "The Micro-Optical Investigation of Non-Ferrous Alloys by Polarized Light" (*Metallurgia*, 1931, 4, 180-186; this *J.*, 1931, 47, 659-660), in which are described in detail the polarizing metallurgical microscope and the Reichert polarizing opaque illuminator.—J. W. D.

**Regulations and Schedule of Charges in Respect of the Testing of Material, Instruments, Gauges, &c., at the A.I.D. Test House.** — ([*British*] *Air Ministry*] *Publication No. 1226*, 1931, 1-15).—S. G.

**Non-Destructive Testing of Welds.** Anon. (*Oxy-Acetylene Tips*, 1931, 10, 155-156).—A brief review of methods of testing welded products by the hydrostatic pressure, air-pressure, reheating, stethoscope, and X-ray tests.

—J. H. W.

**Autogenous Welding of Sheet: Testing the Strength of Welds.** G. Öhler (*Science et Industrie*, 1931, 15, 95-97).—Abridged from an article by Ö. in *Werkstattstechnik*, 1930, 24, 549-553. The tensile test is generally adopted for comparing welded with non-welded material. Some authorities prefer a bending test. Welds have low impact values compared with the original metal. Graphs give the relative strengths of welded and original materials, taking into account: (1) thickness of plate and angle of chamfering; (2) type of chamfer; (3) width of lap; (4) form of lap; (5) different methods of welding. The theoretical basis of the foregoing is discussed, and some practical directions are given.—P. M. C. R.

**Methods of Testing Welds.** G. B. Moynahan (*Canad. Mach.*, 1930, 4, (25), 46-48).—Abstracted from *Metals and Alloys*, 1930, 1, 607-612. See this *J.*, 1931, 47, 32, 353.—P. M. C. R.

**Tentative Method of Test for Determining the Temperature Resistance Constants of Resistance Alloys (B 84-31 T).** — (*Amer. Soc. Test. Mat.*

*Tentative Standards, 1931, 202-207*).—The method provides for determining the change of resistance with temperature of wires of the Manganin and Constantan types (having compositions similar to copper 84, manganese 12, nickel 4%; and copper 55, nickel 45%, respectively), and for computing the constants of the resistance-temperature equation. It is applicable in the temperature range 0°–80° C. and is suitable for wires to be used in precision electrical instruments.—S. G.

**Measurements of the Damping [of Oscillations] in Vibrating Steel Rods.** Dankwart Schenk (*Z. Physik, 1931, 72, 54-67*).—A method for the investigation of fatigue in steel rods, dependent on the measurement of the decrement of longitudinal oscillations excited in the rods by means of a piezoelectric quartz oscillator. The damping coeff. is found to depend on the amplitude of the oscillations, and changes of the coeff. are attributed to structural changes in the rods, which is confirmed by X-ray analysis. After long use both the rods experimented with lost their oscillating property.

—J. S. G. T.

**Optical Analysis of Stresses.** Anon. (*Indian Engineering, 1931, 89, 230*).—An abridged description of the analysis of stresses by the use of celluloid models, e.g. on models of railway wheels and on perforated discs; see Coker, *J. Franklin Inst., 1925, 199, 289-332*; this *J., 1925, 33, 446*.—P. M. C. R.

**On the Stress Distribution of an Angle Plate.** Ziro Tuzi (*Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1931, 16, (319), 140-146*).—[In English.] A photoelectric investigation of the behaviour of angle plates (of glass and phenolite) under compression. The results confirm the previous conclusion of the existence of three singular points.—W. H. R.

**Measuring Infinitesimal Dimensions.** Anon. (*Indust. Australian, 1931, 85, 150*).—The electric gauge developed by the General Electric Co. gives  $\times 10,000$  magnification of movement, and requires very infrequent renewal or refinishing. A small transformer supplies power from a 500-cycle alternator to 4 balanced inductances, 2 being small coils in the gauge-head. One end of a pivoted steel lever armature moves between these as the contact point on the other end conforms to the surface under examination. The gauge spindle carries the contact point. Calibration and adjustment are easy, reading is rapid and accurate, and recording instruments are being developed.—P. M. C. R.

**Large "Buckton" Universal Testing Machine.** Anon. (*Indian Railway Gaz., 1930, 29, 196-197*).—The machine is designed to take tensile test-pieces of max. length up to 6 ft. 4 in., with 25% elongation, the maximum thickness for rounds and squares being 2½ in. and the limiting section for flats 2½ in. thick  $\times$  3½ in. wide. Large compression specimens, up to 8 ft. long and 70 in. square in section, can also be dealt with. Two ranges of load are available—0-20,000 lb. and 0-200,000 lb. Tensile, compression, and deflection tests have their results automatically recorded.—P. M. C. R.

**Olsen Motor-Driven Brinell Machine.** Anon. (*Automotive Ind., 1931, 65, 614*).—A Brinell machine operated by an electric motor and intended for production testing has been developed by the Tinius Olsen Testing Machine Co., U.S.A. The machine can be, alternatively, operated by a treadle. It is rapid and silent in working; all moving parts are enclosed in a bath of oil.

—P. M. C. R.

**Olsen Ductility Testing Machine.** Anon. (*Automotive Ind., 1931, 65, 614*).—The ductility of sheet metal can be determined by a cupping test. The motor-driven machine designed by Tinius Olsen Testing Machine Co., U.S.A., applies the load hydraulically. A graduated scale shows the thickness of the plate to be tested at the time of insertion in the machine. Increase of load is stopped automatically at any desired depth of cup; if the test is carried to destruction, both depth of cup and amount of load are shown. Details of adjustments are given.—P. M. C. R.

**Warner Reverse-Bend Machine.** Anon. (*Automotive Ind.*, 1931, 65, 615).—A reverse-bend testing machine, developed by the Tinius Olsen Testing Machine Co., U.S.A., is designed for small rods and flat specimens. The form of the jaws allows of smooth bending in opposite directions. The machine may be hand-operated or motor-driven.—P. M. C. R.

**Coats Elasticometer Spring Testing Machine.** Anon. (*Automotive Ind.*, 1931, 65, 613).—A loose weight and pendulum spring testing machine is adapted for rapid compression or extension testing of light springs. The maximum load capacity is 5 lb., and the scale consists of a single lever in the ratio of 1 : 1.—P. M. C. R.

**Tentative Specifications for Round-Hole Screens for Testing Purposes (E 17-31 T).** — (*Amer. Soc. Test. Mat. Tentative Standards*, 1931, 870-871).—Cover testing screens for use in the classification of materials according to size in all cases where specifications call for the use of screens having circular openings.—S. G.

### RADIOLOGY.

**Inspection of Welds with Gamma-Rays.** Gilbert E. Doan (*Amer. Soc. Steel Treat. Preprint*, 1931, Sept., 1-7).—The penetrative power of gamma-rays is adequate for examining steel castings up to 10 inches in thickness and is sensitive enough to reveal flaws as small as 2% of the thickness. Comparisons have been made between gamma radiograms and the fractured welds, and it has been shown that the former are comparatively easy to interpret. The sensitivity of the method appears to be adequate to reveal all classes of flaws which are present in improperly made welds.—W. A. C. N.

**Non-Destructive Testing by Gamma Rays from Radium.** R. F. Mehl (*Mech. World*, 1931, 90, 310-312, 325-328).—Abstract *in extenso* of a paper read before the American Society of Naval Engineers. See this *J.*, 1931, 47, 586.—F. J.

**The Use of Gamma-Rays in Testing-Pieces.** R. F. Mehl (*Science et Industrie*, 1931, 15, 534-535).—Abridged from *Amer. Machinist*, 1931, 75, 278-280. The detection of blowholes, occluded gases, and cracks by the use of gamma-rays is described. The method is applied to steel, brass, and bronze; its success in the case of light alloys is not yet assured.—P. M. C. R.

**X-Ray Tests of Welds.** H. H. Lester (*Army Ordnance*, 1930, 11, 124-127).—Cf. this *J.*, 1931, 47, 663. Although dealing principally with welds in ferrous materials, the paper describes many points of general application.—H. F. G.

**The Use of X-Rays in Engineering.** V. E. Pullin (*Indust. Australian*, 1931, 85, 132).—An account of a paper by P. published in *Proc. Inst. Mech. Eng.*, 1930, (2), 1132-1145. See this *J.*, 1931, 47, 545.—P. M. C. R.

**A 400-KV X-Ray Tube.** V. E. Pullin and C. Croxson (*J. Sci. Instruments*, 1931, 8, 282-286).—For very high voltages the life of a sealed-off X-ray tube is too short to be of practical value. A tube has therefore been devised for working in permanent connection with a pumping system consisting of a Metropolitan-Vickers oil diffusion pump, and a Ilyvac two-stage backing pump. The water-cooled anode is of gold, and data are given showing that this metal is more efficient than tungsten for this purpose. The cathode is a filament of tungsten wire backed by thin sheet molybdenum. The available supply enabled only 390 kv. to be attained, and at this voltage the tube ran steadily with a current of 20 m. amp. for periods of more than half an hour. Radiographs could be obtained after a few minutes' exposure through  $\frac{1}{2}$  in. of metallic lead. The protection of such a tube is of grave importance and is being investigated.—W. H.-R.

## VIII.—PYROMETRY

(Continued from p. 44.)

**On Thermocouples and the Reproducibility of their Data. Criteria for their Usefulness in Measuring Temperatures.** Wilhelm Goedecke (*Festschrift zum 50-jährigen Bestehen der Platinschmelze G. Siebert G.m.b.H. Hanau, 1931, 72-99*).—The presence of small quantities of iron, iridium, or palladium in platinum-thermocouple wire decreases appreciably the e.m.f. against a platinum-rhodium wire at high temperatures, the effect of iron being greatest and that of palladium least. Similar impurities in the platinum-rhodium wire increase the e.m.f. against platinum, but to only a relatively small extent. An alloy of platinum with 8% rhenium has an e.m.f. of 32.5 m.v. against platinum at 1300° C., and an alloy of platinum with 4.5% rhenium and 5% rhodium has an e.m.f. of 30 m.v. against platinum at 1300° C. The latter alloy is more stable under prolonged use at high temperatures than the all-rhenium alloy, which tends to lose rhenium by volatilization and develops a coarsely crystalline structure after prolonged heating. Rhodium|platinum-8% rhenium couples can be used in alumina tubes for measuring temperatures up to 1800° C. (e.m.f. 20 m.v.) and rhodium|rhodium-8% rhenium couples for temperatures up to 1900° C. (7.2 m.v.). Curves are given showing the e.m.f. of iron|copper-nickel alloy couples for nickel contents between 0% and 40%; addition of small quantities of iron and manganese reduces only slightly the e.m.f. of the couple, but iron alone has a more marked effect. The conditions under which the alloys have been prepared also affect the thermo-electric properties, higher e.m.f. values being obtained for alloys melted in a carbon monoxide atmosphere than for those melted in a vacuum. For nickel|Constantan couples the alloy wire with 45% nickel gives the longest life and admits of use at the highest temperature. The presence of iron in nickel-7% chromium alloy wires alters the e.m.f. against pure nickel by an amount which is at a maximum at 600° C., for the 5% iron alloy the difference is 2 mv. against the iron-free alloy. A base metal couple comprising a positive wire of 12.3% nickel and 87.7% copper and a negative wire of 20% nickel and 80% copper gives an e.m.f. up to 900°, which follows closely that of the platinum|platinum-10% rhodium couple. Care must be taken in making base metal thermocouple wires of nickel-copper and nickel-chromium alloys that the ingot is worked and annealed until it is homogeneous, as these alloys have a tendency to inverse segregation during the cooling of castings.—A. R. P.

**New Apparatus for Measuring Heat Emission (Thermo-Elements) of Increased Sensitivity and Rapid Adjustability.** Carl Müller (*Wiss. Abhandl. Physikal.-Tech. Reichsanst., 1931, 15, 171-173*).—Reprint from *Naturwiss., 1931, 19, 416-419*; see abstract from *Forschungen u. Fortschritte, 1930, 6, 466-467*; this *J.*, 1931, 47, 220.—M. H.

**"Optix" Pyrometer.** Messrs. Cooke, Troughton, & Simms, Ltd. (*Instrument World, 1931, 4, (44), 157*).—A small pyrometer of the "disappearing spot" type suitable for temperature measurements over the range 750°-1800° C. is described.—J. S. G. T.

**Temperature Regulators for Metallurgical Furnaces.** F. Kofler and G. Schefels (*Siemens-Z., 1931, 11, 448-453*).—The application of the Siemen & Halske temperature regulator for blast furnaces and annealing furnaces is discussed.—M. H.

**Temperature Regulator for Melting Furnaces.** H. Rechenberg (*Elektrotech. Zeit., 1931, 52, 1498-1499*).—Description of a device for maintaining a constant temperature in electrically heated laboratory tube furnaces (wire wound) up to 1000° C. with an accuracy of about 0.2%.—M. H.

## IX.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

## ELECTRODEPOSITION

(Continued from pp. 45-50.)

**A New Abnormality in the Properties of Aqueous Solutions of Cadmium Salts.** Elmer Tesche and Pierre J. Van Rysselberghe (*Trans. Electrochem. Soc.*, 1931, 59, 353-357).—See this *J.*, 1931, 47, 221.—S. G.

**Preliminary Treatment before Chromium Plating.** Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1931, 29, 430-431).—A brief discussion of methods of producing nickel undercoats and their utility in chromium plating various metals and alloys.—A. R. P.

**Preparing Work for Polished Chromium Plating.** W. E. Warner (*Canad. Mach.*, 1931, 42, (24), 23).—The polishing, buffing, and cleaning of the basis metal are described, together with the treatment of the first electro-coating, if any.—P. M. C. R.

**The Beginnings of Modern Chromium Plating.** —Schöpf (*Metallwaren-Ind. u. Galvano-Tech.*, 1931, 29, 429-430).—An historical survey of the early development of chromium plating.—A. R. P.

**What is Chromium Plated in America?** Herbert Kurrein (*Metallwaren-Ind. u. Galvano-Tech.*, 1931, 29, 432-434).—A review of recent articles in the American technical press describing the extensive use of chromium plating in America.—A. R. P.

**Some Chromium Plating Observations.** W. H. Rowe (*Metal Cleaning and Finishing*, 1931, 3, 571-572; *C. Abs.*, 1931, 25, 5352).—The factors which influence the production of good chromium deposits and the methods of overcoming plating difficulties are dealt with.—S. G.

**Lead and Lead-Antimony Anodes for Chromium Plating.** E. M. Baker and P. J. Merkus (*Electrochem. Soc. Preprint*, 1932, Apr., 23-29).—Lead-antimony anodes are frequently used in chromium-plating baths. The effects of variation in the percentage of antimony in the alloy on the rate of anode corrosion, and on the oxidation of trivalent to hexavalent chromium were studied. The pure lead anodes were most resistant to corrosion in continuous plating; the alloys high in antimony were most resistant in intermittent plating. The equilibrium concentrations of trivalent chromium were about the same for all anodes, and were less than 1 gm./litre in 2.5 molar solutions of chromic acid (250 gm./litre).—S. G.

**The Electrodeposition of Chromium and the Influence of the Cathode Metal.** J. W. Cuthbertson (*Trans. Electrochem. Soc.*, 1931, 59, 401-424).—See this *J.*, 1931, 47, 357, and following abstract.—S. G.

**Discussion on Cuthbertson's Paper on "The Electrodeposition of Chromium and the Influence of the Cathode Metal."** Harold K. Work. E. M. Baker. Colin G. Fink. O. P. Watts. W. M. Phillips. E. C. Tomsicek. J. W. Cuthbertson (*Trans. Electrochem. Soc.*, 1931, 59, 425-428).—Cf. preceding abstract. It is not necessary to connect the work with the cathode rod before immersion in chromium-plating baths, but the article, if it has been nickel- or copper-plated, should be rinsed in hot water before chromium plating. The magnesium sulphate nickel bath gives much better nickel undercoats than does the citrate bath, but the work must be thoroughly washed before chromium plating if it consists of aluminium or zinc die-castings, otherwise blisters are likely to form in the chromium plate.—A. R. P.

**Three Crystalline Modifications of Electrolytic Chromium.** Kumazo Sasaki and Sinkiti Sekito (*Trans. Electrochem. Soc.*, 1931, 59, 437-443).—See this *J.*, 1931, 47, 287, and following abstract.—S. G.

**Discussion on Sasaki and Sekito's Paper on "Three Crystalline Modifications of Electrolytic Chromium."** Colin G. Fink. E. A. Ollard (*Trans. Electrochem. Soc.*, 1931, 59, 443-444).—Cf. preceding abstract. The change

from hexagonal to cubic chromium appears to be associated with loss of hydrogen, but it is not clear whether this is essential to the change. A certain amount of evidence has, however, been obtained in support of the theory that the hexagonal modification is a hydride.—A. R. P.

**The Present Position of Chromium Plating.** Anon. (*Machinery (Lond.)*, 1930, 35, 638-639).—*Résumé* of a discussion at a meeting of the Electroplaters' and Depositors' Technical Society. See this *J.*, 1931, 47, 38.

—H. F. G.

**The Resistance of Chromium-Plated Plug Gauges to Wear.** Harry K. Herschman (*Mech. World*, 1931, 90, 80-81, 97-99).—Abstract of paper published in *Bur. Stand. J. Research*, 1931, 6, 295-304. See this *J.*, 1931, 47, 221.

—F. J.

**Chromium Deposits Directly on Aluminium.** Harold K. Work and Charles J. Slunder (*Trans. Electrochem. Soc.*, 1931, 59, 429-435).—See this *J.*, 1931, 47, 287.—S. G.

**A Note on the Tarnishing of Chromium-Plated Brass.** W. M. Phillips (*Trans. Electrochem. Soc.*, 1931, 59, 397-398; discussion, 399).—See this *J.*, 1931, 47, 287.—S. G.

**The Chromium Plating of Silver Objects.** H. Krause (*Mitt. Forschungs-Inst. Edelmetalle*, 1931, 4, 98-101, 107-111; *C. Abs.*, 1931, 25, 5352).—A description of the process from the practical operating point of view.—S. G.

**Chromium Plating on Steel for Wear Resistance at High Temperatures and High Current Densities.** A. Willink (*Electrochem. Soc. Preprint*, 1932, Apr., 73-80).—To produce a chromium plate which will show a high wear resistance, the bath containing about 250 gm./l. of chromic acid and 2.3 gm./l. of sulphuric acid is recommended. It should be operated at a current density of 100-325 amp./dm.<sup>2</sup>, and at 60°-75° C. Under these conditions it is found that the throwing power is better than at lower temperatures and current densities. The importance of having the steel surfaces clean before plating is emphasized. Alkali cleaners are objectionable on account of the alkaline film which remains and adheres to the steel surface. A "vapor degreaser" is described which employs trichlorethylene as the solvent. Control of the plating solution by periodic analyses is advocated.—S. G.

**Electrodeposition of Chromium-Iron Alloy.** G. Fuseya and K. Sasaki (*Trans. Electrochem. Soc.*, 1931, 59, 445-459; discussion, 459-460).—See this *J.*, 1931, 47, 288.—S. G.

**Chemical Control of Cyanide Copper-Plating Solutions.—II.** L. C. Pan (*Metal Cleaning and Finishing*, 1931, 3, 565-569; *C. Abs.*, 1931, 25, 5353).—Cf. this *J.*, 1931, 47, 664. The determination of free cyanide and carbonate in cyanide copper-plating solutions is outlined. Titration diagrams are given from which the amounts can be directly read off in oz. per gall.—S. G.

**Electrodeposition of Iron, Copper, and Nickel Alloys. II.—Discussion of Results Obtained from Cyanide Solutions.** Lawrence E. Stout and Charles L. Faust (*Electrochem. Soc. Preprint*, 1932, Apr., 1-22).—Consists of a theoretical discussion of the physical chemical relations involved in the electrodeposition of iron, nickel, and copper alloys from cyanide solutions. It is demonstrated that the cathode process was controlled by the metal and hydrogen over-voltages, both of which depend on the concentration polarization of the solution as indicated by the rule of mixtures. Numerous experimental indications are cited to show that the depositions occurred from the cyanides in solution buffered with tartrates instead of from the tartrates themselves.—S. G.

**Practical Hints on Electroplating with Lead.** Hans Hornauer (*Metall-waren-Ind. u. Galvano-Tech.*, 1931, 29, 386).—For thin coatings of lead an alkaline solution of 5 gm. of litharge in 50 gm. of caustic potash diluted to 1 litre is recommended for its high throwing power and current efficiency and for the production of lustrous deposits. Acid baths comprise lead fluosilicate



and lead fluoborate dissolved in a 7-8% solution of the corresponding acid and containing 1.5 grm./l. of gelatin; these baths work at high current densities with nearly 100% efficiency and yield deposits up to 1 cm. thick in a relatively short time.—A. R. P.

**High-Speed Nickel Plating as Practised in England.** Ernest R. Canning (*Trans. Electrochem. Soc.*, 1931, 59, 371-374).—See this *J.*, 1931, 47, 221, 359, 495, and following abstract.—S. G.

**Discussion on Canning's Paper on "High-Speed Nickel Plating as Practised in England."** W. M. Phillips. O. B. J. Fraser. Colin G. Fink. R. R. Ridgway. E. M. Baker. E. R. Canning (*Trans. Electrochem. Soc.*, 1931, 59, 374-377).—Cf. preceding abstract. The discussion ranges round the difficulties associated with continuous filtration of large volumes of nickel-plating solution and the advisability of agitating nickel-plating baths. The use of four large alundum thimble filters successively gives sufficient time for cleaning out the filters; it is preferable to pass the solution from the outside of the thimble to the inside so as to facilitate cleaning. Alundum plates may be used in place of the thimbles. Bagging of the anodes is advisable in violently agitated baths.—A. R. P.

**Passive and Dense Nickel Deposits "Panzer-Nickel."** Carl Schuch (*Metallwaren-Ind. u. Galvano-Tech.*, 1931, 29, 408-409).—The merits of a new nickel-plating process, the Panzer process, are detailed, but no information is given as to its nature. The deposits obtained are claimed to be free from pores, smooth, finely crystalline, and firmly adherent. The plate is stated to be superior to chromium plate as a protection against rust. To detect pores in nickel plate, grease is removed with benzine, the specimen is dipped for 1 minute in 5% sulphuric acid, washed with water, and covered with a warm solution of 7.5 grm. of gelatin, 2.5 grm. of glycerin, and 1 grm. of potassium ferricyanide in 100 c.c. of water. This mixture sets on cooling to a jelly in which blue spots develop above the pores in the nickel plate.—A. R. P.

**High-Duty Nickel-Plating Baths.** Karl Altmannsberger (*Metallwaren-Ind. u. Galvano-Tech.*, 1931, 29, 457-458).—A rapid nickel-plating solution contains 64 grm. of nickel as sulphate, 10 grm. of sodium citrate, 3 grm. of magnesium sulphate, 3.4 grm. of boric acid, 2 grm. of sodium ethylsulphonate, 0.26 grm. of citric acid, and 0.2 grm. of sodium chloride per litre. The bath has a  $p_{\text{H}}$  of 5.2-5.8 and sp. gr. 1.17; it is preferably operated at 45-50°C. with a current density of 1.5-2 amp./dm.<sup>2</sup> at 3.5-4.5 volts.—A. R. P.

**Progress of the Hot Nickel Solution.** Oliver P. Watts (*Trans. Electrochem. Soc.*, 1931, 59, 379-383).—See this *J.*, 1931, 47, 289, and following abstract.—S. G.

**Discussion on Watts' Paper on "Progress of the Hot Nickel Solution."** E. M. Baker (*Trans. Electrochem. Soc.*, 1931, 59, 383-384).—Cf. preceding abstract. It is desirable to fill the cross-section of the bath with the articles to be plated; this considerably increases the effective resistance between anode and cathode, and therefore raises the voltage necessary to produce a given current density, hence current densities of 100 amp./ft.<sup>2</sup> or more are prohibitive from the point of view of cost of power. The potential between anode and cathode is about 12 v. at 50 amp./ft.<sup>2</sup> and 20 v. at 100 amp./ft.<sup>2</sup>. Better plating is obtained at low current density with a low temperature and at high current density with a high temperature.—A. R. P.

**Control of Acidity in Low  $p_{\text{H}}$  Nickel-Plating Baths.** L. C. Pan (*Trans. Electrochem. Soc.*, 1931, 59, 385-392).—See this *J.*, 1931, 47, 289.—S. G.

**Further Developments in Low  $p_{\text{H}}$  Nickel Deposition.** W. M. Phillips (*Trans. Electrochem. Soc.*, 1931, 59, 393-396).—See this *J.*, 1931, 47, 289, 664.—S. G.

**Rustless Nickel Plating.** Anon. (*Demizet*, 1931, 47, 502-503).—The process of nickel plating when a coating most resistant to corrosion is required and the relation between current density and time of plating for equal thick-

ness of coating are discussed. Control of the bath composition to avoid blisters and the like is emphasized. Electrolytic degreasing must be employed; cleaning with petrol, benzine, &c., is not sufficient. The anti-corrosion properties of nickel coatings depends largely on the care given to such details.

—J. H. W.

**Determination of Nickel by Moore's Method [in Plating Baths].** A. Wogrinz (*Metalwaren-Ind. u. Galvano-Tech.*, 1931, 29, 381-383).—The application of Moore's cyanide process to the determination of nickel in plating baths is described. When the bath contains much magnesium salt or is contaminated with iron it is preferable to precipitate the nickel first with dimethylglyoxime from a neutral tartrate solution after oxidation of the iron with hydrogen peroxide. The glyoxime precipitate is dissolved by boiling with sulphuric acid and hydrogen peroxide, the solution rendered slightly ammoniacal, and titrated with cyanide and silver nitrate in the usual way. From the results obtained directions are given for adjusting the strength of the bath.—A. R. P.

**Electrodeposition of Platinum, Palladium, and Rhodium.** W. Keitel and H. E. Zschiegner (*Trans. Electrochem. Soc.*, 1931, 59, 273-275; and (abridged) *Indust. Australian*, 1931, 85, 325-326).—See this *J.*, 1931, 47, 290, 394, 445, 590.—S. G.

**A Study of Silver-Plating Solutions.** B. Egeberg and N. Promisel (*Trans. Electrochem. Soc.*, 1931, 59, 287-306).—See this *J.*, 1931, 47, 290, and following abstract.—S. G.

**Discussion on Egeberg and Promisel's Paper on "A Study of Silver-Plating Solutions."** W. C. Moore. Colin G. Fink. Daniel Gray. Louis Kahlenberg (*Trans. Electrochem. Soc.*, 1931, 59, 306).—Cf. preceding abstract. The mode of action of carbon disulphide as a brightener in silver-plating baths is discussed. Three theories are suggested, viz. (a) a soluble xanthate is formed, (b) a complex compound is formed between the carbon disulphide and silver cyanide, and (c) the small quantity of sulphur which is always present in commercial carbon disulphide acts as the brightener. Sodium xanthate in minute quantities is an efficient brightener, but in excess produces "burnt" or frosted deposits.—A. R. P.

**Bright Silver Plating from the Cyanide Bath. A Preliminary Note.** L. C. Pan (*Trans. Electrochem. Soc.*, 1931, 59, 329-334).—See this *J.*, 1931, 47, 290, 359, and following abstract.—S. G.

**Discussion on Pan's Paper on "Bright Silver Plating from the Cyanide Bath."** Wm. C. Moore. Louis Kahlenberg. E. M. Baker. L. C. Pan (*Trans. Electrochem. Soc.*, 1931, 59, 334-335).—Cf. preceding abstract. In view of the fact that some organic sulphur compounds seem to have a powerful brightening effect on electrodeposits of silver, it is suggested that a systematic investigation of the behaviour of organic compounds with the sulphur atom in various positions in the molecule should be made. Pyridine behaves like ammonia in producing bright deposits. The use of the ammoniatiosulphate brightener recommended in the paper has effected a saving of 44% in plating tank capacity, and a 60-75% saving in labour required for polishing and finishing.—A. R. P.

**Cyanides in Relation to Silver and Gold Solutions.** E. J. Dobbs (*Indust. Australian*, 1931, 86, 266).—A paper read before the Electrochemical Society. See this *J.*, 1931, 47, 549; this volume, p. 46.—P. M. C. R.

**Electrodeposition of Silver from Sulphate, Nitrate, Fluoborate, and Fluoride Solutions.** Edward B. Sanigar (*Trans. Electrochem. Soc.*, 1931, 59, 307-327).—See this *J.*, 1931, 47, 290.—S. G.

**Formation of Stains on Electrolytic Silver Plate.** K. V. Frölich (*Mitt. Forschungsinst. Edelmetalle*, 1931, 4, 91-98; *C. Abs.*, 1931, 25, 5352).—A

discussion of the mechanism of the formation of stains in electrolytic silver plating. They may be avoided by thorough washing after polishing, followed by immersion for 15 minutes in 5% acetic acid at 60°–80° C. and washing with water.—S. G.

**The Change in Reflecting Power Caused by Tarnishing Electrodeposited Silver–Cadmium Alloys.** Lawrence E. Stout and William G. Thummel (*Trans. Electrochem. Soc.*, 1931, 59, 337–348).—See this *J.*, 1931, 47, 290, and following abstract.—S. G.

**Discussion on Stout and Thummel's Paper on "The Change in Reflecting Power Caused by Tarnishing Electrodeposited Silver–Cadmium Alloys."** R. M. Burns. O. P. Watt. E. M. Wise. Colin G. Fink. E. M. Baker (*Trans. Electrochem. Soc.*, 1931, 59, 348–351).—Cf. preceding abstract. Artificial tarnishing tests with sodium polysulphide solution do not produce a film similar in character to that produced in ordinary atmospheric tarnishing, in which sulphur dioxide and not hydrogen sulphide seems to play the chief part. The colour of the tarnish produced on silver alloys is important, for while the public are used to the rich brown tarnish which forms on standard silver, objection is raised to the pale lilac-coloured tarnish which is formed on silver–zinc alloys. A protective "flash" of rhodium is suggested as a tarnish-resisting film; the reflecting power of rhodium-plated silver is 75–80% of that of freshly cleaned silver, whereas that of chromium-plated Stellite is only 65%. Rhodium plate is not quite so hard as chromium plate, but is more ductile and has less tendency to peel.—A. R. P.

**The Electrodeposition of Tungsten from Aqueous Solutions.** Colin G. Fink and Frank L. Jones (*Trans. Electrochem. Soc.*, 1931, 59, 461–481; and (abstract) *Chem. and Met. Eng.*, 1931, 38, 449).—See this *J.*, 1931, 47, 395, and following abstract.—S. G.

**Discussion on Fink and Jones' Paper on "The Electrodeposition of Tungsten from Aqueous Solutions."** O. P. Watts (*Trans. Electrochem. Soc.*, 1931, 59, 481).—Cf. preceding abstract. W. has obtained deposits of tungsten from solutions of tungsten compounds in methyl alcohol saturated with dry hydrogen chloride. The current efficiency is much less than 1%, and after 1 hr. the deposit ceases to thicken.—A. R. P.

**Procedure in Plating Rolled Zinc and Zinc Die-Castings.** Anon. (*Brass World*, 1931, 27, 239, and *Amer. Machinist (Eur. Edn.)*, 1931, 75, 723).—Reprinted from a chart issued by the New Jersey Zinc Co. Tabulates the procedure to be adopted in nickel- and chromium-plating zinc and zinc die-castings, with the precautions to be observed at each stage. Gives the composition of the plating and stripping solutions.—J. H. W.

**The Effect of Mercury in Zinc Cyanide Plating Solutions.** M. de Kay Thompson and W. E. Charles (*Met. Ind. (Lond.)*, 1931, 39, 399).—Abstract of a paper read before the American Electrochemical Society. See this *J.*, 1931, 47, 550.—J. H. W.

**The Limiting Current Density in the Electrodeposition of Noble Metals.** S. Glasstone (*Trans. Electrochem. Soc.*, 1931, 59, 277–284; discussion, 284–285).—See this *J.*, 1931, 47, 291.—S. G.

**Pickling Metals for Electroplating.** C. M. Hoff (*Metal Cleaning and Finishing*, 1931, 3, 561–564, 637–640).—See this *J.*, 1931, 47, 496.

—S. G.

**Simplified Methods for the Determination of Metals in Electroplating Baths.** Herbert Kurrein (*Metallwaren-Ind. u. Galvano-Tech.*, 1931, 29, 405–406).—The iodide method for copper and the cyanide method for silver are described.

—A. R. P.

## ELECTRO-REFINING

**Contributions to the Chemistry of Beryllium. III. Electrolysis of Solutions of Beryllium Compounds in Liquid Ammonia.** Harold Simmons Booth and Gilberta G. Torrey (*J. Physical Chem.*, 1931, **35**, 3111-3120).—Cf. *J.*, this volume, p. 50. Very pure metallic beryllium can be prepared by electrolysis of solutions of its compounds in liquid ammonia. The metal obtained is so pure that it can be dissolved only with difficulty in ordinary reagents, e.g. aqua regia. A special apparatus for electrolysis at the boiling point of ammonia solutions and for washing the deposited metal by liquid ammonia is described. The decomposition voltage of solutions of beryllium chloride in liquid ammonia is very approximately 3.6 v. The effect of different current densities on the nature of the deposited metal is described. Electrolysis of liquid ammonia solutions of beryllium nitrate dehydrated in fused ammonium nitrate and containing some of the latter gave coherent deposits of metallic beryllium. Even when the solution became viscous at room temperature by evaporation beryllium could still be deposited.—J. S. G. T.

**Copper Electrolysis at the Tin Works Wilhelmsburg G.m.b.H. at Harburg-Wilhelmsburg near Hamburg.** Georg Eger (*Siemens-Z.*, 1931, **11**, 537-541).—An illustrated description.—M. H.

**Electrothermic Zinc.** A. Walter (*Trans. Electrochem. Soc.*, 1931, **59**, 87-91).—See this *J.*, 1931, **47**, 163, and following abstract.—S. G.

**Discussion on A. Walter's Paper on "Electrothermic Zinc."** Robert Lepsoe. E. M. Baker. M. O. Sem. A. Walter (*Trans. Electrochem. Soc.*, 1931, **59**, 91-94).—Cf. preceding abstract. The discussion ranges round the size of a plant which can operate as a commercial success in competition with electrolytic zinc plants, and on the recoveries of zinc to be expected with varying grades of ore.—A. R. P.

## ELECTROCHEMISTRY—GENERAL

**The Electrochemical Industries of Sweden.** Wilh. Palmær (*Proc. World Eng. Congress, Tokyo, 1929*, 1931, **31**, 181-190).—See this *J.*, 1930, **43**, 608.  
—S. G.

**The Metals in Electrochemistry.** Louis Kahlenberg (*Trans. Electrochem. Soc.*, 1931, **59**, 29-34).—Presidential Address. An outline of the progress of electrochemistry with suggestions for future research.—A. R. P.

**The Relations between Hydrogen Overvoltage and Composition of Brass.** M. de Kay Thompson (*Trans. Electrochem. Soc.*, 1931, **59**, 115-119).—See this *J.*, 1931, **47**, 222.—S. G.

**Platinum in Electrochemistry.** K. Arndt (*Festschrift zum 50-jährigen Bestehen der Platinschmelze G. Siebert G.m.b.H. Hanau*, 1931, 1-11).—A brief account is given of the use of platinum in the electrochemical industry. With very high current densities both platinum anodes and cathodes are slowly pitted in 50% sulphuric acid, and frequently brown, red, or yellow patches of platinum trioxide may appear on the anode. "Technically pure" platinum is usually more resistant to attack than is the chemically pure metal. Photographs of corroded platinum electrodes are included.—A. R. P.

**Studies of Fully Organized Anodic Layers on Aluminium.** J. E. Lilienfeld, L. W. Appleton, W. M. Smith, and J. K. Nich (*Electrochem. Soc. Preprint*, 1932, Apr., 55-72).—Having in view the discrimination made by other authors between the materially demonstrable and often visible anodic layer and the one acting as the dielectric—the "active" layer—of the electrolytic condenser, experimental evidence is presented indicating that *essentially* both layers are identical. It is shown, on the one hand, how "pure active layers" can be produced, composed of nothing but the dielectric component, and, on the other

hand, that the indicated discrimination of former investigators is due to the inclusion in the "compound layers" used by them of essentially avoidable, non-dielectric components due to purely accidental features of their formation—features which, with the requisite knowledge, may easily be eliminated in the experiment. A systematic connection of the present work with the organization hypothesis that has been advanced in a previous paper (*Trans. Amer. Electrochem. Soc.*, 1930, 58, 225-274; see this *J.*, 1930, 44, 629, and 1931, 47, 397) is established. The hydratibility of different layers is discussed as one of their basic characteristics and a suggestion for their molecular structure is offered. The function of capacity versus formation voltage is found to correspond very closely with a rectangular hyperbolic relation, and this necessarily follows from our conception of the nature and stratified structure of the layer. Incidentally, the relation between the resistance of the electrolyte and the breakdown voltage is broadly outlined, and also the way in which the breakdown voltage is affected by changing the solvent of the electrolyte. An explanation of these facts is suggested.—S. G.

**Theory of Electrolytic Valve Action.** W. J. Müller (*Z. Physik*, 1931, 73, 560-564).—M. claims priority over Günther-Schulze and Betz for the electro-osmotic theory of valve action shown by a pair of electrodes, e.g. of aluminium or tantalum immersed in electrolyte. The action is attributed to the formation of a massive layer of oxide or hydroxide at the small electrode. —J. S. G. T.

**Electrolytic Solution Tension and the Consideration Necessary Therewith of the Galvanic Potential Metal/Metal in the [Discussion of the] Galvanic Circuit.** H. Hammerschmid and E. Lange (*Physikal. Z.*, 1931, 32, 958-964).—The theory of the galvanic circuit is discussed theoretically and the necessity of taking into account in any such discussion the occurrence of contact differences of potential between metal and metal is stressed.—J. S. G. T.

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## X.—INDUSTRIAL USES AND APPLICATIONS

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(Continued from pp. 50-52.)

**Bearing Metals.** Anon. (*Machinery (Lond.)*, 1930, 35, 671, 743-744).—The properties of the ordinary yellow bearing metals, viz., phosphor-bronze and binary copper-tin alloys, are summarized, and details of the analyses and mechanical properties of 6 alloys containing from 5 to 25% of lead are tabulated and discussed. The principal difficulty with these alloys is due to segregation of the lead, which may be prevented by addition of up to 1% of nickel. When added to phosphor-bronze, lead lowers the strength but increases the plasticity. Copper-tin-lead bronzes containing not less than 4% of tin are unsuitable for general use in bearings, and those with more than 5% of lead give satisfactory service only when constant lubrication can be maintained. Up to 4% of zinc has little effect. The copper-rich bearing bronzes are hard and abrasion-resisting, and are favoured for heavy loads and high speeds; lead-bronzes are usually not lined, but the phosphor-bronzes and gun-metal are usually lined with white metal. The specifications of the American Society for Testing Materials for the composition of 4 classes of bronze are tabulated. White bearing metals include tin-rich and lead-rich alloys; specimen analyses of 12 such alloys, and a table of mechanical properties, are given. Where conditions are not severe, zinc-base alloys have been used, although not extensively; they contain zinc 60-90, tin up to 20, and copper up to 10%. Alloys containing lead 96-98, and barium 2-4%, or calcium and barium, resemble the tin-base tin-antimony-copper alloys, and are said to have a very low coeff. of friction; the ease of oxidation, however, places them at a

disadvantage in ordinary foundry practice, but they may be produced by electrolysis of fused barium and/or calcium chloride over molten lead. Frary metal contains lead 97, barium 2, and calcium 1%.—H. F. G.

**Plain and Anti-Friction Bearings Discussed.** R. N. Austin (*Power House*, 1931, 25, (3), 56).—Split-sleeve cast iron and Babbitt bearings are on the whole preferable to ball or roller bearings for centrifugal pumps.—H. F. G.

**Copper Wire Laid in Babbitt on Bearing.** J. Ellithorn (*Power House*, 1931, 25, (9), 24).—The bearing on a large sewage pump persistently heated, with the result that the Babbitt metal melted. The difficulty was overcome by binding the shaft with  $\frac{1}{2}$  in. diam. copper wire in a spiral of  $\frac{1}{2}$  in. pitch. The Babbitt metal was then poured in the usual manner.—H. F. G.

**Uses of Aluminium and its Alloys.** Anon. (*Bull. tech. Suisse Romande*, 1930, 56, 147-148).—Casting and rolling practice, with appropriate precautions and modifications of these processes in special instances, are described for different industrial alloys in various sizes. Special stress is laid on prevention of shrinkage in the ingot, on the necessity for reheating ingots before rolling, and on the danger of too-vigorous reduction in rolling. Some mechanical properties of important industrial light alloys for a variety of purposes are summarized.—P. M. C. R.

**The Use of Aluminium in Electrotechnics.** H. Schmitt (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1931, 3, 253-260).—The advantages of the use of aluminium and its light alloys as material for overhead transmission cables and for electrical machines, motors, and apparatus are emphasized.—M. H.

**Aluminium for the Construction of Strong Current Condensers.** L. Lux (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1931, 3, 261-262).—M. H.

**Aluminium Castings in the Electrical Industry.** — Schaumann (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1931, 3, 284-292).—An illustrated article.—M. H.

**Influence of Corona Phenomena on Free Transmission Cables.** — von Zeeleder (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1931, 3, 267-269).—Free-transmission cables of aluminium and its alloys (e.g. Aldrey) behave against the corona-effect at least as satisfactorily as copper cables.

—M. H.

**Aluminium for Oil Tanks.** Anon. (*Met. Ind. (Lond.)*, 1931, 39, 489).—A short note. The corrosive action of concentrated brine solutions on aluminium tank plates under different operating conditions has been investigated by the U.S. Bureau of Mines (cf. Schmidt, Devine, and Wilhelm, this *J.*, 1931, 47, 556). It was found that natural gas and oil were without corrosive action, but that salt water was very corrosive. Sulphuretted hydrogen has no direct action, but has an indirect corrosive effect by producing iron sulphide in the steel delivery pipes, and this acts as an accelerator to the salt-water attack.

—J. H. W.

**Truck Tanks of Aluminium Eliminate Scale and Increase Pay-Load 24 Per Cent.** Anon. (*Automotive Ind.*, 1931, 64, 551).—Aluminium and light-alloy tanks for conveyance of gasoline, &c., are described; it is claimed that any extra initial cost is quickly compensated by the saving in load weight.

—P. M. C. R.

**Aluminium in Motor Cars.** Anon. (*Indust. Australian*, 1931, 86, 139).—A brief summary of the industrial applications of aluminium and its chief alloys, especially in regard to automobile work.—P. M. C. R.

**Cast Aluminium Lustre Features Buildings.** Anon. (*Canad. Mach.*, 1931, 42, (2), 41).—Sheet, drawn, and cast aluminium and its alloys find increasing use in architectural ornament, where paint, which needs constant renewal, fills up and obscures the finer detail. For castings, sharp definition is obtained with a 5% silicon alloy, which can be obtained with either bright or dull surface, and which shows great resistance to corrosion.—P. M. C. R.

**Aluminium Paint Suitable for Creosoted Wood.** Anon. (*Compressed Air Mag.*, 1931, 36, 3503).—Abstracted from *Wood Preserving News*. Aluminium paint was found to withstand a 2-years' exposure test on creosoted wood, whilst 3 standard paints—cellulose, lead-base, and zinc-base—showed discoloration within 60–90 days. The selection of vehicle and proportion of pigment are discussed.—P. M. C. R.

**Aluminium as a Fuel.** Anon. (*Indian and Eastern Eng.*, 1931, 68, 563–564).—The "Thermit" mixture has been produced in briquette form, and it is claimed that a temperature of about 2760° C. can be produced in a minimum of space by this means. The briquette is proof against explosion or shock, and can be lit with a specially prepared match. Possible applications are in soldering, welding, and melting metals, and in preheating the starters of some internal-combustion engines. An oxygen-aluminium powder burner, made by R. A. Baker and F. M. Strong, University of Syracuse, N.Y., is said to produce temperatures as high as 3400° C.—P. M. C. R.

**The Application of Cupal for Contact Purposes.** H. Schmitt and B. Wulff (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1931, 3, 262–265).—In continuation of earlier work (cf. this *J.*, 1931, 47, 293) the contact resistance of Cupal (i.e. copper-plated aluminium) as a function of the contact pressure has been determined. The results indicate that Cupal is well suited for many contact purposes, especially for those of a complicated nature, e.g. for transmission cables.—M. H.

**[Use of Alclad in] Metal-Clad Airships.** Anon. (*Mech. World*, 1931, 89, 528).—Editorial note on the American development of the metal-clad airship in which the gas is contained in a metal envelope, which is also the principal strength-member, thus dispensing with much of the complex framework such as is incorporated in the fabric-covered ship. The metal plating is Alclad, consisting of sheet Duralumin, coated on both sides with pure aluminium, the total thickness being 0.0095 in.—F. J.

**Tentative Specifications for Aluminium-Base Alloy Die-Castings (B 85-31 T).** — (*Amer. Soc. Test. Mat. Tentative Standards*, 1931, 151–153).—Cover die-castings die-cast from aluminium-base alloys. Seven alloy compositions are specified, designated alloys Nos. IV–IX, inclusive, and XII. The alloys shall conform to the limits specified below.

Alloy No.	Desired Composition. %				Permissible Variations in Alloying Elements. %				Other Elements. Max. %.					
	Copper.	Silicon.	Nickel.	Aluminium.	Copper.	Silicon.	Nickel.	Aluminium.	Iron.	Zinc.	Manganese.	Magnesium.	Tin.	Total of last four.
IV	...	5	...	95	0.6 max.	4.5–6.0	0.5 max.	balance	2.0	0.75	0.3	0.1	0.1	0.2
V	...	12	...	88	0.6 max.	11–13	0.5 max.	"	2.0	0.75	0.3	0.1	0.1	0.2
VI	2	3	...	95	1.5–2.5	2.5–3.5	0.5 max.	"	2.5	0.75	0.3	0.1	0.1	0.2
VII	4	5	...	91	3.5–4.5	4.5–5.5	0.5 max.	"	2.25	0.75	0.3	0.1	0.1	0.2
VIII	1.5	1	2.25	95.25	1–2	0.75–2	1.75–2.5	"	2.5	0.75	0.3	0.1	0.1	0.2
IX	4	1.75	4	90.25	3.5–4.5	1.0–2.5	3.5–4.5	"	2.5	0.75	0.3	0.1	0.1	0.2
XII	8	1.5	...	90.50	7.0–9.0	1.0–2.0	0.5 max.	"	2.5	1.0	0.3	0.1	0.2	0.5

It is understood that iron contributes to the hardness of all these alloys. Whilst the use of steel or iron containers for the commercial manufacture of die-castings unavoidably introduces some of this element into the alloy, it shall not exceed the % specified above. Manganese and nickel up to the limits specified are not regarded as harmful elements in these alloys. In an Appendix (which does not constitute a part of the specification) the following data of physical properties are given as an indication to the purchaser of what may be expected of tension and impact test-specimens when made in a die, the test specimens being cast in regular production routine and conforming to the chemical composition specified. The figures represent die-cast specimens and not specimens cut from commercial die-cast parts. Rockwell hardness values are not given, as they are considered to be too unreliable on die-castings :

Alloy No.	Tension Tests on Round Specimens.		Charpy Impact on Square Specimens. Ft.-lb.
	Tensile Strength. Lb./in. <sup>2</sup> .	Elongation. % on 2 in.	
IV . . .	29,000	3.5	4.5
V . . .	33,000	1.5	2.0
VI . . .	30,000	3.5	5.0
VII . . .	32,000	2.0	2.5
VIII . . .	29,000	4.0	4.5
IX . . .	31,000	1.5	2.0
XII . . .	33,000	1.0	1.5

—S. G.

**Cast Aluminium Alloys in the Construction of Aeronautical Motors.** C. Panseri (*Fonderie mod.*, 1931, 25, 427).—Abstract of a paper presented to the 6e. Congrès Internationale de Fonderie. Describes the applications of cast aluminium alloys in the construction of motors for aeroplanes.—J. H. W.

**Diatherm Pistons.** Anon. (*Mech. World*, 1931, 90, 88).—Cf. Maybrey, this J., 1931, 47, 591. The inventor, Raymond de Fleury, of the diatherm piston for internal-combustion engines, claims that it solves the problem of excessive clearance necessitated by the high coeff. of thermal expansion of aluminium, by the application of a formula to determine the logical shape of the piston. The alloy used, the composition of which is not disclosed, has a sp. gr. of 2.60.

—F. J.

**The Electric Locomotives of the Viège-Zermatt Railway.** Ad.-M. Hug (*Bull. tech. Suisse Romande*, 1929, 55, 309-313).—Aluminium and the light alloys Anticorodal and Alufont are extensively used in the construction of new electric railway engines, thus effecting great saving in weight. Anticorodal is used for sheet and angles, and Alufont as castings. The mechanical properties of these materials in varying conditions of hardness are tabulated.

—P. M. C. R.

**Aluminium in the Construction of Furniture.**—I. N. Minaur (*Indian and Eastern Eng.*, 1931, 69, 296-298).—The use of light alloys in furniture construction has steadily increased since its adoption in France. The material is light, strong, clean, durable, and incombustible, and the alloys Duralumin and Anticorodal (the American 51 S, containing small percentages of magnesium and silica) are easily and simply worked. Heat-treated sheet, tubes, and shapes are die-formed, welded together, again heat-treated, and finished by sand-blasting and enamelling or anodic oxidation. Light alloy furniture is recommended for marine, office, and hotel use, and especially for colonial service.—P. M. C. R.



**A Stellite Pick.** Anon. (*Indust. Gases*, 1931, 12, 155).—Description and photographs of a pick, on the point of which Stellite has been deposited by means of the oxy-acetylene blowpipe.—H. W. G. H.

**Hard Facing in Tank Shop.** Louis Perona (*Welding Eng.*, 1931, 16, (10), 28-29).—Dies are made from ordinary plate steel and surfaced with Stellite.—H. W. G. H.

**Copper Tubes for Installation Work.** E. T. Richards (*Demizet*, 1931, 47, 723-724).—Copper tubes have increasing application in installation work, particularly as water pipes, and have the advantage over lead pipes of being both much stronger and lighter. A lead pipe can withstand only  $\frac{1}{3}$ th the water pressure of a copper pipe with  $\frac{1}{3}$ th the wall thickness. The bending coeffs. of iron, lead, and copper are 1.06, 0.94, and 0.86, respectively. The solubility of copper in still water is 0.14 part per 100,000 parts in 24 hrs.

—J. H. W.

**Tentative Specifications for Insulated Wire and Cable: 30 per Cent. Hevea Rubber (D 27-31 T).** — (*Amer. Soc. Test. Mat. Tentative Standards*, 1931, 744-761).—Cover conductors, rubber insulation, cable tape, cotton braid, and lead sheaths. The design and factor of safety depend on the service conditions and shall be at the option of the purchaser. The conductor shall be of soft annealed copper, properly tinned. Each individual wire of a stranded conductor shall be considered separately and shall be designated as a strand. Each solid conductor and each strand shall be round and reasonably free from imperfections. The stranding shall conform to the requirements set out in a table, and shall be either standard concentric or flexible as specified in the order. For the purpose of calculating weights, cross-sections, &c., in conductivity determinations, the density of the copper shall be taken as 8.89 gm./cm.<sup>3</sup>. The permissible variations in dimensions are set forth. *Physical properties and tests:* Each solid conductor and each strand previous to stranding shall be so drawn and annealed that after tinning it shall conform to the following values:

Size of Conductor.		Maximum Tensile Strength. Lb./in. <sup>2</sup> .	Minimum Elongation on 10 in. %.
Diam., in.	A.w.g. Number.		
0.460-0.290	000-1	36,000	30
0.289-0.103	2-10	37,000	25
0.102-0.021	12-24	38,500	20
0.020-0.012	25-28	39,000	15
0.011-0.003	29-40	40,000	10

After stranding, the tensile strength of each strand shall not exceed that specified above by more than 5%, and the minimum elongation on 10 in. shall not be less than that specified above by more than 5%. The conductivity of the conductors after tinning shall not be less than the following:

Diam., in.	A.w.g. Number.	Conductivity. %.
0.460-0.290	0000-1	97.65
0.289-0.103	2-10	97.15
0.102-0.021	12-24	96.15
0.020-0.012	25-28	94.15
0.011-0.003	29-40	93.15

The continuity of the tin coating of each sample before stranding or insulating shall be determined by the sodium polysulphide test, which shall be made in accordance with the requirements of Sections 4-10 (incl.) of the "Standard Specifications for Tinned Soft or Annealed Copper Wire for Rubber Insulation" (B 33). *Lead sheaths*: Lead sheaths shall consist of commercially pure lead (approx. 99.85%) without flaws and tightly formed about the taped core of the cable. The required thicknesses of cable sheath are set out in a table.

—S. G.

**Renewable Valve Seats Cut Maintenance Costs by Eliminating Necessity for Periodic Re-grinding.** P. M. Heldt (*Automotive Ind.*, 1931, 65, 794-796).—H. recommends the use of inserts to combat the increased wear and erosion on valve-seats in modern commercial vehicles. The method of insertion is shown diagrammatically. The material of an insert must have approximately the same coeff. of expansion as that of the block; it must show neither corrosion nor softening at high temperatures. Materials in favour are aluminium-bronze for light alloy pistons, and Stellite, tungsten-chrome-vanadium steel, or a high-speed tungsten alloy for engines intended for heavy duty.

—P. M. C. R.

**Tooth Gearing.** W. Clough (*Mech. World*, 1931, 89, 586-588).—Various forms of machine-cut gears are described, together with appropriate data and formulæ. In worm-gearing, the worm is preferably made in phosphor-bronze and the wheels in hardened steel.—F. J.

**Domestic Water Pipe—German Practice: Lead, Tin-Lined Lead, and Copper.** Anon. (*Deut. Installateur- u. Klempner-Z.*, 1931, (40), Oct. 7; *Bull. B.N.F.M.R.A.*, 1931, (38), 13).—Discusses the behaviour in service of lead, of lead lined internally with tin, and of copper piping. Stress is laid on the use of the last-named.—S. G.

**Use of Elektron Metal Spreads Rapidly in Europe.** Paul Fidrmuc (*Canad. Mach.*, 1931, 42, (11), 25).—Elektron is much used in aero work, on account of its low sp. gr., and is produced as castings, or rolled or extruded. Its rate of oxidation is less than that of steel, and paint gives perfect protection. Inflammability becomes a danger if turnings are allowed to accumulate and if old or dull tools are employed; water cannot be used to extinguish Elektron fires. A list is appended of articles made from Elektron now in regular use.

—P. M. C. R.

**Tentative Specifications for Magnesium Alloy Castings (B 80-31 T).** — (*Amer. Soc. Test. Mat. Tentative Standards*, 1931, 128-130).—Cover commercial magnesium-base alloy sand-castings having a sp. gr. of 1.9 or less. Three typical alloys are specified and are designated Alloys Nos. 1, 2, and 3. The alloy may be made from virgin metal or from purified scrap metal of known composition. Castings made from alloy No. 2 may be subjected to such heat-treatment as the manufacturer desires to produce material that will conform to the requirements specified. Heat-treatment shall be performed on the whole casting, never on a part only, and shall be applied in a manner that will produce the utmost uniformity. The alloys shall conform to the following requirements as to chemical composition:

Alloy.	Magnesium. %.	Aluminium. %.	Manganese Minimum. %.	Copper. %.	Cadmium. %.	Other Impurities Maximum. %.
No. 1.	remainder	5.5-7.0	0.2	0.1 max.	...	0.3
No. 2.	remainder	6.5-8.5	0.2	0.1 max.	...	0.3
No. 3.	remainder	1.7-2.3	0.2	3.5-4.5	1.6-2.4	0.3

The sample for chemical analysis may be taken by sawing, drilling, or milling the casting or tension test-specimen, and shall represent the average cross-section of the piece. The saw, drill, cutter, or other tool shall be thoroughly cleaned. No lubricant shall be used in the sampling operation. The castings shall conform to the following requirements as to tensile properties :

Alloy.	Condition.	Tensile Strength, Minimum. Lb./in. <sup>2</sup> .	Elongation on 2 in. Minimum. %.
No. 1.	Sand-cast.	24,000	4
No. 2.	{ Sand-cast.	24,000	4
	{ Sand-cast, heat-treated.	29,000	6
No. 3.	Sand-cast.	21,000	2

The test-bars shall be separately cast in green-sand and shall be "cast to size" according to the dimensions shown in an illustration. They shall not be machined prior to test except to adapt the grips to the holders of the testing machine in such a manner as to ensure an axial load. The tests shall, so far as possible, be made by heats or melts, but unless otherwise agreed upon, two tension tests shall be made for each unit of 500 lb. or fraction thereof. If any test-specimen shows defective machining or develops flaws, it may be discarded; in which case the manufacturer and the purchaser, or his representative, shall agree upon the selection of another specimen in its stead.—S. G.

**A Revolution in the Domain of Electrotechnics [Mercury Vapour Transformer].** Anon. (*Bull. tech. Suisse Romande*, 1931, 57, 306-307).—The principle and working of the polarized grid mercury vapour transformer, lately introduced by the Brown Boveri Co., are described, and its applications are enumerated.—P. M. C. R.

**Nickel Alloys in Automotive Manufacture.** Thomas H. Wickenden (*J. Soc. Automotive Eng.*, 1931, 29, 328-330).—Nickel is used in the automotive industry in a variety of forms, the principal ones being as an alloy with steel and cast iron and in nickel plating, sparking-plug wires, Monel metal, and in aluminium alloys. W. deals chiefly with the use of nickel in cast iron and special steels.—W. P. R.

**Tentative Specifications for Drawn or Rolled Alloy, 80 per Cent. Nickel, 20 per Cent. Chromium, for Electrical Heating Elements (B 82-31 T).** — (*Amer. Soc. Test. Mat. Tentative Standards*, 1931, 143-146).—Cover annealed, drawn, or rolled shapes for electrical heating element purposes having a nominal chemical composition of nickel 80 and chromium 20%. The material shall conform to the following requirements as to chemical composition :

	Per cent.
Nickel *	77-79
Chromium	19-20
Iron, max.	1.5
Manganese, max.	2.5
Carbon, max.	0.25
Silicon, max.	0.40
Sulphur, max.	0.03

\* Small quantities of cobalt included shall be reported as nickel.

—S. G.

**Tentative Specifications for Drawn or Rolled Alloy, 60 per Cent. Nickel, 15 per Cent. Chromium, and Balance Iron for Electrical Heating Elements (B 83-31 T).** — (*Amer. Soc. Test. Mat. Tentative Standards*, 1931, 147-

150).—Covers annealed, drawn, or rolled shapes for electrical heating element purposes having a nominal chemical composition of nickel 60% chromium 15%, and the balance iron. Wire and ribbon shall be thoroughly and uniformly annealed. The material shall conform to the following requirements as to chemical composition:

	Per cent.
Nickel,* min. . . . .	57
Chromium . . . . .	14-18
Iron . . . . .	balance
Manganese, max. . . . .	3
Silicon, max. . . . .	0.40
Carbon, max. . . . .	0.25
Sulphur, max. . . . .	0.03

\* Small quantities of cobalt included shall be reported as nickel.

—S. G.

[Use of Non-Ferrous Metals for] Nitriding Containers. J. W. Harsch and J. Muller (*Metal Progress*, 1931, 20, (6), 41-44).—Low carbon steel and heat-resisting chromium iron and "18-8" alloys are unsuitable for the nitriding process; embrittlement is rapid in the appropriate temperature range (480°-630° C.). The depth and hardness of the nitride case are influenced by the container, the material of which itself reacts, increasing ammonia dissociation and wasting gas. Both with ammonia and with atomic nitrogen, containers of Monel metal, of Nichrome, and of inert material such as silica gave the most satisfactory results and showed the longest life, although the presence of more than 0.5% manganese in the Monel metal caused porosity and fairly rapid deterioration. The effect of nitriding gases on welded joints and on enamelled containers is considered.—P. M. C. R.

Konel—a Substitute for Platinum. Anon. (*Engineers and Engineering*, 1931, 48, vi-vii).—Konel is superior to platinum for use in radio filament cores. Its makers claim longer life and greatly improved emission; also an ultimate tensile strength of nearly 27 tons/in.<sup>2</sup> at 600° C., high electrical resistance, absence of scale, and low corrodibility. Many industrial applications are suggested.—P. M. C. R.

The Increase in Superheated Steam Temperature. Anon. (*Indian Eng.*, 1931, 89, 415).—The Detroit Edison Co. have installed a 10,000-kw. turbo-generator to operate at 365 lb. pressure and 1000° F. (353° C.) superheated steam. Special improvements in valve and turbine construction are demanded by these conditions. The alloy Platnam, having a coeff. of expansion almost equal to that of steel, together with great hardness, close grain, and good corrosion resistance, is selected for valve seatings. Valves of various types are illustrated.—P. M. C. R.

Platinum as a World Historical Factor. Wilhelm Ostwald and Eberhard Brauer (*Festschrift zum 50-jährigen Bestehen der Platinschmelze G. Siebert G.m.b.H. Hanau*, 1931, 240-256).—The part played by platinum catalysts in the development of the synthetic nitrate industry is discussed.—A. R. P.

Some Uses of Tin in Modern Industry. F. C. Thompson (*Tin*, 1931, Sept., 6-8).—Tin has considerable application in dentistry in many forms, such as foil, type metal, Britannia metal, fusible alloy, Mellotte's alloy, silver alloys containing silver 67, tin 28, copper up to 4, and zinc up to 1% for amalgams, and casting alloys containing gold, silver, or bismuth.—J. H. W.

Making an Electric Lamp. Anon. (*Indian and Eastern Eng.*, 1931, 68, 704-708).—A detailed description is given of the manufacture of electric lamps at the works of the Edison Swan Electric Co.—P. M. C. R.

Tentative Specifications for Zinc-Base Alloy Die-Castings (B 86-31 T). — (*Amer. Soc. Test. Mat. Tentative Standards*, 1931, 154-156).—The alloys may be made by any approved method. The casting shall be of uniform quality,

and no scrap shall be used other than sprues, gates, rejected castings, &c., of this alloy which are produced in the manufacturer's own plant. The rejected castings used shall be free from finishes, solder, or inserts which may contaminate the alloy. The base metal for all alloys shall be slab zinc conforming to the requirements of "Standard Specifications for Slab Zinc (Spelter)" (No. B 6), except that the total impurities, including lead, iron, tin, and cadmium, shall not exceed 0.02%. The alloy shall conform to the following:

	Per cent.
Copper . . . . .	2.5-3.5
Aluminium . . . . .	3.5-4.5
Magnesium . . . . .	0.02-0.12
Iron, max. . . . .	0.1
Lead, max. . . . .	0.010
Cadmium, max. . . . .	0.005
Tin, max. . . . .	0.005
Total other impurities . . . . .	0.02
Zinc . . . . .	remainder

The average expansion of any 5 or more castings when aged shall not exceed 0.0025 in. per inch. An expansion of 0.0025 in. will be allowable in any dimension less than 1 in. Requirements as to physical properties, as determined by tension or impact test-specimens, are set forth, but these need not be complied with unless specially specified in the order.—S. G.

**New Alloys for Marine Engineering.** S. L. Archbutt (*Indian Eng.*, 1930, 88, (1), 15).—Abridged from *Trans. Inst. Marine Eng.*, 1930, 42, 295-346; see this *J.*, 1930, 44, 657.—P. M. C. R.

**Model Railroad Trains Need Many Modern Alloys.** Anon. (*Metal Progress*, 1931, 20, (6), 37-40).—The model toy industry makes extensive use of high-quality material. Die-castings in light alloys and zinc, brass stampings and wire, nickel-brass, stainless steel, copper pipes, and phosphor-bronze springs are found to give satisfactory service, and take a high finish.—P. M. C. R.

**Compression Fittings.** Anon. (*Chem. and Met. Eng.*, 1931, 38, 301).—The Dieform metal-to-metal compression coupling for small industrial and power-plant pipe lines as made by the Bailey Meter Company (U.S.A.) is illustrated. Fittings are available in brass, Monel metal, and steel for pressures as high as 2000 lb.—F. J.

**Homogeneous Metal Linings.** Anon. (*Chem. and Met. Eng.*, 1931, 38, 419).—Various metals may be homogeneously bonded to steel, cast iron, brass, bronze, copper, and other metals by means of a new process recently designed by Francis R. Glenner, of the Homogeneous Equipment Company (U.S.A.). The method is used for lining autoclaves, kettles, tanks, tubing, and other equipment with lead, tin, aluminium, bronze, copper, or nickel. The adhesion depends on "molecular fusion" of the metals and is capable of withstanding vacuum, vibration, and mechanical and thermal shocks.

—F. J.

**Modern Blacksmithing.** John G. Mapes (*Metal Progress*, 1931, 20, (6), 84-88).—M. describes a modern decorative metal plant. Monel metal, aluminium, stainless steel, brass, bronze, and copper are extensively used. Storage, forging, annealing, welding, and finishing methods are described.

—P. M. C. R.

**Possibilities of Powdered Metals.** Anon. (*Compressed Air Mag.*, 1931, 36, 3659).—The increased demand for porous metal bearings and the wide application of the spraying process have led to a greatly extended use of pulverized metals and alloys, notably copper, nickel, tin, cobalt, Permalloy, and silver.

—P. M. C. R.

## XI.—HEAT-TREATMENT

(Continued from p. 53.)

**Heat-Treating and Forging Some Light Alloys.** W. C. Devereux (*Metalurgia*, 1931, 5, 45-50).—*Résumé* of a paper read before Manchester Metallurgical Society. The heat-treatment and forging of Duralumin, "Y" alloys, and Hiduminium R.R. alloys is discussed. Tables are given showing the composition of the alloys, the heat-treatment, both solution and precipitation, applied to the alloys, and the effect of such treatment on the physical properties, strength, hardness, and fatigue. The influence of crystal size on the physical properties of extruded bars is also considered, and it is shown that the proof stress and elastic limit decrease with increase in crystal size. The influence of crystal growth on the fatigue value is also dealt with, and it is found that extruded bar of perfect structure has a fatigue value of  $\pm 5$  tons/in.<sup>2</sup> lower than that of forged bar. Consideration is also given to the influence of overheating on bars and a method of testing for overheating by means of a twist test is described.—J. W. D.

**The Time-Law Relating to the Annealing of Worked (Hammered) Metals.** F. Sauerwald and W. Scholz (*Z. Physik*, 1931, 73, 511-525).—Cf. *J.*, this volume, p. 6. The hardening of aluminium, copper, and iron by hammering and the course of the isothermal annealing of these metals in the region of about 300° C. in the case of the first two and about 550° C. in the case of the last metal are investigated. The results suggest the existence of an induction period in the annealing of copper. The effect of recrystallization is briefly discussed.—J. S. G. T.

## XII.—JOINING

(Continued from pp. 53-55.)

**Joints in Heavy Electrical Conductors.** W. E. Warner (*Power House*, 1931, 25, (2), 40).—Before making joints between copper bus-bars the two surfaces should be ground flat with an emery wheel or by draw filing.—H. F. G.

**Braze in Atmospheres of Gas in Electrical Furnaces.** Anon. (*Canad. Mach.*, 1928, 39, (20), 38-40).—An atmosphere of hydrogen facilitates the process of copper-brazing by preventing oxidation and reducing oxides already present: fluid copper diffuses easily and gives good penetration. The operation consists of 3 steps—assembly, heating, and cooling. Automatic handling arrangements, and movable hoods for the heating and cooling stages, make it possible for all three processes to be performed simultaneously. Cooling must proceed in a reducing atmosphere. The principle is also applied to bright-annealing.—P. M. C. R.

**On the Soldering of Hard Metals (Widia).** C. Agte and K. Schröter (*Werkstattstechnik*, 1931, 25, 373-374).—Soldering tests with silver solder, "Porö" bronze, and Constantan have been made in a hydrogen atmosphere, in a charcoal fire, in a muffle, in a coal gas atmosphere, before a blast burner, and in a Cekas furnace. The best and strongest joint between the Widia tip and steel shank was obtained by the use of silver solder in a reducing atmosphere using the minimum welding temperature. Welds made before the blowpipe and in the air damaged the surface of the tip, and re-grinding was necessary.

—A. R. P.

**Some Practical Notes on Solders and Soldering Fluxes.** A. Eyles (*Met. Ind. (Lond.)*, 1932, 40, 3-6).—The requirements of a good solder, the distinction between hard and soft solders, the use of bismuth and antimony in solders, and the difficulties of making solder from materials the chemical

composition of which is not accurately known are discussed. Soldering tools, brazing metals, the effects of impurities, and the operations of soldering and brazing by blowpipe, dip, and electric methods are described. A table is given showing the flux to be used and the composition of solders recommended in the case of 20 metals and alloys.—J. H. W.

**Soft Solders and Their Application.** G. O. Hiers (*Metals and Alloys*, 1931, 2, 257-261, 277).—A review of recent work on methods of soldering, the use of fluxes, and the mechanical properties of soldered joints. The article contains a bibliography with 47 references.—A. R. P.

**Silver Solders in Engineering Construction.** Ernest A. Smith (*Met. Ind.* (Lond.), 1931, 39, 531-534, 567-568).—Summary of an address to the Sheffield Local Section of the Institute of Metals. The constitution, classification, and compositions of alloys in the ternary system silver-copper-zinc are given. British specifications are: Grade A, silver 60-62, copper 27.5-29.5, zinc 9-11%; Grade B, silver 42.4, copper 36-38, zinc 18.5-20.5%. The effects of impurities are important. Lead and iron are injurious, the latter hardening the alloy. Cadmium raises the melting point slightly, but tends to confer greater ductility. Tin lowers the melting point, but more than small quantities make for brittleness. The tensile strength of the alloys is 41,800-64,300 lb./in.<sup>2</sup> and the elongation 5.3-25% on a 2-in. gauge-length. The characteristics of silver solders and their resistance to corrosion are described, and details of their use with copper, brass, and bronze, nickel and nickel alloys, and "aluminium-bronze" are briefly considered.—J. H. W.

**How to Silver Solder Metal Parts.** Anon. (*Indust. Gases*, 1930, 11, 13-14).—Silver soldering by the oxy-acetylene flame is used for many metals other than silver. Borax is used as flux and joints are obtained having great resistance to vibration and shock. The low melting point of silver solder makes it useful for light brass and bronze articles; its resistance to corrosion is sufficient to permit its use in fabricated chemical engineering vessels of nickel, Monel metal, or copper; its high electrical conductivity explains its wide use for electrical connections.—H. W. G. H.

**Notes on Silver Soldering.** W. E. Warner (*Canad. Mach.*, 1931, 42, (11), 23).—Contains no fresh information.—P. M. C. R.

**Oxy-Acetylene Silver Soldering in Craft-Work.** Anon. (*Indust. Gases*, 1930, 11, 15-16).—H. W. G. H.

**The Gas-Fusion Welding of Aluminium.** Anon. (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1931, 3, 140-141).—Practical hints.—M. H.

**Aluminium Welding.** Anon. (*Power House*, 1931, 25, (2), 57).—Oxy-acetylene welding is the most suitable for aluminium. A small quantity only of flux should be used, preferably as a varnish on the welding rod. For welding the stronger aluminium alloys rods containing 5% of silicon are advantageous.—H. F. G.

**Oxy-Acetylene Welded Aluminium Products.** Anon. (*Indust. Gases*, 1931, 12, 24-30).—Reprinted from *Oxy-Acetylene Tips*, 1931, 10, 27-34. See this *J.*, 1931, 47, 296.—H. W. G. H.

**Welding Sheet Aluminium.** Anon. (*Indust. Gases*, 1930, 11, 226).—Reprinted from *Oxy-Acetylene Tips*, 1930, 9, 43. Elementary hints and an illustration of some welded pipes.—H. W. G. H.

**Resistance Welding of Aluminium and its Alloys.** Anon. (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1931, 3, 148).—The different methods of electrical resistance welding (point-welding, seam-welding, and butt-welding) are briefly described.—M. H.

**Welded Aluminium in Chemical and Process Industries.** W. M. Dunlap (*Mech. and Welding Eng.*, 1930, 4, 137-140).—The corrosion-resisting and strength properties of aluminium welds are discussed. Hammering reduces the differences in solution potential between the weld metal and the adjacent

sheet. Pure aluminium specimens welded with pure wire and with 5% silicon alloy wire show no appreciable difference in resistance to corrosion by salt spray. Undressed welds in annealed sheet and tube have greater strength than the original material.—H. W. G. H.

**Best Aluminium Airplane Tanks Ox-welded.** Anon. (*Canad. Mach.*, 1928, 39, (24), 51-52).—Different types and positions of wing and fuselage tanks are described, with some details of their construction from aluminium sheet, and some peculiarities of aluminium welding are pointed out. The welding of baffle-plates is also described. Material thus prepared has successfully withstood serious accidents to the machine without failure.—P. M. C. R.

**The Welding of Duralumin.** Anon. (*Indust. Gases*, 1930, 11, 40-41).—Unless the complete article can be heat-treated, Duralumin can only be welded to give a weak joint which is susceptible to corrosion. The use of a 5% silicon-aluminium wire is recommended in order to compensate for the extraordinary contraction in the Duralumin.—H. W. G. H.

**The Oxy-Acetylene Welding of Locomotive Copper Tube Plates and Fire Boxes.** M. A. Boutté (*Mech. and Welding Eng.*, 1931, 5, 196-203).—A description is given of the process developed by the Technical Division of the French Autogenous Welding Society for repairing cracked copper plates and fireboxes for locomotives. Rods, 6 mm. in diam., of high-grade copper, containing, if necessary, a little phosphorus, are used. Two welders are necessary, one executing the weld and the other supplying additional heat from the opposite side. No flux is considered necessary, and no trouble is experienced from oxide in the copper, the large mass of the plate slowing the cooling sufficiently to allow the cuprous oxide eutectic to be re-transformed into free cuprous oxide. No mention is made of any blowhole formation. The welds are hammered hot.—H. W. G. H.

**Ox-Welding Brass and Copper Piping.** Anon. (*Indust. Gases*, 1931, 12, 99-101; and (abstract) *Welding Eng.*, 1931, 16, 39-40).—Reprinted from *Oxy-Acetylene Tips*, 1931, 10, 99-102. See this *J.*, 1931, 47, 597.

—H. W. G. H.

**A Résumé of Copper Welding.** J. D. Millar (*Mech. and Welding Eng.*, 1931, 5, 122-123).—A brief description of copper welding practice.

—H. W. G. H.

**Review of Copper Welding.** Anon. (*Indust. Gases*, 1930, 11, 225).—Explains the difficulties due to cuprous oxide and the advantages of deoxidized copper.—H. W. G. H.

**Copper Welding.** Anon. (*Indust. Gases*, 1931, 12, 34).—Illustrates three copper bottoms for boiling pans—for varnish, chocolate, and acetic acid. Each has been repaired by oxy-acetylene welding.—H. W. G. H.

**Copper Welding.** Anon. (*Mech. and Welding Eng.*, 1930, 4, 274).—Deoxidized copper is recommended and the filler rod should contain deoxidizer. Welds should be hammered hot.—H. W. G. H.

**Large Welded Everdur Vessels.** M. Powell and J. T. Hook (*J. Amer. Welding Soc.*, 1931, 10, (9), 39-47).—Everdur is an alloy containing 96% copper, 3% manganese, and 1% silicon, which is highly resistant to corrosion and is therefore used in the manufacture of chemical apparatus, boiler tubes, and large boilers. The alloy is readily autogenously or electrically welded, and the joints are characterized by high strength and ductility; they may be hardened by annealing with an oxy-acetylene flame. The building up of large high-pressure boilers with welded seams is discussed in detail.—A. R. P.

**Some Notes on P.M.G. Metal.** Anon. (*Indust. Gases*, 1930, 11, 221-222).—A description of the general properties and table of mechanical tests on cast and forged alloys with various amounts of hardener. P.M.G. metal is said to be easily weldable by the oxy-acetylene process, using an oxidizing flame and a mixture of borax and sodium carbonate as flux.—H. W. G. H.



**Autogenous Welding of Lead and its Alloys—Ancient and Modern.** E. B. Partington (*Welding J.*, 1931, 28, 304-310).—Read before the Institution of Welding Engineers. The history of lead and the joining of lead parts by fusion are traced from early times. The modern method of oxy-acetylene welding is shown in application to chemical plant fabrication and repairs, homogeneous coating of iron, and in the electrical trades. Brief mention is made of the British Non-Ferrous Metals Research Association ternary alloys.

—H. W. G. H.

**Lead Burning on the New Singer Building in London.** Anon. (*Indust. Gases*, 1930, 11, 10-12).—A description, with photographs of the construction of the dome for the new Singer building in City Road, London, E.C.—H. W. G. H.

**Lead Welding.** A. Eyles (*Canad. Mach.*, 1931, 42, (3), 56, 58).—Reprinted from an article by A. Eyles in *Mech. World*, 1930, 88, 345. See this *J.*, 1931, 47, 113.—P. M. C. R.

**To do Good Welding on Monel Metal.** W. E. Warner (*Canad. Mach.*, 1931, 42, (25), 39).—Directions are given for the application of oxy-acetylene, metallic arc, and spot welding to Monel metal.—P. M. C. R.

**Welding Monel Metal by the Oxy-Acetylene Process.** Anon. (*Welding and Mech. Eng.*, 1929, 3, 410).—Reprinted from *Power*, 1929, 69, 1063. See this *J.*, 1931, 47, 597.—H. W. G. H.

**Welding of Stainless and Corrosion-Resistant Alloys.** W. B. Millar (*Metal Progress*, 1931, 20, (6), 68-72).—Directions and precautions are given for welding high- and low-carbon stainless steel, ferritic chromium-iron, chromium-nickel iron, high chrome-nickel, and "heat-resisting" chromium alloys. Special attention is paid to preheating, to support, to the question of flux and slag, and to annealing and cooling conditions.—P. M. C. R.

**How to Repair Rivet Heater Electrodes by Bronze Welding.** Anon. (*Indust. Gases*, 1930, 11, 21-22).—H. W. G. H.

**Bronze Welding Progress.** De W. Endicott (*Canad. Mach.*, 1931, 42, (5), 46-52).—Bronze welding is distinguished from brazing, of which it is a later development, in that the bronze, supplied as welding rod, is melted by the oxy-acetylene flame at the same time as the base material is heated by it. Detailed adaptations of the process are given for cast, malleable, wrought, and galvanized iron, steel, copper, brass, and bronze. It is claimed that the welds are comparable in strength and reliability with good fusion welds. The process can be applied to materials of higher melting point than bronze, to bronze itself, and to building up worn surfaces.—P. M. C. R.

**Progress in Welding.—I.—II.** Joseph J. Cave (*Canad. Mach.*, 1930, 41, (9), 56-58; (11), 60-66).—(I.)—Doubt as to the practical results obtainable by welding is ascribed to the lack of standard qualifications for the operation, of a practical non-destructive means of testing welds, and of concerted action on welding design. The principal methods of welding are described and their especial applications indicated; the processes dealt with are autogenous welding, spot and resistance welding, flash-resistance welding, and arc welding with the straight carbon arc, by the atomic hydrogen-arc process, by the shielded arc, and by the "metallic arc." (II.)—C. emphasizes the importance of careful and intelligible design and of the human element. The questions of voltage and electrode size, their influence on tensile strength, of heat absorption, arc length, stability of arc, and magnetic disturbance are discussed. Graphic methods of recording work are reproduced. Cables and ground connections are often carelessly kept and their material is of poor quality; it is more economical to face a greater initial outlay and obtain longer and more reliable service.—P. M. C. R.

**Autogenous Welding and Cutting.** Anon. (*Mech. World*, 1931, 90, 36-37, 51-53).—Autogenous welding, in which the surfaces of the metals to be united are melted (either with or without the addition of filling material), is applicable

to a much wider range of metals than is forge-welding, which is restricted to those metals assuming a plastic state when heated. Heat may be obtained by the use of electricity or of a gas flame giving intense heat. Electric-arc welding of different kinds, the quasi-arc process, metal-cutting, resistance welding (butt and spot welds and welding machines), oxy-acetylene welding, including high- and low-pressure methods, and oxygen metal-cutting are described.—F. J.

**Welding: Conditions for Successful Work.** Anon. (*Indian Railway Gaz.*, 1931, 30, 154-155).—Common metals and alloys are enumerated and described, with brief comments on their respective welding properties.—P. M. C. R.

**Welding Inspection.** R. Kraus (*Canad. Mach.*, 1931, 42, (15), 34-40).—Surface indications of faulty welding, and other methods of testing and gauging, are enumerated and diagrammatically illustrated, together with correct and incorrect methods of weaving and jointing.—P. M. C. R.

**The Strength of Frontal and Lateral Welds.** E. Hoehn (*Engineering*, 1931, 132, 115-118).—A mathematical analysis of the results obtained in an investigation into the strength of lap welds; it is concluded that, for both frontal and lateral welds, the sp. resistance diminishes as the height of the fillet increases.—W. P. R.

**Correcting Welders' Instincts.** Leonard A. Blake (*Canad. Mach.*, 1931, 42, (9), 36-43).—The natural mistakes of inexperienced operators are most usefully corrected by giving a proper understanding of the behaviour of molten metal. This is controlled by: (1) heat, pressure, and direction of flame blast; (2) gravity; (3) surface tension. Detailed applications to edge welding, lap welds, butt seams, and corner welds, and the proportions of welded joints are discussed.—P. M. C. R.

**Preheating Arrangements in Welding.** P. G. Gibbons (*Canad. Mach.*, 1930, 41, (9), 60-62).—Reprinted from *Mech. World*, 1929, 86, 369; see this *J.*, 1930, 43, 657.—P. M. C. R.

**Welding in a Process Industry.** H. R. H. Young (*Indust. Gases*, 1931, 12, 81-83).—Read at the 3rd Annual Welding Conference, Oregon, Feb. 1931. Oxy-acetylene, electric arc, and lead welding are of great use in pulp and paper mills.—H. W. G. H.

**Welding Facts and Figures: LI and LII.** D. Richardson (*Welding J.*, 1931, 37, 78-79, 134-136).—The constitution and applications of the oxy-hydrogen, the oxy-ethylene, and the oxy-methane flames and of vaporizing liquid hydrocarbons and mixing them with oxygen, are explained.—J. H. W.

**The Welding of Alloys.** Anon. (*Welding News*, 1931, 2, 1-21; and *Indust. Gases*, 1931, 12, 93-97).—See *J.*, this volume, p. 54.—H. W. G. H.

**The Use of a Cleansing Flux on the Reverse Side of the Weld.** Anon. (*Welding News*, 1931, 2, 6).—Translated from *Rev. Soudure autogène*. See this *J.*, 1931, 47, 564.—H. W. G. H.

**Oxy-Welding with an Auxiliary Reducing Flame.** M. R. Meslier (*Mech. and Welding Eng.*, 1931, 5, 257-259; also *Indust. Gases*, 1931, 12, 128-129; and *Rev. Soudure autogène*, 1930, Sept.).—A paper presented to the 10th Congress of the Acetylene and Oxy-welding Industries, held at Zürich in July, 1930. Nickel and its alloys, aluminium, and brasses are said to be welded much more easily by the use of an auxiliary air-acetylene flame following the welding flame. The air-acetylene flame is also proposed to form a protective atmosphere when arc-welding.—H. W. G. H.

**The Oxy-Acetylene Flame.** D. Séférian (*Rev. Soudure autogène*, 1929, 21, 1870-1873; and *Mech. and Welding Eng.*, 1930, 4, 84-88 and 92).—Discusses the chemical reactions, products of combustion, and zones of the normal flame; gives gas analyses and temperatures of different parts, and shows how the former vary when the proportions of oxygen and acetylene are altered.—H. W. G. H.

**Blowpipe Applications.** Anon. (*Indust. Gases*, 1931, 12, 134-138).—Miscellaneous cutting and welding applications taken from reports of actual practice are described. These include lead lining of tanks, an all-welded aluminium petrol tank, brazing and welding in domestic copper boilers, joining flanges of "R.R. 50" alloy to copper tubes, and a locomotive firebox repair.—H. W. G. H.

**The New Keel Multi-Flame Blowpipe.** Anon. (*Welding J.*, 1931, 28, 137-140, 176).—Reprint from the (Swiss) *Journal de la Soudure*, describing the construction and mode of operation of the Keel Multi-flame (2-3 nozzles) blow-pipe. An increase of 50% in the welding speed is claimed for this invention.—J. H. W.

**Industrial Applications of the Oxy-Acetylene Welding and Cutting Process.** W. A. Duncan (*Canad. Mach.*, 1931, 42, (1), 38-43).—Sound quality in welds can be ensured by sufficient attention to selection of materials and operators, design of joints, preparation of material, correct technique, organization, and adequate final testing. With appropriate fluxes and welding rod almost any non-ferrous alloy can be successfully welded by the oxy-acetylene process. For cast iron, except where the part is to be exposed to very high temperatures, bronze welding is recommended. A hard-wearing Stellite layer can be applied to softer materials, effecting a considerable saving. The oxy-acetylene cutter finds varied application, and new machinery for complex shape-cutting has been developed.—P. M. C. R.

**Oxy-Acetylene Welding in a Sand Quarry.** Anon. (*Indust. Gases*, 1930, 11, 68-72).—Describes, *inter alia*, the repairing of worn tines by depositing a layer of Stellite.—H. W. G. H.

**The Tenth International Acetylene Congress.** Anon. (*Indust. Gases*, 1930, 11, 76-80).—A review of the Congress, held at Zürich in July, 1930, and a brief outline of the 67 communications made, which included papers on the training of welders, the production of gases, carbide and dissolved acetylene, oxy-acetylene equipment, welding methods and applications.—H. W. G. H.

**Electric Welding.** Anon. (*Electrician*, 1931, 106, 733).—Abstract of two pamphlets (D.L. 783/2a-1 and D.L. 784/4-1) issued by The Metropolitan-Vickers Electrical Co. and dealing with automatic and continuous-feed welding equipments and atomic hydrogen arc welding, respectively.—S. V. W.

**Electric Welding Machines.** Anon. (*Science et Industrie*, 1931, 15, 52).—Two machines recently erected by La Soudure électrique are described. The first welds links from rod where the diameter is as high as 90 mm. The second makes end-to-end welds in plates or sheets 300 mm. wide and up to 5 mm. thick.—P. M. C. R.

**Spot-Welding Sheet Metal.** W. E. Warner (*Canad. Mach.*, 1930, 41, (1), 52).—A spot-welded joint between sheets of metal is claimed to be more permanent, tighter, and more rapidly made than a riveted joint. Copper and copper-tungsten electrodes are largely used; the material of the electrodes must be determined by the composition and thermal and electrical conductivity of the materials to be welded. Sheet copper, for instance, requires special adaptations.—P. M. C. R.

**Heavy Duty Spot-Welding Machine.** Anon. (*Engineering*, 1931, 132, 539).—A machine capable of making 600 welds per hour. Illustrated.—W. P. R.

**Electrical Spot Welder.** J. W. Urquhart (*Canad. Mach.*, 1930, 41, (19), 78-80).—From *Mech. World*, 1929, 86, 343; see this *J.*, 1930, 43, 660.

—P. M. C. R.

**The Use of Arc-Welding in Naval Construction; The Problem of Welded Joints.** M. J. Pinczon (*Génie civil*, 1931, 98, 613).—Abstract of a paper read before l'Association Technique Maritime et Aéronautique in 1931.—W. P. R.

**Resistance Welding of Non-Ferrous Metals from the Metallographic Point of View.** F. Goldmann (*Elektroschweissung*, 1931, 2, (10), 195-200; *Bull.*

*B.N.F.M.R.A.*, 1931, (38), 23).—Deals with copper, nickel, zinc, aluminium, molybdenum, and lead. The following are discussed: formation of welds; effect of degree and duration of heating; formation of alloys in welding different materials together; and the value of metallography in the investigation and performance of welding. In the case of copper, resistance welding (spot and butt) can be carried out successfully without formation of cuprous oxide, even in the absence of a flux or deoxidant.—S. G.

**Fundamentals of Resistance Welding.** Anon. (*Canad. Mach.*, 1930, 41, (3), 73-74).—The heat required for this process is generally an electric current passing through the parts to be welded, pressure then being applied by levers and toggles; hydraulic pressure is recommended for heavy work. Butt and spot welding are modifications of this method. A butt-welding machine and its necessary adjustments are described. The method is applicable to nearly all metals and alloys, and finds wide application in the case of carbon and high-speed steels. A forging built up by resistance-welding can often be substituted for a solid forging, effecting great economy.—P. M. C. R.

**Essential Considerations when Selecting Resistance Welding Machines.** G. Falck (*Siemens Rev.*, 1931, 7, 185-187).—It is stated that the classification of resistance welding machines according to their electrical input is misleading, and the maximum energy consumption should be regarded as an indication of the quantity of current supply necessary. The factors which govern the selection of a spot-welding machine are considered. An important consideration is short welding time in order to avoid warping of the work, and this leads to the purchase of a larger machine than would have been necessary having regard to the required number of spots per hr.—R. Gr.

### XIII.—WORKING

(Continued from pp. 55-59.)

**The Effect of Cold-Working on the Magnetic Susceptibility of Metals.** Kotarô Honda and Yosomatsu Shimizu (*Sci. Rep. Tôhoku Imp. Univ.*, 1931, [1], 20, 460-488).—[In English.] Cf. this *J.*, 1931, 47, 134. The effect of cold-working on the magnetic susceptibility of 10 cubic metals has been investigated. The magnetic susceptibility of the diamagnetic metals, copper, silver, gold, and lead decreases by compression. The weakly diamagnetic copper becomes paramagnetic on compression. The magnetic susceptibility of the paramagnetic metals, aluminium, platinum, rhodium, palladium, molybdenum, and barium also decreases by compression. The relation between the changes in density and magnetic susceptibility is linear. The temperature effects on the magnetic susceptibility of platinum and rhodium are in opposite senses, but the effect of internal stress on the magnetic susceptibility in the two metals is the same.—E. S. H.

**Light Metal Works.** A. Vella-Ferrand (*Aciers spéciaux*, 1931, 6, 245-250).—See abstract from *Rev. Aluminium*, 1930, 7, 1268-1275; this *J.*, 1931, 47, 230.—J. H. W.

**Wires Drawn through Rotating Dies.** H. Greenwood and F. C. Thompson (*Nature*, 1931, 128, 152).—If the die through which a wire is being drawn is simultaneously rotated, the tension required is appreciably reduced. So far, no change has been observed in the structure of wires drawn through fixed and rotating dies, nor is there any marked alteration of tensile properties, Brinell hardness, and recrystallization on annealing.—E. S. H.

**Water Solubles for Cutting or Drawing.** W. M. Wallace (*Blast Fur. and Steel Plant*, 1931, 19, 1242-1243).—W. deals with the choice of lubricating and cooling materials for the working of metals. He states that there are four requirements in a grinding compound: as a coolant; as a lubricant for the

thousands of miniature cutting tools on the face of the wheel; as a cleaner of the wheel, so that it does not become a buffer instead of a cutter, as an anti-rust element, and, probably most important, as an element to precipitate chips so that they do not continue to float in the wheel and mar the finish where a very high finish is required. A great development has taken place in the use of water solubles, and W. predicts that they will almost entirely replace oils for all ordinary machining processes and cold-drawn operations.

—R. Gr.

**A Modern Extrusion Press for the Manufacture of Non-Ferrous Tubes.** Anon. (*Met. Ind. (Lond.)*, 1931, 39, 511-513).—A description is given of the construction and operation of a 600-ton vertical tube extrusion press installed in the works of Messrs. H. H. Vivian & Co., Ltd., Birmingham. It is used for making condenser and other tubes of 70 : 30 copper-nickel, aluminium-brass, ordinary brass, Admiralty gun-metal, and copper.—J. H. W.

**The Production of Shaped and Fancy Tubes.** Anon. (*Met. Ind. (Lond.)*, 1931, 39, 581-582).—Details of the method of drawing shaped and fancy tubes in 70 : 30 brass, copper, gilding metal, and mild steel are given.—J. H. W.

**Some Recent Advances in Rolling Plant.** W. J. P. Rohn (*Met. Ind. (Lond.)*, 1931, 39, 461-464).—Read before the London Local Section of the Institute of Metals. An account is given of the various stages of rolling, from the roughing or cogging mill, to the finishing rolls, and the various rolling machinery used in the process is described. Details of construction are given, these depending, as regards the material of the rolls, on the power demand for rolling the various alloys, and as regards the design and lubrication of the bearings, on the load and speed at which the rolls are run. An account is also given of cold-rolling mills, strip mills, and an experimental wire-drawing bench.—J. H. W.

**Aluminium Sheet Production. X.—Hot Mills.** Robert J. Anderson (*Metallurgia*, 1931, 5, 21-22 and 26, 37-38, and 40).—The several types of mills—two-high irreversible, two-high reversible, double-duo, and three-high—used for the hot breakdown operation on aluminium and aluminium-alloy sheet ingots are described in detail. The relative advantages of such mills as regards initial cost, maintenance, and output are discussed, and it is stated that for tonnage work the three-high type are most desirable. Rolls for aluminium hot mills are usually made of chilled cast iron, or chilled alloy cast iron (chromium nickel or molybdenum) with an average scleroscope hardness of 55-71 in the former and 70-75 in the latter. Forged steel rolls are also used. The life of hot mill rolls is prolonged by operating at as low a temperature as possible and by preventing sudden or wide changes of temperature. Special accessories and fittings, such as table shoes, breaker blocks, screw-downs, and bearings (leaded and phosphor-bronzes), are also discussed.—J. W. D.

**The Cold-Roll Forming of Rust-Resistant Metals.** D. A. Johnston (*Metal Stampings*, 1931, 4, 815-816).—Cf. this *J.*, 1931, 47, 402. An account of typical applications of cold-rolled formed sections in copper, aluminium, aluminium alloys, and rustless steels.—J. H. W.

**Hydraulic Forming Artificial Limbs.** Anon. (*Amer. Machinist (Eur. Edn.)*, 1931, 75, 583-587).—The adaptation of the common hydraulic press for forming seamless Duralumin-type tubing in the manufacture of artificial limbs is described.—J. H. W.

**Modern Stamping-Press Construction.** Anon. (*Science et Industrie*, 1931, 15, 258-260).—Modern machinery for stampings of various types is described and illustrated; applications of machinery designed for simultaneous stamping and cutting are discussed, and cutting tools are described.—P. M. C. R.

**Automatic Friction Drop-Stamp.** New Massey Self-Contained and Battery Form Designs. Anon. (*Mech. World*, 1931, 90, 337-338).—The simplex automatic gear described and illustrated has been designed by B.

and S. Massey, Ltd., Manchester, to take the place of the driver in the hand-operated stamp and allow the workman to operate the stamp by foot.

—F. J.

**High-Speed Blanking Press.** A. Eyles (*Mech. World*, 1931, 90, 403-404).—A four-post high-speed blanking press constructed by the Waterbury Farrel Foundry and Machining Co., Waterbury, Conn., U.S.A., is illustrated and described.—F. J.

**Drawing and Forming Tools.**—I. W. Richards (*Canad. Mach.*, 1931, 42, (20), 33-36; (21), 21-23, 52).—Abstracted from a series of articles in *Mech. World*, 1930, 88, 8-10, 78-80, 296-298, 344-345. See this *J.*, 1931, 47, 115.

—P. M. C. R.

**Cutting Speeds for Sawing with Metal Band Saws.** — Lipke (*Metallwaren-Ind. u. Galvano-Tech.*, 1931, 29, 337-338).—A table is given showing the most suitable cutting speed for sawing steel, bronze, brass, copper, Elektron, aluminium, and Silumin with steel band saws, the best cooling medium, and the best type of saw to use.—A. R. P.

**Gear-Driven Sawing-Off Machine.** Anon. (*Mech. World*, 1931, 89, 590).—A lever-operated gear-driven sawing-off machine, constructed by Charles Taylor (Birmingham), Ltd., is illustrated and described. The drive is transmitted through 2 pairs of hardened steel and phosphor-bronze spiral gears which give the necessary reduction of speed to the saw.—F. J.

**Tapping Aluminium.** W. E. Warner (*Canad. Mach.*, 1931, 42, (2), 63).—Ordinary taps give satisfactory results with satisfactory lubricants. Beeswax or tallow should be melted and run into the holes being tapped; the combined pressure and friction of the process ensure proper fluidity. For castings, the theoretically correct size of drill may be used, but for the more compressible, softer forms a slightly larger drill is needed.—P. M. C. R.

**Hazards in Fabricating Magnesium Metal.** L. E. Averill (*Amer. Machinist (Eur. Edn.)*, 1931, 74, 977).—Short article indicating the precautions to be taken to prevent fire when machining magnesium castings.—J. H. W.

**Machining Monel Metal.** W. E. Warner (*Canad. Mach.*, 1930, 41, (21), 38).—Proper adjustment of cutting speed and feed eliminate nearly all difficulty in machining. Cutters of high-speed steel, and drills of either high-speed or carbon steel, are satisfactory. Cutting, reaming, and milling speeds and feeds, and instructions for drilling, are given.—P. M. C. R.

**Cutting Speeds and Feeds.** E. N. Simons (*Mech. World*, 1931, 90, 340-341).—Data are given concerning the best speeds and feeds for cutting brass, cast iron, and steel. For brass the periphery speeds are as follows: using carbon tool-steel milling-cutters, 80-100 ft./minute; using high-speed steel cutters, 150-250 ft./minute; using slitting saws, 150-200 ft./minute.—F. J.

**Characteristics and Selection of Cutting Fluids.** P. M. (*Machinery (Lond.)*, 1930, 35, 729-735).—The functions and desirable properties of a cutting lubricant are described, emphasis being laid on the power of adhesion of the liquid to the metal surfaces. Temperature-fluidity and temperature-viscosity curves are given for 10 different types of oils, and the physical and chemical characteristics and corrosive action on copper, &c., are tabulated. Sulphur is a form of solid lubricant, but although its addition to a cutting oil offers advantages, its presence is not generally desirable owing to its deleterious action on lubricating oil and copper. There is no known test for evaluating a cutting lubricant; spreading tests have been made, but they do not yield any definite conclusions. Emulsions consist of a sulphonated oil or soap oil base, or of a soap compound; their characteristics are outlined. The chief advantage of emulsions is that they may be diluted to the best concentration for any particular work; their disadvantages are their instability and penetration to working parts, where they wash out the lubricant, and thus cause sticking. The selection of cutting lubricants is discussed.—H. F. G.

**Cutting Tests with Cemented Tungsten-Carbide Lathe Tools.** T. G. Digges (*Trans. Amer. Soc. Mech. Eng.*, 1931, 52, (2), M.S.P. 155-165).—The object of the investigation described was to develop a method of testing tungsten-carbide lathe tools under heavy duty, and the so-called lathe breakdown test for high-speed steel tools was found to be applicable. The relation between cutting speed and tool life within a range of 9-156 minutes for cutting a 3.5% nickel-steel can be expressed by the empirical equation  $VT^u = c$ , where  $V$  = cutting speed in ft./minute,  $T$  = tool life in minutes, and  $c$  and  $u$  are constants. High cutting speeds with fine cuts are more favourable to the successful application of tungsten-carbide tools than heavy cuts at low speeds. In the discussion it was pointed out that the full benefit of the new material would not be obtained until new machines were built suitable to the peculiar characteristics of the new cutting material.—W. P. R.

**Are Cemented Tungsten Carbide Tools Economical?** A. J. Strain (*Canad. Mach.*, 1931, 42, (11), 21-23).—Comparative tables of works returns show considerable economy. A possibility of 20-30% increase in production is indicated, and various commercial applications are enumerated.—P. M. C. R.

**Osram Hard Metal and its Use in Technology.** A. Fehse and K. Schröter (*Tech.-wiss. Abhandl. Osram-Konzern*, 1931, 2, 207-217).—Osram hard-metal tools are made of sintered tungsten carbide alloys, and, on account of their extreme toughness and hardness, can be used for practically every type of work. The discovery and properties of the material are discussed, and a large number of hard-metal tools are described.—v. G.

**[Ramet] A New High-Speed Cutting Metal.** Anon. (*Mech. World*, 1931, 89, 365-366).—Ramet metal is a development of the Fansteel Products Co. Inc., N. Chicago, Ill., U.S.A.—F. J.

**Tools for Working Some New Alloys.** J. Haydock (*Science et Industrie*, 1931, 15, 308-309).—Abstract of an article in *Amer. Machinist (Eur. Ed.)*, 1930, 73, 459-463; see this *J.*, 1931, 47, 50.—P. M. C. R.

#### XIV.—FINISHING

**The Brass Spraying Process as a Modern Manufacturing Process in the Metal Ware Industry.** Anon. (*Demizet*, 1931, 47, 127-128).—A description is given of the spraying of brass gas- and water-pipes with a wall thickness of 1-10 mm. and with a tolerance of  $\pm 0.05$  mm. with aluminium and zinc. The metals are sprayed under a pressure of 200 atm., and precautions are taken to prevent surface oxidation of the articles which are preheated to 100°-200° C. The structure of the brass, which would in general be determined by the previous working and heat-treatment, becomes fine-grained, owing to the rapid freezing of the sprayed metals. The mechanical properties of typical sprayed and unsprayed metal are as follows :

	Tensile Strength. Kg./m. <sup>2</sup> .	Elongation. %.	Hardness. Kg./m. <sup>2</sup> .
Zinc sprayed casting . . .	18.5	1	35
Aluminium sprayed casting . . .	24	2.5	70
Brass sand casting . . .	20	10	55
Brass sprayed casting . . .	38	10-30	100-130
Brass pressure casting . . .	40	20	100

—J. H. W.

**The Treatment of Alpaca Ware.** Heinrich Günther (*Demizet*, 1931, 47, 855-856).—In spite of the low current price of silver, substitutes are finding increasing applications. Of these, Alpaca is becoming most widely used. The treatment given to this alloy to impart to it the desired appearance for various purposes is described.—J. H. W.

**Process for the Colouring of Aluminium and Aluminium Alloys.** Anon. (*Demizet*, 1931, 47, 356).—A new patent colouring process for aluminium and its alloys depends on the use of molybdenum salts of fluoric and fluo-silicic acids and zinc salts. Such a bath consists of 12 gm. zinc sulphate, 5 gm. sodium molybdate, 3 gm. sodium fluoride in 1.5 l. water, and is worked at 50°-70° C. Alteration of the tone of the colour is effected by the use of other salts, such as those of nickel, manganese, cobalt, and copper, the colours which can be produced being light and dark blue, golden yellow, pink, red, dark red, green, and brown.—J. H. W.

**Industrial Methods of Old-Silver Colouring.** K. Altmannsberger (*Metallwaren-Ind. u. Galvano-Tech.*, 1931, 29, 360-361).—See this *J.*, 1931, 47, 569.

—A. R. P.

**Industrial Methods of Producing Oxidized Silver Finishes.** K. Altmannsberger (*Oberflächentechnik*, 1931, 8, 133-134).—The article is first quickened in a mercury cyanide bath, then plated with silver in a bath containing 22-25 gm. of silver as potassium argenticyanide and 13-15 gm. of free potassium cyanide per litre, using a current density of 1-1.2 amp./dm.<sup>2</sup> at 0.8 v. The deposit is then coloured by (a) immersion in a solution of 35 gm. of lead acetate and 140 gm. of sodium thiosulphate per litre at 60° C., (b) electrolysis as cathode in a solution containing 50 gm. of arsenious acid, 20 gm. of sodium carbonate, and 25 gm. of potassium cyanide per litre at 4 v., or (c) alternate immersion in a bath containing 15 gm. of potassium sulphide per litre and a bath containing 9 gm. of copper sulphate and 3 gm. of sulphuric acid per litre. Similar oxidized silver finishes may be obtained by cadmium plating the articles and colouring them with a solution containing 60 gm. of potassium chlorate and 40 gm. of copper nitrate per litre.

—A. R. P.

**Lacquering of Metals.** Alfred Nauck (*Metallwaren-Ind. u. Galvano-Tech.*, 1931, 29, 218, 289-290).—For lacquering bronze and brass a solution of 1 part of shellac and 0.25 part of camphor in 8-10 parts of alcohol is recommended. This may be coloured by addition of basic copper acetate mixed with turpentine oil and copal varnish. The compositions of several lacquers for sheet iron ware are given.—A. R. P.

**Modern Pickling Methods.** David Brownlie (*Burn's Eng. Mag.*, 1931, 25, 199-200).—B. enumerates modern applications of pickling. Hydrochloric acid was frequently replaced by sulphuric acid as a medium, but improvements in mechanical handling, whilst greatly facilitating the whole treatment, have also increased the ease of employing hydrochloric acid, which is therefore regaining favour. Types of tank material and desirable bath strengths and temperatures are discussed, and methods of agitation, storage, and fume disposal are described. Research is needed on the function and working of inhibitors; a list is given of the most usual of these.—P. M. C. R.

**Trichlorethylene for Degreasing Metals.** Anon. (*Brass World*, 1931, 27, 273, and *Amer. Machinist (Eur. Edn.)*, 1931, 75, 579).—The properties of trichlorethylene and the method of using it as a metal cleaner and degreaser are set out in a booklet, "Trichlorethylene, Its Properties and Uses," issued by the Roessler and Hasslacher Chemical Co., Inc., New York.—J. H. W.

**Modern Methods of Removing Grease from Metals.** B. Wernick (*Metallwaren-Ind. u. Galvano-Tech.*, 1931, 29, 357-358).—A translation, in abstract, of a paper by Wright and Taylor read before the Electroplaters' and Depositors' Technical Society (cf. this *J.*, 1931, 47, 406).—A. R. P.



**Effect of Impurities in Cleaning and Finishing Materials.** R. F. Cohn (*Metal Cleaning and Finishing*, 1930, 2, 103-106; *C. Abs.*, 1931, 25, 5376).—Impurities may exert beneficial as well as detrimental effects. Some specific examples are given.—S. G.

**The Bullard-Dunn Process of Cleaning.** Floyd T. Taylor (*Monthly Rev. Amer. Electroplaters' Soc.*, 1931, 18, (8), 17-22).—The process comprises electrolytic cleaning in a sulphate-chloride electrolyte using lead anodes, whereby the scale is removed from the articles being cleaned and replaced by a film of lead which prevents subsequent oxidation. The articles may be plated with the desired metal without removing this film, or the film may be removed, if desired, by a short anodic treatment in an alkali bath.

—A. R. P.

**The Maintenance and Life of Cleaning Solutions.** R. W. Mitchell (*Monthly Rev. Amer. Electroplaters' Soc.*, 1931, 18, (6), 30-34).—Numerical examples are given illustrating the method to be adopted in replenishing alkaline cleaning baths.—A. R. P.

**Hard and Soft Rubber for Pickling Tanks.** H. E. Fritz (*Chem. and Met. Eng.*, 1931, 38, 396-397).—For use in the pickling of metals, no material has been found entirely satisfactory for the containers. The stability of metal can now be combined with the corrosion- and abrasion-resisting properties of flexible rubber. In the Triflex construction soft and hard rubber plies are used, the soft rubber being capable of attachment to steel by the Vulcalock process, so as to possess an adhesion exceeding 500 lb./in.<sup>2</sup>, whilst the hard rubber is more resistant to acids at higher temperatures and to the cutting action of sharp objects and to the action of ordinary mineral or vegetable oils. The resilience of the soft layer enables it to accommodate itself to varying expansions and contractions. Further protection is afforded by an inner wood-sheathing, whilst temperatures up to 100° C. are permissible by using a sheathing of acid-proof brick or cement.—F. J.

**Metal-Cleaning Tank.** Robert W. Mitchell (*Amer. Machinist (Eur. Edn.)*, 1931, 75, 437).—Abstracted from a pamphlet "The Cleaning of Metal." The construction of metal-cleaning tanks, pipe sizes, and length of heating coils for steam-heating, the necessity for agitation, and the construction of compressed-air agitators and the cleaning out of the tanks are discussed.

—J. H. W.

**An Experimental Study of Metal Polishing by Flexible Polishing Wheels.** Edwin M. Baker and George E. Holbrook (*Trans. Electrochem. Soc.*, 1931, 59, 483-498; discussion, 498).—See this *J.*, 1931, 47, 304.—S. G.

**Grinding Aluminium Alloys.** W. E. Warner (*Canad. Mach.*, 1931, 42, (5), 30).—Wet grinding is recommended, using silicon carbide wheels with a surface wheel speed of 5000-6500 ft./minute and a work speed of 75 ft./minute. Soda, together with water, kerosene, or grinding compound, is preferred as lubricant. The coolant, which is repeatedly used, should be kept free from grit and chips by filtration in order to avoid surface scratches.—P. M. C. R.

**Grinding a Vee Tool.** S. Munday (*J. Sci. Instruments*, 1931, 8, 302-304).—A note. Vee notches were required to be turned in small cylinders to within fairly close limits of accuracy, and the tools had to be ground to the correct angle. This was accomplished by using a shaping machine in conjunction with a small portable grinder, and the arrangement is described.—W. H. R.

**Grinding-Wheel Manufacture.** Anon. (*Canad. Mach.*, 1930, 41, (13), 145-146).—The practice at the plant of the Dominion Abrasive Co., Ltd., is described. The "vitrified bond" type of grinding wheel is recommended for most purposes. The mixing, moulding, and turning of these wheels are described; the applications of silicate, elastic, and Bakelite wheels are then considered. Methods of testing are outlined.—P. M. C. R.

## XV.—FOUNDRY PRACTICE AND APPLIANCES

**Foundries, Large and Small.** Anon. (*Metallurgist (Suppt. to Engineer)*, 1931, 7, 129-130).—Arguments are advanced in favour of the view that only in the largest concerns is the establishment of an internal foundry to be justified. Large industrial foundries developed to produce castings for the use of other industries have the advantages of good purchasing conditions, of a highly skilled staff, of plant, and of scientific control, and castings are normally supplied to specifications which ensure good quality.—R. G.

**Some Developments in Modern Foundry Practice.** E. Longden (*Trans. Manchester Assoc. Eng.*, 1930-31, 193-222).—The paper deals primarily with cast iron, but describes production methods applicable to any ferrous or non-ferrous alloy.—H. F. G.

**There is Still Room for Economy in the Foundry.** Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1931, 52, 101-102, 105-107).—Considerable saving in material can be effected in foundry work by preventing or cutting down avoidable losses and by the proper treatment of used material. This argument is considered from the point of view of the reduction of fuel consumption by economic handling and of the reduction of metal losses through volatilization, oxidation, splashing, and absorption by the crucible. Experiments are described showing how these savings may be effected.—J. H. W.

**Foundry Practice and Equipment.** P. W. Peel (*Indian and Eastern Eng.*, 1930, 66, 164-166; 67, 68-70, 201-202, 337-340, 473-474, 609-611).—A series of articles on modern methods of plant maintenance, handling, and preparation of material. Moulding sands and moulding machinery are classified and described, and the making of moulds and patterns is discussed, with illustrations and descriptions of recent appliances. Developments of grinding practice are dealt with. Specialized treatment is given in some detail in the cases of malleable castings and of phosphor-bronze.—P. M. C. R.

**Canadian Manufacturers Cut Costs by Die-Casting.**—I.-II. Joseph Bailey (*Canad. Mach.*, 1931, 42, (11), 32-33, 47-48; (14), 36-37, 51).—(I.)—The die-casting process is to-day potentially applicable, especially in the case of alloys of fairly low melting point, to any part which is within reasonable limits for weight, which is required in sufficient quantity to justify the cost of making the dies, and which would normally require much machining. Parts to be used in the rough state or with little machining cannot be economically die-cast. Saving is effected by careful design of dies, allowing holes of all shapes, threads, and ratchet formations to be accurately die-cast; several parts of a mechanism can be combined in a single die-casting, and in many cases parts made in materials other than the casting alloys can be incorporated in the casting. A high degree of uniformity, accuracy, and finish is obtained, and the wear and corrosive attack on cores are usually small. (II.)—The form and placing of the parting line must depend on the region of the casting offering the greatest resistance to extraction, and must be so arranged that one half of the die can be easily removed after casting. The witness line should, if possible, coincide with a well-defined line or plane on the casting. Variation of size owing to spring between the halves of the die should take place where its importance is minimized. The sprue cutter method is recommended for gating. Porosity and trapped air are obviated by attention to venting. A good grade of steel for die construction justifies its initial cost by longer service, little trouble in working, and high accuracy and finish: a high standard of the latter is necessary in die-construction.—P. M. C. R.

**Material Economy by Metal Moulding.** Anon. (*Machinery (Lond.)*, 1929, 35, 416).—A note on the advantages of die-casting, hot stamping, and pressing.—H. F. G.

**Making Die-Castings for Many Purposes.** A. S. Taylor (*Compressed Air Mag.*, 1930, 35, 3338-3342).—The scope of the die-casting industry is indicated, and parts of the process are described, with special emphasis on the material and making of dies and inserts.—P. M. C. R.

**Aluminium-Bronze Die-Castings.** Anon. (*Metallurgia*, 1931, 4, 171-172, 200).—Die-castings in "aluminium-bronze" are produced within limits of 0.005 in. in all weights from 1 oz. to 10 lb. and over. Difficulties are encountered due to the high casting temperature required, to the high shrinkage of "aluminium-bronze"—between 1.9% and 2.4%, according to the aluminium content—and to the effect of the fluid metal on the die. Casting temperatures vary according to the design, and are usually between 1150° and 1300° C., whilst high shrinkage is overcome by placing runners in the thickest sections to act as feeders. Dies are usually manufactured of close-grained cast iron of low phosphorus content, but carbon steels, high-speed steels, stainless steels, and high-chromium alloy steels are also used for special purposes. Cores are made of highly polished heat-resisting steels and phosphorus-free cast irons or semi-steels.—J. W. D.

**Bronze Pressure Castings.** J. E. Crown (*Trans. Bull. Amer. Found. Assoc.*, 1931, 2, (11), 496-503; discussion, 503-505).—The manufacture of bronze castings for pressure service demands a high-grade product. Successful production of this class of work is possible only with a full appreciation of the various factors involved. The factors listed as of most importance are: selection of alloys, design of pattern, allowance for machine finish, methods of moulding, character of cores, and type of heads and gates. The principal alloy used at the U.S. Naval Gun Factory for non-ferrous pressure castings is stated to have the composition copper 87.25, tin 9, zinc 3, and nickel 0.75%. The average pouring temperature is about 1950° F. (1065° C.), although this varies with the design. A hydraulic cylinder casting is used as a typical case to illustrate the production factors involved.—S. G.

**Is the Installation of Pressure Casting in the Casting of Armatures Advisable?** L. Siehttam (*Z. ges. Giesserei-Praxis: Das Metall*, 1931, 52, 81-83).—The nature of pressure die-casting, its application, the materials for which it can be used, the machinery and the plant required, the production of pressure die-castings, the advantages of the process, and the properties of the castings so made are discussed.—J. H. W.

**Slush Casting of Aluminium Utensil Spouts.** Robert J. Anderson (*Met. Ind. (Lond.)*, 1932, 40, 7-10).—The 2 principal types of spout used on aluminium utensils are the (sand-)cast spout and the drawn or stamped spout. Both have considerable disadvantages. Commercial aluminium is troublesome to sand-cast, and the castings often have pinholes, especially as the metal must be run very hot for thin castings. The cost of polishing is appreciable, and cast spouts cannot be clinched to an upset flange, but must be welded. Sheet spouts can be clinched, but are usually more expensive to make. One method of overcoming these difficulties is to adopt slush casting, *i.e.* casting the metal or alloy into a metal mould and at once inverting the mould, thereby pouring out the metal that is still liquid. This procedure yields a hollow casting, the external contour of which corresponds with the mould cavity. Such a method can be applied only to relatively simple hollow shapes, but within these limits it gives high speed of production and a good exterior finish. The method is described and illustrated in detail and the aluminium alloys suitable for the process are discussed.—J. H. W.

**Permanent Mould Foundry Practice for Bronze Castings.** Henri Marius (*Trans. Bull. Amer. Found. Assoc.*, 1931, 2, (10), 393-418; discussion, 418-422).—The term "permanent moulds" in this paper is used to designate long-life iron moulds. These are stated to have a metallurgical advantage over sand moulds in increasing strength and increasing the ability of copper-

tin alloys to hold more lead. Foundry factors are stated to be most important, the principal ones being correct pouring temperatures, guarding against porosity and oxidation, gating and risering, melting, mould-wall thickness, clamping of moulds, and the type of iron used in the moulds. Each of these factors is discussed in detail.—S. G.

**A Practical Method for Studying the Running Quality of a Metal Cast in Foundry Moulds.** C. M. Saeger, Jr., and A. I. Krynsky (*Trans. Bull. Amer. Found. Assoc.*, 1931, 2, (12), 513-532; discussion, 532-540).—The ability of molten metals to fill foundry sand moulds is related to the fluidity of the molten metal and also to the "running qualities" as affected by the sand mould prepared under various conditions. A test method for determining the "running qualities" of metals has been developed. Such tests were conducted for aluminium, brass, and cast iron in both dry- and green-sand moulds. The results indicate that (1) the metals cast in dry-sand moulds run further than the same metals cast in green-sand moulds; (2) with an increase in pouring temperature the length of test-specimens increased in direct proportion to the pouring temperature; and (3) the maximum heating temperature before pouring has an effect on the results for aluminium.—S. G.

**Prevent Losses with Proper Gates and Risers.**—XIII-XX. Pat Dwyer (*Foundry*, 1931, 59, (14), 41-43; (15), 53-56; (16), 35-37, 41; (17), 68-70; (18), 33-35; (19), 51-53, 56; (20), 34-36, 38; (21), 47-49).—F. J.

**Aluminium in the Electric Furnace.** Wirt S. Scott (*Heat-Treating and Forging: Furnaces*, 1931, 17, 1055-1058, 1064).—The difficulties met with in melting aluminium are reviewed. The heating medium must be only a few degrees above the pouring temperature of the metal. Ceramic crucibles will not conduct the heat fast enough, and ordinary cast-iron, steels, and nickel-chromium alloys are not practicable, as they bulge and scale after a few heats. A suitable material (not specified) has been found and gives more than 20,000 lb. molten aluminium per pot. Test data on aluminium-silicon castings melted in an electric furnace, a coke furnace, and a gas furnace are tabulated. Taking electric power at \$0.01 per kw.-hr., gas at \$0.35 per 1000 cu. ft., and coke at \$5.80 per ton, the total inclusive costs per 100 lb. metal cast works out at \$0.586, 0.490, and 0.499, respectively. The advantages connected with the use of the electric furnace make it much to be preferred for melting aluminium.—J. H. W.

**The Melting and Pouring of Aluminium Alloys.** Werner Froehlich (*Metalurgist* (Suppt. to *Engineer*), 1931, 7, 174-175).—A practical description of the melting and pouring of aluminium alloys, referring to errors commonly made in aluminium foundry work. Careful cleaning of scrap is advocated, and reference is made to the use of flux cleansers in the melt. In order to speed up the melting process and to afford protection against oxidation, a method has been developed, consisting in the leaving in the crucible of a portion of the charge. This is skimmed, fluxed, and heated to about 800° C. before the fresh metal is charged. Pouring temperature is discussed in relation to the type of casting.—R. G.

**High-Strength Sand-Casting Aluminium Alloys.** W. C. Devereux (*Found. Trade J.*, 1931, 45, 331-334, 349-351; discussion and reply, 351 and 357).—Read before the Scottish Branch of the Institute of British Foundrymen. Describes the mechanical properties, solubility range, soundness, wear and friction, and casting properties of light alloys used for highly stressed parts. Such alloys are "Y" alloy, R.R. alloys, and the 4% copper American alloy. Practical details as regards temperature control, mould, and core dressing, and typical results are discussed.—J. H. W.

**Meeting the Demand for Aluminium Castings.** Anon. (*Canad. Found.*, 1931, 22, (8), 7-11).—The composition, properties, and applications of 12 aluminium alloys suitable for sand casting are given. Pattern and core

designs, type and treatment of moulding sands, gating, melting, modification, heat-treatment, and inspection of the castings are discussed.—J. H. W.

**The Manufacture of Aluminium Alloy Centrifugal Blower Casings.** Gustav Krebs (*Z. ges. Giesserei-Praxis: Das Metall*, 1931, 52, 109–111).—A description is given of the manufacture of centrifugal blower casings of an alloy consisting of aluminium 68, copper 2, zinc 30%. This alloy has a tensile strength of 28 kg./mm.<sup>2</sup> if cast at 720° C., but only 23 kg./mm.<sup>2</sup> if cast at 800° C. If a lighter alloy is required, one having a composition of aluminium 85, copper 5, zinc 10%, poured at 730° C. is used. Large parts of the frame are cast from a copper 5, zinc 80, antimony 15% alloy, and smaller parts, where the shrinkage is less important, from a lead 83, antimony 17% alloy. For welding the aluminium alloy casing an alloy of copper 20, aluminium 30, zinc 50% is used, and for further protection against oxidation the welded pieces are tinned by being dipped in an alloy consisting of tin 82, aluminium 18%.—J. H. W.

**Aluminium Pots and Kettles are Foundry Products.** James Braeky (*Canad. Found.*, 1931, 22, (9), 7–9).—Details of casting aluminium pots and kettles are given. The aluminium used is a special non-corrosive alloy with a silicon hardener, no copper being used.—J. H. W.

**Moulding Practice for Heat-Treated Aluminium-Alloy Castings.** Lewis H. Fawcett (*Foundry*, 1931, 59, (15), 62–65; and *Found. Trade J.*, 1931, 45, 241–242).—Abstracts of a paper read before the American Foundrymen's Association. See this *J.*, 1931, 47, 605.—J. H. W.

**The Manufacture of Aluminium Pistons.** Anon. (*Fonderie mod.*, 1931, 25, 113–114).—Transcribed from *La Fonderia*. Detailed considerations are given of casting aluminium pistons with regard to the dimensions of the gate, the point at which it feeds the casting, the inclination, and the shape and dimensions of the gate.—J. H. W.

**Washing Machine and Ironer Parts are Speciality of Midwestern Foundry.** Edwin Bremer (*Foundry*, 1931, 59, (15), 44–48).—The Electric Household Utilities Corporation, Cicero, Ill., a suburb of Chicago, U.S.A., is one of the leading manufacturers of electric washing machines and ironers, in the construction of which a certain number of aluminium castings are used. The moulding practice in the case of a light, intricate, aluminium housing is illustrated and described.—F. J.

**The Casting of Tough-Pitch Copper.** W. F. Brazener (*Met. Ind. (Lond.)*, 1931, 39, 559–563; discussion and reply, 611–619).—Abstract of a paper read before the Co-ordinating Committee (Birmingham Local Section of the Institute of Metals, Birmingham Metallurgical Society, and Staffordshire Iron and Steel Institute). Describes the usual procedure adopted by English refiners in producing tough-pitch copper castings, from the charging of the raw material to the final lading into the moulds.—J. H. W.

**Melting and Casting of "Aluminium-Bronzes."** Edmund R. Thews (*Metalurgist (Suppt. to Engineer)*, 1931, 7, 159–160).—A practical description of methods of melting and casting "aluminium-bronzes" and similar alloys containing iron, nickel, zinc, and manganese. Addition of lead up to 1–1.5% improves the cutting qualities of the castings without causing appreciable deterioration in the chemical and mechanical properties of the alloys. The difficulties in the casting of "aluminium-bronze" are discussed and directions are given as to suitable means of arranging sand moulds.—R. G.

**The Manufacture of Copper Alloys with High Nickel Content.** E. Becker (*Z. ges. Giesserei-Praxis: Das Metall*, 1931, 52, 111–112).—The presence of a large proportion of nickel in copper alloys involves many practical difficulties, such as a tendency to porosity and the absorption of sulphur and carbon. Whilst oxygen can be removed by suitable deoxidation agents, the removal of the sulphur and the carbon is not so easily effected. German silver must be poured at 1100°–1300° C., and therefore requires heating to 1300°–1500° C.

The copper should not contain any antimony or arsenic, and the nickel is added as a 50% copper alloy. Deoxidation is effected by phosphor- or manganese-copper. If zinc is used, a slag covering is required to keep the melt out of contact with furnace gases, and a second deoxidation with magnesium is given. The melting of cupro-nickel and Monel metal is carried out in a similar manner, the latter being deoxidized with magnesium.—J. H. W.

**Melting of Dense Bronze to Withstand High Pressure.** M. Schied (*Giesserei*, 1931, 18, 603-604).—Hints are given for the production of sound bronze castings to withstand hydraulic pressures up to 400 atmospheres. The most suitable alloy for this purpose comprises 83% copper, 6.5% tin, 8.5% zinc, and 1% nickel. When the alloy is melted, 1% of its weight in phosphor-copper is added as a deoxidizer; a neutral atmosphere is advisable to avoid the possibility of gas absorption.—A. R. P.

**The First Equestrian Statue of Louis XIV.** Anon. (*Fonderie mod.*, 1931, 25, 288-290).—It would appear that the first large casting made by one continuous pouring was the equestrian statue of Louis XIV, erected in Paris in 1699 and subsequently destroyed. The details of the mould construction and the manner in which the obvious difficulties of such an undertaking were overcome are discussed.—J. H. W.

**The Selection and Treatment of Gear Materials.** Francis W. Rowe (*Trans. Manchester Assoc. Eng.*, 1930-31, 37-62).—Deals principally with ferrous materials, but notes the use of bronze where sliding friction is considerable. Phosphor-bronze containing 11-13% of tin and 0.2-0.5% of phosphorus is probably the most suitable alloy. The ordinary sand casting possesses many disadvantages; by centrifugal casting the resistance to fatigue by pitting is raised by about 55%. Strength and hardness data for sand-, chill-, and centrifugally-cast phosphor-bronze are given.—H. F. G.

**The Manufacture of Phosphor-Bronze Strip and Sheets.** Edward S. Richards (*Met. Ind. (Lond.)*, 1931, 39, 484).—Phosphor-bronze strip having the following composition is in frequent demand for springs, &c.: tin 3-5%, phosphorus 0.05-0.1%, copper the remainder. It is made up of electrolytic copper, pure tin, and 15% phosphor-copper stick, and is melted in plumbago crucibles, the charge being covered with a good layer of stick charcoal. Cast-iron moulds dressed with molten tallow, powdered charcoal, and a little china clay are used, the strip being removed as soon as possible after pouring. Only light passes can be given in rolling, and longer annealing than with bronze is required.—J. H. W.

**The Fundamentals of Brass Foundry Practice.** R. R. Clarke (*Met. Ind. (Lond.)*, 1931, 39, 438 and 442).—Test-specimens of the same alloy apparently melted and cast under the same conditions often give very discordant results. The reasons for this are explained and the practice which will give the best results is outlined, using an 88 copper, 10 tin, 2% zinc alloy as an example, especially as regards the gating and feeding of test bars.—J. H. W.

**The Preparation of Special Brasses.** R. Berger (*Z. ges. Giesserei-Praxis: Das Metall*, 1931, 52, 86-87).—The preparation of special brasses having the composition copper 58, zinc 35, aluminium 2, iron 1, nickel 2, and manganese 2%, and having a yield point of 50-60 kg./mm<sup>2</sup>, an elongation of 15-20%, and a Brinell hardness of 110-130 is described. The copper and zinc are added as virgin metal running 99.6 and 99.7%, respectively. Aluminium is added as an 80:20 copper-aluminium alloy, and the iron, manganese, and nickel are also added as a copper alloy containing about 68% copper. The effect of the aluminium is to raise the yield-point and of iron to give a fine structure. Manganese and nickel have both these effects. An account is given of the preparation of the addition alloys and of the casting of the final alloy. The use of scrap and the most suitable form and material for the mould are discussed.—J. H. W.

**Specifications for Wood Patterns.** — (*Trans. Bull. Amer. Found. Assoc.*, 1931, 2, (11), 18–32).—These specifications for wood patterns were formulated as standard specifications by a special committee of the Milwaukee Branch of the National Metal Trades Association. They were presented for discussion before the pattern-shop round-table meeting at the 1931 convention of the American Foundrymen's Association.—S. G.

**Cupola Melting of Brass.** T. Mauland (*Trans. Bull. Amer. Found. Assoc.*, 1931, 2, (12), 602–605; discussion, 606–608).—Describes the melting of brass in a cupola when the fuel used is of high fixed-carbon content. The fuel contains 98% or more of fixed-carbon, and is low in sulphur and ash. The cupola is small, lined down to 22½ in. in diameter, and is operated on low blast pressure and low air volume. The lining used is a monolithic silicon carbide cement, with a backing of firebrick and an insulating brick. Alloys melted are of the composition 85 : 5 : 5 : 5 copper-zinc-lead-tin and 80 : 10 : 10 copper-tin-lead. With the first alloy the principal loss is of zinc, whilst that for the second is of lead. The castings produced consist largely of carburettors and bushings, and some of these, being light, are poured at temperatures as high as 2300° F. (1260° C.).—S. G.

**Making a Large Brass Plate by Wet-Sand Casting.** Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1931, 52, 114–116).—The moulding and casting operations used in casting a bronze plate measuring 1.3 m. square × 1.5 cm. thick from 320 kg. of metal are described.—J. H. W.

**The Manufacture of Small Bells.** Hans Eckart (*Z. ges. Giesserei-Praxis: Eisen Zeitung*, 1931, 52, 197–198; and *Fonderie mod.*, 1931, 25, 428–429).—The preparation of the moulds and the details of casting bells of 75 : 25 or 78 : 22 copper-zinc alloy are described.—J. H. W.

**Type-Metal. Modern System of Production from Scrap Alloys.** Anon. (*Met. Ind. (Lond.)*, 1931, 39, 490).—Type-metal is now usually made from alloys, scrap, dross, &c., by smelters and supplied to the type-founders with a composition of tin 30, antimony 30, and lead 40%, or tin 20, antimony 30, and lead 50%. Frequently a white-metal alloy not approximating to these compositions is supplied, and requires conversion. Copper is removed as a matte. Antimony is removed by overheating the alloy at about 600° C. and adding the correct amount of aluminium as molten foil at about 650° C., this being poured in a thin stream on to the molten type-metal. When the mass cools, a thick dross containing the antimony is formed. This is removed and liquated to recover the metal. The small amount of aluminium still remaining in the type-metal is removed by steaming according to Parke's process.—J. H. W.

**Bottom Pouring Hand Ladle.** J. H. Rodgers (*Canad. Mach.*, 1930, 41, (22), 42; and *Power House*, 1931, 25, (2), 40).—A cone-shaped ladle, giving a clear view of the opening to receive the molten metal, has its lower end closed by a valve, which can be operated by a spindle and trigger, and which is normally kept closed by a spring. A stop prevents twisting of the spindle, and the whole can be held and operated by one hand. The use of this type of ladle gives easy control, avoids splashing, and obviates skimming.—P. M. C. R.

**Improved Types of Ladles made by Oxy-Acetylene Welding.** Anon. (*Indust. Gases*, 1930, 11, 159).—Illustrates and gives full details of welded ladles for white-metalling bearings and for pouring solder strips in quantity.—H. W. G. H.

**Briquetting Machine for Metal Scrap.** Anon. (*Compressed Air Mag.*, 1930, 35, (11), 3315).—Briquettes of scrap metal (chips, turnings, &c.) with a density as high as 85% of the original metal can be produced by the Southwark briquetting machine; such briquettes are easily re-melted with little waste.—P. M. C. R.

**Cleaning Castings.** P. W. Peel (*Indian and Eastern Eng.*, 1931, 68, 685-687).—Cleaning in a rattling barrel is now being superseded by sand-blasting. Methods of dust elimination are described. Details of the working of a sand-blast tumbling barrel are given. The selection of abrasives is discussed, and a description is given of a modern sand-blast room.—P. M. C. R.

**Cleaning Castings by Hydro-Blast Method.** Anon. (*Canad. Mach.*, 1930, 41, (7), 38-39).—Castings are cleaned by this method much more quickly and efficiently than by hand; the hydro-blast is applicable to complex castings. Dust is eliminated, and about 75% of the core sand is recovered, and after being rebounded can be put into use again. The equipment consists of a housing to enclose the castings and limit the throwing of water, sand, coke, and core irons. A turntable carries the castings, which can thus be kept advantageously placed, and water is supplied through a high-pressure pump. A screening system is needed, and the water must be led off after passing through the screens. Fuller constructional details are appended.—P. M. C. R.

**Sand-Blasting Tests.** Anon. (*Indian Eng.*, 1931, 90, (3), 53).—Recent abrasion tests carried out by the American Hardware Corporation are described. 200 lb. of silica sand, alundum, and steel grit were used for sand-blasting under service conditions until each material had lost its effectiveness. The steel grit showed an effective life of four times that of the alundum and seventeen times that of the sand, besides being much the cleanest abrasive tested and causing least labour and least nozzle wear. The initial cost, however, is relatively high.—P. M. C. R.

**Novel Pattern Methods Devised to Make Decorative Castings.** James Breakey (*Canad. Found.*, 1931, 22, (7), 7-9).—A description of the patterning, moulding, and coring for special decorative castings in bronze and aluminium alloys is given.—J. H. W.

**Facing Materials for Ingot Moulds.** Anon. (*Compressed Air Mag.*, 1931, 36, (11), 3647).—Adhesion of oxide crusts to the walls of moulds is checked by facing with graphite and bitumen; with large bottom-cast ingots, formation of oxide crust persisted. It was obviated by the use of a powdered aluminium facing, or of a mixture of aluminium powder and either water-free tar or quickly-drying asphalt. The correct method of application is described.

—P. M. C. R.

**The Character of Sand Grains.** H. Ries and G. D. Constant (*Trans. Bull. Amer. Found. Assoc.*, 1931, 2, (10), 353-391; discussion, 391-392).—R. and C. have made a microscopic study of the sieve separates of several hundreds of sands. The characteristic features of the constitution, shape, and surface of the grains are described, and it is pointed out that these may and probably do exert an influence on the different properties of sand, such as permeability, bond strength, flowing quality, sintering absorption, &c. It is also evident that the formation of the deposit cannot be determined from a study of the texture and grain characters alone.—S. G.

**A Grain Distribution Index for Sand Grading.** Clarence E. Jackson (*Trans. Bull. Amer. Found. Assoc.*, 1931, 2, (11), 506-512).—The present development of the American Foundrymen's Association grading classification is briefly discussed. The need for a grain distribution index is pointed out. Previous methods suggested for this determination are reviewed. A method is developed, based on statistical analysis, that yields a numerical value for a grain distribution index. Directions for the use of the method are given, and the method is used in application to actual sand samples.—S. G.

**Effect of Heat on the Permeability of Sea Coal Facing Sands and Core Sand Mixtures.** Walter M. Saunders and Walter M. Saunders, Jr. (*Trans. Bull. Amer. Found. Assoc.*, 1931, 2, (10), 440-447; discussion, 447-448).—An explanation is advanced of the effectiveness of sea coal in facing sands for the purpose of producing smooth castings. On heating test cores of moulding



sand and sea coal mixtures, and also core sand with binders, the permeability decreases considerably. The proportions of sea coal and moulding sand may vary greatly without affecting the reduction of permeability when mixtures are heated. When sea coal is mixed with moulding sand and heated under the conditions of the tests, very little volatile matter is left in the mixtures.

—S. G.

**Old Miner Shows Foundry Way to Cut Costs.** A. S. Taylor (*Compressed Air Mag.*, 1930, 35, (5), 3125-3128).—A detailed and illustrated description of the Bullard method of disintegrating and breaking out sand cores by high-pressure water jets.—P. M. C. R.

**Foundry Processes.** Anon. (*Indian Railway Gazette*, 1931, 30, (9), 76-79).—The selection and preparation of sand, and the making of cores and of moulds, are briefly described, and the various operations are illustrated.

—P. M. C. R.

**Sand-Rubbing Machines.** Anon. (*Burn's Eng. Mag.*, 1931, 28, 9-10).—2 types of sand-rubbing machine are described. The Universal System of Machine Moulding and Machinery Co., Ltd., claim for them that they can incorporate clay with either burnt or silica sand by a rod process. The dry method vitiates the bonding qualities of the clay and the permeability of the product, and is, moreover, expensive. The larger machine gives an hourly output of 15 tons of sand, without undue crushing.—P. M. C. R.

## XVI.—FURNACES AND FUELS

### FURNACES

**Industrial Furnaces.** John Fallon (*Fuel Economy Review*, 1931, 10, 40-47).—Recent types of furnaces, principally for heat-treatment, representative of their class in productive capacity, precision heating, and economy in fuel, maintenance, and labour, are briefly discussed. The general trend in recent years has been to design each furnace unit as a complete machine incorporating means for charging and discharging and for automatic control.—J. S. G. T.

**Industrial Thermal Efficiency.** E. G. Phillips (*Fuel Economy Review*, 1931, 10, 62-68).—The necessity for a more definite knowledge of the efficiency of heat-production and heat-utilization plants and processes in industry is urged. It is suggested that the output of the heat-production department of a works should be measured and every department using heat should be periodically informed of, and charged for, its heat consumption.—J. S. G. T.

**Theory of Heat Transfer.** W. E. Stark (*Amer. Gas J.*, 1931, 135, (1), 25-27).—Laws governing the passage of heat from its source to the medium to be heated are briefly discussed. The importance of reducing surface film resistance is stressed. The radiation from flames is considerable and often underestimated.—J. S. G. T.

**Pyroptic Furnace Inspection Window.** Anon. (*Fuel Economist*, 1931, 7, (73), 32-39).—A form of inspection window suitable for all kinds of furnaces operating at temperatures up to 2800° F. (1537° C.) is briefly described. The window is supported free from strains and the glass can be removed or cleaned. The window is ventilated internally to prevent deposition of ash, slag, &c., on the window.—J. S. G. T.

**Mirror Melting Furnace.** Anon. (*Indian Eng.*, 1931, 89, 533).—Cf. this *J.*, 1931, 47, 612. Briefly describes the use of an elliptical mirror with an electric arc lamp in adapting the principle of the burning-glass to furnace work.

—P. M. C. R.

**The Practical Barthel Soldering and Melting Furnace "Amiantha."** Anon. (*Z.V.d. Kupferschmied.*, 1931, 43, 263-264; and *Apparatebau*, 1931, 43, 269-270).—Description of a small handy petroleum and benzine furnace

especially suitable for heating soldering bits, &c. The furnace is made up by Gustav Barthel, Dresden A. 21, Germany.—M. H.

**The Ellipsoid Furnace.** Anon. (*Found. Trade J.*, 1931, 45, 315).—A description of a rotary oil-fired furnace with a deep bath and suitable for casting brass and bronze is given.—J. H. W.

**The Brandt Furnace.** Anon. (*Canad. Mach.*, 1929, 40, (14), 55).—A furnace for the annealing, soldering, or heat-treatment of gold, nickel, silver, brass, copper, steel, &c., is described. The Brandt Engineering Corporation, New York, claims that it brightens metal discoloured by a blow-torch flame, eliminates oxidation and cleaning, affords simple temperature control, is continuous in operation, and requires one operator only.—P. M. C. R.

**Industrial Furnaces for Gas.** Lawrence E. Biemiller (*Amer. Gas J.*, 1931, 134, (2), 34-36, (3), 36-39, (4), 46-48, (5), 57-59, (6), 39-41; 135, (1), 48-49, (2), 47-48, (3), 54-56, (4), 68-69, (5), 62-63, 67, (6), 33-35).—Metal pot furnaces for soft-metal melting, crucible furnaces, special furnaces for metal melting and reduction, heat-treatment pot and oven furnaces, and muffle, combination, and rotary furnaces, rivet heaters, small and large forge furnaces, and accessory equipment are discussed and illustrated.—J. S. G. T.

**Modern Brass-Melting Furnace of Radically New Type.** Anon. (*Amer. Gas J.*, 1929, 130, (5), 60-61).—A gas-fired brass-melting furnace comprising a revolving drum made of a special alloy enclosed in an insulated refractory-lined shell is briefly described. Losses of metal occur only during pouring, and the efficiency claimed is 2.5 ft.<sup>3</sup> of gas per lb. of brass melted. (See also this *J.*, 1929, 42, 673.)—J. S. G. T.

**Gas for Baking Radiator Cores.** Lawrence E. Biemiller (*Amer. Gas J.*, 1930, 132, (3), 54-56).—The application of gas-fired furnaces for baking cores used in the production of automobile radiators, the cores being made of a mixture of sand, linseed oil, and water, is described and illustrated. The efficiency attained is 2.21 ft.<sup>3</sup> of gas per lb. dry core. Very few defective cores are produced. Both truck-type and continuous-type ovens have been employed. Advantages of the respective systems are briefly referred to.

—J. S. G. T.

**Temperature Control of Gas-Fired Furnaces as Related to Production Costs.** Alvin M. Stock (*Amer. Gas J.*, 1929, 131, (4), 55-57).—Advantages of automatic temperature control of furnaces are briefly reviewed. These include economy of fuel, material, time and labour, uniformity and increase of production.—J. S. G. T.

**Gas-Burner Design.** E. R. Weaver, J. H. Eiseman, and F. A. Smith (*Amer. Gas J.*, 1931, 134, (5), 54-56, (6), 35-38, 62; 135, (1), 37-40).—Underlying phenomena in gas-burner operation, the entrainment of primary air, and details and dimensions of burner parts are discussed.—J. S. G. T.

**Gas-Pressure Regulation.** Geo. Wehrle (*Amer. Gas J.*, 1931, 134, (5), 36-39, (6), 46-48; 135, (1) 34-36).—Various types of gas-pressure regulators, designs of distribution systems, and accessories are discussed and illustrated.

—J. S. G. T.

**Electric Heat for Industry.** British Electrical Development Association (*Brit. Elect. Development Assoc.*, E.D.A., 906, 1931, 1-32; *Bull. B.N.F.M.R.A.*, 1931, (38), 17).—Gives a general idea of what has been accomplished by illustrating typical examples of electric furnace equipment. Among materials to which electric heat has been applied are mentioned aluminium, brass, copper, lead, phosphor-bronze, and zinc. It is stated that more than 500,000 lb. of brass are now being melted electrically every day in Great Britain.—S. G.

**Perfect Electric Galvanizing Furnace for Wire.** Anon. (*Canad. Mach.*, 1931, 42, (8), 38).—Low electric power cost in Hamilton, Ontario, renders possible the Frost Steel and Wire Co.'s use of an electric furnace in galvanizing wire. The capacity is about 35 tons of molten zinc; the wires are drawn

through the furnace at an automatically controlled temperature. The makers claim that galvanized wire so produced can be wrapped round its own diameter without fracture or separation of the coating, and further that uniformity of tensile strength, ductility, and temper is obtained.—P. M. C. R.

**Atmosphere of Electric Furnaces is Controlled by Electrolene Producer.** H. M. Webber (*Automotive Ind.*, 1931, 65, 690–693).—A copper brazing plant with controlled atmosphere is described. "Electrolene," the atmosphere selected, is produced by electrically heating a mixture of town gas and steam; the resulting mixture contains 25% carbon monoxide and 67% hydrogen, as against 1.1% and 15.5%, respectively, in town gas. Copper and iron strip are laterally rolled together into a double-walled tube; copper is applied to the joints, and the tubes are fed into the furnace system, the heating section of which operates at about 1150° C. The molten copper alloys with the iron, producing a sound and clean inter-metallic joint. Plant and furnaces are illustrated.—P. M. C. R.

**Experiences with Some Electric Furnaces for Melting Copper and Copper Alloys.** W. L. Govier (*Met. Ind. (Lond.)*, 1931, 39, 535–537, 564–566, 568; discussion 586).—Read before the Glasgow Local Section of the Institute of Metals. Arc furnaces have the disadvantages of local overheating and certain difficulties in operation, and resistance furnaces are now largely used for brass melting. These latter are of 2 types: (1) the crucible type using a carbon resistance and (2) the hearth type. The former are not very successful owing to increased labour and fuel costs and low rate of production. A full description of the Baily furnace, with its method of operation and applications, is given, and the use and advantages and disadvantages of low-frequency furnaces are considered. The efficiency of the Ajax-Wyatt and the Russ furnaces depends on the pinch effect and the motor effect of an electric current passing through molten metal. Melting brass in these furnaces often causes furring-up and erosion, but they are very suitable for copper-nickel alloys, stick carbon being used as a cover for the charge. In high-frequency furnaces the metal forms the secondary loop of a high-frequency transformer circuit. The temperatures obtainable are limited only by the refractoriness of the furnace lining. These furnaces are especially suitable for melting pure nickel, 0.3% manganese being used as a deoxidizer.—J. H. W.

**An Inexpensive Electric Furnace.** Anon. (*Indian Eng.*, 1931, 90, 74).—A simple type of resistance furnace is described. For temperatures up to 950° C., the Alundum core is wound with Nichrome; for higher temperatures, not exceeding 1500° C., platinum or one of the allied metals is used. A method of reducing overload on the heating element is described, and some limitations of this type of furnace are indicated.—P. M. C. R.

**The Low-Frequency Induction Furnace and its Scope.** A. G. Robiette (*Metallurgia*, 1931, 4, 153–155, 175–176).—The development of the induction method of heating is considered, and particularly the development of the submerged-ring type of furnace which overcomes such difficulties as those produced by the "pinch effect" causing rupturing of the metal in the secondary channel, the volatilization of zinc in the melting of brass, and the tendency to gravitational segregation in certain alloys. Improvements in lining methods, such as using a clay-base refractory or a fritting method found to be beneficial in coreless induction furnaces, have made possible the melting of high-copper alloys, nickel-brasses, and cupro-nickel alloys, whilst a corundum-base lining has been found most satisfactory for pure copper. 4 sizes of furnaces are constructed holding 300 lb., 600 lb., 1200 lb., and 2400 lb., and require respectively 40, 60, 120, and 240 kw. The operating efficiency under the most favourable conditions—continuous working and short pouring time—when melting yellow brass is a consumption of 200 units/ton.

—J. W. D.

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- \*Institution of Chemical Engineers. *List of Members*. Demy 8vo. Pp. 61. 1931. London: The Institution, Abbey House, Victoria St., S.W.1.
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[Contains the following: "President's Address," by C. A. McCune; "The Business Outlook," by Marc A. Rose; "Production Welding by Oxy-Acetylene Process," by Earl A. Booth; "Resumé of Production Welding. An Introduction to Oxy-Acetylene Committee Report," by L. R. Gurley; Discussion on "Report of Oxy-Acetylene Committee"; "Experiments on Gas-Welded Structural Joints," by James R. Griffith; "Inspection of Welded Steel Framing in Buildings," by F. Eder; "Welding in the Construction of a Home," by Eric H. Ewertz; Discussion of American Welding Society's Structural Welding Code; "Welded Piping System in the Montgomery-Ward Building Chicago," by W. H. McCaully; "Welding as Applied to Sprinkler Systems," by F. B. Quackenboss; "The Development of Oxy-Acetylene Welding in the Various Piping Fields," by R. E. Fritsch; "Working against Time and Cost with the Oxy-Acetylene Process in Shipyards," by James W. Owens; "General Railroad Welding," by G. H. Gjertsen; "Reclamation Welding and Cutting," by G. W. Lieber; "Cold Facts Concerning the Welding of Battered Rail Ends," by S. E. Tracy; "Commercial Aircraft and Welding," by Charles Froesch; "Welded Aluminium in Tank Trucks," by W. M. Dunlap; "Success of Oxy-Acetylene Welded Pipe Line," by G. O. Carter and T. W. Greene; "Oxy-Acetylene Welding in Local Gas Transmission and Distribution," by L. A. Kirsch; "Economics of Welding in Maintenance and Operation of Gas Transmission Systems," by Eric Larson.]

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**Lenzen, Victor F.** *The Nature of Physical Theory: a Study in Theory of Knowledge.* Med. 8vo. Pp. xii + 301. 1931. New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd. (21s. net.)

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- \*Macchia, Osvaldo. *Cromatura elettrolitica.* Med. 8vo. Pp. xvi + 489, with 204 illustrations. 1932. Milano: Ulrico Hoepli. (Lire 50.)
- Martin, L. C., and Johnston, B. K. *Practical Microscopy.* (Blackie's "Technique" Series.) Cr. 8vo. Pp. vii + 116, with 10 plates. 1931. London, Glasgow, and Bombay: Blackie and Son, Ltd. (3s. 6d. net.)
- Medicus, L. *Kurze Anleitung zur qualitativen Analyse: zum Gebrauch beim Unterricht in chemischen Laboratorien.* Dreiundzwanzigste verbesserte Auflage. (Einleitung in die chemische Analyse, Heft 1.) 8vo. Pp. x + 135. 1931. Dresden und Leipzig: Theodor Steinkopff. (R.M. 5.)
- Medicus, L. *Kurze Anleitung zur technisch-chemischen Analyse.* (Einleitung in die chemische Analyse, Heft 4.) Dritte vollständig neubearbeitete Auflage, von H. Töpelmann. 8vo. Pp. viii + 172. 1931. Dresden und Leipzig: Theodor Steinkopff. (R.M. 6.)
- \*Mining and Metallurgical Society of America. *Copper Tariff Number.* (Bulletin No. 222.) Med. 8vo. Pp. 83-115. 1931. New York: Mining and Metallurgical Society of America, 75 West St.  
[Contains the following three papers, and a discussion: "The Need of a Copper Tariff," by A. E. Peterman; "Does the United States Need a Copper Tariff?", by Percy E. Barbour, and "A Copper Tariff," by Arthur Notman.]
- Munby, Alan E. *Laboratories: their Planning and Fittings.* With an Historical Introduction by the late Sir Arthur E. Shipley. Cr. 4to. Pp. xix + 224. 1931. London: G. Bell and Sons, Ltd. (30s. net.)
- \*Nederlandsch Instituut voor Documentatie en Registratuur. *Repertorium Technicum. International Bi-monthly Bibliography of Books and Articles appearing in Periodicals on Technical and Allied Subjects.* [Mimeographed.] 4to. Volumen I. Fasc. No. 3. Pp. 110-205. Fasc. No. 2. Pp. 206-291. 1931. Den Haag: Nederlandsch Instituut voor Documentatie en Registratuur, Carel van Bylandtlaan, 30. (£3 per annum.)
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- Norton, F. H. *Refractories.* Roy. 8vo. Pp. 594. 1931. New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd. (36s. net.)
- \*Optical Year-Book, Directory and Appointment Diary, 1932. 4to. Pp. 95. 1932. London: The Hatton Press, Ltd.
- Pehrson, E. W. *Zinc in 1929.* (Mineral Resources of the United States, 1929. Part I.) Med. 8vo. Pp. 675-727. 1931. Washington, D.C.: Government Printing Office. (10 cents.)



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[Contents : Description and properties, history, occurrence, uses, production, markets and prices, bibliography.]

- \*Petar, Alice V. *Gallium, Germanium, Indium, and Scandium*. (U.S. Bureau of Mines, Information Circular No. 6401.) [Mimeographed.] 4to. Pp. 17. 1930. Washington, D.C. : Bureau of Mines.

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- Prost. *Métallurgie des métaux autres que le fer*. (Compléments à la 2e. édition.) Pp. 696. 1931. Paris : Ch. Béranger. (Relié, 160 francs.)

- \*Railway Officials. *The Railway Diary and Officials' Directory*, 1932. Med. 8vo. Pp. 214. 1932. London : McCorquodale and Co., Ltd., Cardington St., Euston Sq., N.W.1. (3s. 6d.)

- \*Rolfe, R. T. Edited by. *Foundrywork and Metallurgy. A Practical and Authoritative Guide for Moulders, Patternmakers, and Apprentices*. To be completed in about 30 weekly parts. Cr. 8vo. Part 13, pp. 769-832. Part 14, pp. 833-896. Part 15, pp. 897-960. Part 16, pp. 961-1024 (end of Volume IV). Part 17, pp. 1025-1088. Part 18, pp. 1089-1152. 1931. London, Bath, Melbourne, Toronto and New York : Sir Isaac Pitman and Sons, Ltd. (1s. per part.)

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- Rossmann, Joseph. *The Psychology of the Inventor. A Study of the Patentee*. Pp. 252. 1931. Washington, D.C. : The Inventors Publishing Co., 1266 New Hampshire Ave. (\$3.00.)

- Santmyers, R. M. *Barite and Barium Compounds*. Part II.—*Barium Products*. U.S. Bureau of Mines, Information Circular No. 6223 (revised). Pp. 26. 1931. Washington, D.C. : Bureau of Mines.

- \*Santmyers, R. M. *Cæsium, Rubidium, and Lithium*. (U.S. Bureau of Mines, Information Circular No. 6215.) [Mimeographed.] 4to. Pp. 17. 1930. Washington, D.C. : Bureau of Mines.

[Contents : History, minerals and ores, tests for identification, uses, sources of supply and production, imports and exports, markets and prices, list of producers and dealers, list of purchasers; bibliography.]

- \*Santmyers, R. M. *Monazite, Thorium, and Cerium*. (U.S. Bureau of Mines, Circular No. 6321.) [Mimeographed.] 4to. Pp. 43. 1930. Washington, D.C. : Bureau of Mines.

[Contents : Minerals and ores, tests for identification, history, mode of occurrence, geographical distribution, mining and preparation, world production, domestic production and costs, imports, tariff history, exports, monazite trade in foreign countries, markets and prices, incandescent gas mantles, gas-mantle scrap, properties of thorium, thorium nitrate (uses, manufacture, imports, exports), mesothorium, properties of cerium, cerium nitrate, description and uses, pyrophoric alloys (uses, manufacture, imports), purchases of thorium and cerium compounds, flaming arc carbons and glower lamps; bibliography.]

- \*Santmyers, R. M. *Selenium and Tellurium*. (U.S. Bureau of Mines, Information Circular No. 6317.) [Mimeographed.] 4to. Pp. 23. 1930. Washington, D.C. : Bureau of Mines.

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- Smith, L. A. *Manganese and Manganiferous Ores in 1929.* (Mineral Industry of the United States, 1929. Part I.) Med. 8vo. Pp. 275-332. 1931. Washington, D.C. : Government Printing Office. (10 cents.)
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- Tyler, P. M. *Antimony in 1929.* (Mineral Resources of the United States, 1929. Part I.) Med. 8vo. Pp. 1-15. 1931. Washington, D.C. : Government Printing Office. (5 cents.)
- \*Tyler, Paul M. *Bismuth.* (U.S. Bureau of Mines, Information Circular No. 6466.) [Mimeographed.] 4to. Pp. 19. 1931. Washington, D.C. : Bureau of Mines.  
 [Contents : Description and properties, uses, history, occurrence, extraction, world production, domestic production, imports, tariff duties, exports, industry in foreign countries, market control, markets and prices, list of bismuth metal producers and dealers, list of possible producers of ore and residues, list of possible buyers and consumers.]
- \*Tyler, Paul M. *Hafnium.* (U.S. Bureau of Mines, Information Circular No. 6457.) [Mimeographed.] 4to. Pp. 11. 1931. Washington, D.C. : Bureau of Mines.  
 [Contents : Description and properties, occurrence, identification and analysis, geographical distribution, history, separation of zirconium and hafnium, preparation of hafnium and zirconium, preparation of pure hafnium salts, production and trade.]
- Tyler, Paul M. *Magnesite.* (U.S. Bureau of Mines, Information Circular No. 6437.) Pp. 53. 1931. Washington, D.C. : Bureau of Mines.
- Tyler, Paul M. *Mercury in 1929.* (Mineral Resources of the United States, 1929. Part I.) Med. 8vo. Pp. 31-56. 1931. Washington, D.C. : Government Printing Office. (5 cents.)
- \*Tyler, Paul M. *Rhenium (and Masurium).* (U.S. Bureau of Mines, Information Circular No. 6475.) [Mimeographed.] 4to. Pp. 17. 1931. Washington, D.C. : Bureau of Mines.  
 [Contents : Description and properties; identification and analysis, occurrence, history, extraction and preparation of rhenium, production and trade, prospective uses; bibliography.]
- \*Tyler, Paul M., and Santmyers, R. M. *Platinum.* (U.S. Bureau of Mines, Information Circular No. 6389.) [Mimeographed.] 4to. Pp. 69. 1931. Washington, D.C. : Bureau of Mines.  
 [Contents : Description and properties, uses, alloys, substitutes, stamping laws, history, ores and minerals, mode of occurrence, assaying, qualitative test, mining operations, mechanical concentration, refining, world production, organization of platinum industry, marketing, prices, costs and international competition, iridosmine or osmiridium.]

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- \*U.S. Department of Commerce, Bureau of Standards. *Supplement to Recommended Minimum Requirements for Plumbing.* Progress revision, May, 1931. Med. 8vo. Pp. 3, with 6 folding tables and diagrams. 1931. Washington, D.C.: Government Printing Office.
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- Van Leuven, E. Perry. *Cold Metal Working; an Introductory Course to the Metal Trades.* Med. 8vo. Pp. 275. 1931. New York: McGraw-Hill Book Co., Inc. (\$2.25); London: McGraw-Hill Publishing Co., Ltd. (13s. 6d. net.)
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- Wejnarth, Axel. *Beiträge zur Kenntnis der Elektrothermischen Zinkgewinnungsmethode.* Avhandling som med tillstånd av K. Tekniska Högskolan för Teknologie Doktorgrads vinnande den 29 Mars 1930 kl. 14 å stora hörsalen (N: R: 407) inom fackavdelningens för kemi och kemisk teknologi byggnad vid Tekniska Högskolan, Valhallavägen, till offentlig granskning framlägges. 8vo. Pp. vii + 146, with 21 illustrations in the text. 1930. Stockholm: Wille Hedbergs Tryckeri Aktiebolag.
- West, Clarence J., and Hull, Callie. Compiled by. *Industrial Research Laboratories of the United States, Including Consulting Research Laboratories.* (National Research Council, Bulletin 81.) Fourth edition. Pp. 267. 1931. Washington, D.C.: National Research Council. (\$2.00.)
- Who's Who in Engineering. *A Biographical Dictionary of the Engineering Profession.* Third edition. Pp. 1536. New York: Lewis Historical Publishing Co.
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\*Youngman, E. P. *Zirconium*. Part I.—*General Information*. (U.S. Bureau of Mines, Information Circular No. 6455.) [Mimeographed.] 4to. Pp. 30. 1931. Washington, D.C.: Bureau of Mines.

(Contents: Description and properties (metal and oxide), history, uses (metal, oxide and other compounds), alloys, minerals, ores, occurrence, mining and concentration, preparation (metal and oxide), world and domestic production, imports, markets and prices, list of importers, producers and dealers (U.S.A. and foreign), list of possible buyers (U.S.A. and foreign), patents reported in 1929 and 1930.)

\*Youngman, E. P. *Zirconium*. Part II.—*Domestic and Foreign Deposits* (U.S. Bureau of Mines, Information Circular No. 6456.) [Mimeographed.] 4to. Pp. 63. 1931. Washington, D.C.: Bureau of Mines.

Zeise, H. *Repertorium der physikalischen Chemie*. (Teubners Mathematische Leitfaden, Band 32.) Pp. vi + 215. 1931. Leipzig und Berlin: B. G. Teubner. (R.M. 8.)

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## XX.—BOOK REVIEWS

(Continued from pp. 63-64.)

**Metallographers' Handbook of Etching.** Compiled by Torkel Berglund. Translated from the Swedish by William H. Dearden. Demy 8vo. Pp. ix + 183, with 17 illustrations. 1931. London, Bath, Melbourne, Toronto, and New York: Sir Isaac Pitman and Sons, Ltd. (12s. 6d. net.)

The Society of Swedish Metallographers has rendered a considerable service to metallographists in proposing and arranging the publication of this handbook of etching. The fact that the book is issued under the auspices of this society, with a foreword by its President, Professor Dr. Carl Benedicks, is in itself more than a sufficient recommendation, but the author deserves every credit for the manner in which the information has been collected, classified, and presented. Mr. W. H. Dearden has carried out the translation in a most admirable manner, and has thereby provided the most comprehensive work on this branch of the subject available in the English language. Originally, it was intended to confine the book to the etching of iron and steel, but later it was decided to embrace both ferrous and non-ferrous alloys. This enlargement has greatly increased its value as a standard work of reference.

The first two chapters are devoted to general considerations, including the sampling and preparation of the specimens, the chemistry of etching, and the influence of various factors on the results obtained. It is perhaps to be regretted that the preparation of the specimens prior to etching, although not properly included under the heading of etching, has not been dealt with in far greater detail. Even comprehensive descriptions of the actual grinding and polishing operations, with information on the choice and grades of abrasives available and their respective methods of application, would have necessitated little enlargement of the work. With these additions, the book would cover in a most complete manner all stages in the preparation of metallographic specimens, and would have an even greater value.

Chapter III is devoted to the micro-etching of iron and steel, and includes particulars of a large number of reagents which have been found of service by individual investigators for special purposes. The micro-etching of iron and steel is next dealt with, and this section again includes numerous references to little-used reagents, which have found application in various researches. Special reference is made to reagents suitable for the various groups of special steels, and very full tables (from Wohrman) are given for the identification of non-metallic inclusions.

The last chapter is devoted to the etching methods employed for the chief groups of the non-ferrous alloys. This work provides the most comprehensive list of etching reagents available. It includes all the more usual reagents, and in addition a very large number of alternative or specialized reagents.

It is possible that an inexperienced experimentalist may find some difficulty in the selection of a suitable reagent for any given purpose, owing to the number of alternatives available and the somewhat restricted guidance that is given by the author. The reagents ordinarily employed in the majority of metallographic laboratories are relatively few in number, and this limitation makes for simplicity and readily comparable results. Some additional method of classification, which would enable the inexperienced reader to distinguish with certainty the more common reagents, would therefore be of value. Finally, special mention may be made of the completeness of the references and the inclusion of a satisfactory index.

—L. T.

**Anniversary Volume dedicated to Masumi Chikashige by his Pupils in Celebration of his Sixtieth Birthday.** Sup. Roy. 8vo. Pp. x + 348, with numerous illustrations. 1930. Kyoto: Kyoto Kagaku Gakushi Kwai, Institute of Chemistry, Department of Science, Imperial University.

This book contains a collection of 20 papers on biochemical, chemical, and metallurgical subjects by the students of Professor Masumi Chikashige, together with a short biography of the Professor, and a bibliography of his work. The details of the papers will be found in the abstracts of the Institute (this *J.*, 1931, 47), and do not call for comment here, although it may be noted that some of the papers contain both original and previously published work. In so far as the book may be taken as an indication of the present standard of Japanese research work in physical metallurgy, the reviewer is struck by the following points. The work on equilibrium diagrams is accurate in so far as concerns the determination of the liquidus, but solidus points are still taken directly from cooling curves and durations of arrests, although this method is known to be inaccurate in cases where diffusion has to occur in the solid if true equilibrium is to be reached. The method of long annealing and quenching is frequently omitted entirely. In other work the importance of giving details of heat-treatment is not appreciated. Thus hardness tests are described for complex ternary alloys of silver with no indications as to whether the alloys were as cast, worked, or annealed, &c. Malleability tests are described for these alloys after "they had been annealed for a few hours," whilst the crystal structure of the antimony-cadmium alloys was investigated from specimens melted at 650° under a flux, and "considered to solidify under conditions corresponding to the points . . . in the equilibrium diagram." In the opinion of the reviewer it may well be questioned whether it is worth while to publish papers in which the conditions of the materials under investigation are so vaguely described. As a tribute to a distinguished scientist the book is very welcome, but the reviewer is left with the impression that, when compared with the better-class metallurgical research work of to-day, much of the non-ferrous metallurgical work presented here loses its value owing to the omission of vital details in publication, and to a failure to appreciate the necessity of prolonged heat-treatment in order to obtain complex alloys in an equilibrium state.—W. HUME-ROTHERY.

**XXXVI. Hauptversammlung der Deutschen Bunsen-Gesellschaft für angewandte physikalische Chemie E.V. vom 25. bis 28. Mai, 1931, zu Wien. 67 Vorträge (mit Diskussionen) darunter 5 zusammenfassende Vorträge über das Hauptthema; Fortschritte der Metallkunde und ihre Anwendungen auf Leichtmetalle.** 4to. Pp. v + 353, with 342 illustrations. 1931. Berlin: Verlag Chemie G.m.b.H. (M. 16.)

This volume contains the complete proceedings at the 36th General Meeting at Vienna of the German Bunsen-Gesellschaft. Of the 67 papers included, about 30 are of metallurgical interest, and of these more than 20 are of purely non-ferrous interest, including five papers of a more or less review nature dealing with recent advances in the metallography of the light metals. Abstracts of all the papers within the scope of this *Journal* have appeared in this *Journal*. They deal with such subjects as the mechanism of age-hardening, the study of crystal structure by X-ray analysis and its modification by deformation and heat-treatment, the formation of films on metals, the rate of dissolution of metals in acids, and various aspects of electroplating. Altogether this is a volume of considerable interest to all concerned with the study of metals and physical metallurgy.—A. R. POWELL.

**Foundry Work and Metallurgy. A Practical and Authoritative Guide for Moulders, Patternmakers, and Apprentices.** Edited by R. T. Rolfe. To be completed in about 30 weekly parts. Cr. 8vo. Parts 1-12. 1931. London, Bath, Melbourne, Toronto, and New York: Sir Isaac Pitman & Sons, Ltd. (1s. per part.)

It is rather a new departure to publish a technical work in weekly parts in order that the reader may pay for it on the instalment system. To some this may be a distinct advantage, as well as affording the opportunity of completing the reading of the book in comfortable

stages. The casting of metals is the primary subject with which the book deals, but there are very full sections that treat of the subsidiary operations such as pattern-making, moulding, metal-melting, pyrometry, and refractory materials. The engineering and metallurgical principles involved are carefully explained. Little or no previous knowledge of the subject is assumed, and each section is written by an expert. In the course of the work the reader is led to consider large and complicated castings as well as smaller types more commonly encountered. It is therefore of value to the apprentice as well as to the experienced worker. Unlike certain periodical publications in other spheres, each section is considered completely in its appropriate place in a pre-designed sequence, so that the reader is enabled to obtain a good grasp of one operation before passing on to the next.

The twelve parts under review deal successively with the following branches—pattern-making, moulding and core-making, machine-moulding, moulding sands, non-ferrous metallurgy, ferrous metallurgy, refractories, dressing and sand-blasting, pyrometry, foundry plant, and metal-melting. In general the diagrams and illustrations are clear, but some, unfortunately, are not reproduced with sufficient clarity. Opinions will probably differ on the question as to whether too little or too much descriptive matter has been included, but it may fairly be said that fundamental principles are adequately covered.—W. A. C. NEWMAN.

**Materials of Construction; their Manufacture and Properties.** By (the late) Adelbert P. Mills. Fourth edition, edited by Harrison W. Hayward. Med. 8vo. Pp. xxxv + 423, with 154 illustrations in the text. 1931. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd. (24s. net.)

In the preface, Professor Mills states that this book was "intended primarily as a text-book of somewhat elementary character," and the publication of a fourth edition shows that it has found a place to fill.

185 pages are devoted to the metallic materials of construction, of which the non-ferrous section occupies 47 pages. In this small space are included a brief summary of the extraction processes and properties of copper, zinc, tin, lead, aluminium, and nickel; an explanation of the constitution of alloys, equilibrium diagrams, and the use of the microscope; and a description of the properties of bronzes, brasses, aluminium alloys, nickel alloys, bearing metals, and fusible alloys. This field is clearly too wide to be covered adequately, but, since completeness is neither claimed nor implied, the book should not impart that little knowledge which is dangerous. In this connection, a great improvement would be made if references were more abundant and a bibliography were given at the end of each section.—H. W. G. HIGGERT.

**Der Giessereischachtel in Theorie und Praxis. Handbuch für Giessereiingenieure und Studierende des Giessereifaches.** Von Albert Achenbach. Med. 8vo. Pp. vi + 156, with 72 illustrations in the text. 1931. Leipzig: Max Jänecke. (R.M. 7.80.)

There is little in this book of direct application or use in non-ferrous metallurgy. It deals mainly with the design and construction of various forms of cupolas employed in the large-scale production of grey iron, and presents a very clear picture of the bases of calculation. The conditions of working, and particularly those for economical production, are closely examined. Examples of slag and charge calculations and of process costs are given towards the end of the book.—W. A. C. NEWMAN.

**Handbuch der Eisen- und Stahlgießerei.** Zweite, erweiterte Auflage. Vierter Band: Betriebswissenschaft. Herausgegeben von C. Geiger. Unter Mitarbeit von P. Aulich, O. Bauer, L. Beck, H. Bitter, E. Brütisch, Georg Buzek, T. Cremer, K. Daeves, F. Dellwig, K. Dornhecker, R. Durrer, M. Escher, G. Fick, G. Hellenthal, J. Hornung, C. Irresberger, Th. Klingenstein, H. Kopp, U. Lohse, Fr. Martens, Joh. Mehrtens, M. Phillips, E. Schüz, C. Schwarz, A. Stadeler, R. Stotz, H. Tillmann, L. Treuheit, P. Uebbing, S. J. Waldmann, Fr. Wernicke, A. Widmaier, und H. Witte. Imp. 8vo. Pp. ix + 618, with 526 illustrations in the text and 5 folding plates. 1931. Berlin: Julius Springer. (R.M. 72.)

This is an interesting study of methods employed in the manufacture of iron and steel castings, and has therefore little to do with actual technique in non-ferrous practice. But from a general point of view much may be gained from the analytical presentation of all the factors of which account has to be taken. Detail costing, time studies, mechanical aids to quick working, and similar subjects are discussed very thoroughly in a clear manner. A considerable

section is devoted to works' lay-out and also to the arrangement of laboratory accommodation. Examples and illustrations are given from actual practice. The book is excellently produced.

—W. A. C. NEWMAN.

**The Physics of High Pressure.** By P. W. Bridgman. Demy 8vo. Pp. vi + 398, with 87 illustrations. 1931. London: G. Bell and Sons, Ltd. (22s. 6d. net.)

Research in a vacuum has been the fashion since the beginning of this century, and an abundant harvest has been reaped—cathode-rays, X-rays, the electron, crystal analysis are but a part. However, if Heisenberg is right—and his conclusion is accepted by all physicists—then there is a limit to the information that is obtainable by the investigation of matter in an attenuated state. Interest has now been revived in the investigation of the properties of matter in a highly compressed state. Already the harvest is a bountiful one, if we think only of the synthetic production of ammonia. High-pressure laboratories have been established by Imperial Chemical Industries, Ltd., at Billingham, and Professor Bone has founded a high-pressure school at South Kensington. Professor Bridgman, working at Harvard University, has, since about 1908, carried out very extensive investigations of the properties of matter subjected to pressures of the order of tens of thousands of atmospheres, pressures under which, as I have heard Professor Bridgman state in characteristically American language, "all the slack is taken out of the molecules." A book by Professor Bridgman on the Physics of High Pressure will be very acceptable to all physicists, for most of his work has been published in the *Proceedings of the American Academy of Arts and Sciences*, a somewhat inaccessible publication. And the work will appeal not only to physicists. There is much here to interest metallurgists and technologists generally. Do you want to know how to make a metal pipe joint that will stand 20,000 atmospheres and become tighter as the pressure increases up to bursting point? All the technique of highest pressure work is given in Chapters II and III, following a historical introduction in Chapter I. Then follow chapters devoted to ruptures peculiar to high pressures, P-V-T relation in fluids, the compressibility of solids, melting phenomena, polymorphic transitions, electrical and thermal properties, viscous properties, all under extremely high pressures. The book is very well got up and is well printed on good paper. References are given to practically the whole literature of high pressure work from 1762 to the present day. An adequate name and subject index is provided, and the price of the book is reasonable. Professor Andrade's editorial duties were probably not heavy; they have been efficiently discharged. I do not need to recommend the book to physicists; they have been awaiting its appearance. Well, here it is.—J. S. G. THOMAS.

**Recent Advances in Analytical Chemistry. Volume II.—Inorganic.** Edited by C. Ainsworth Mitchell. Demy 8vo. Pp. xiv + 452, with 26 illustrations in the text. 1931. London: J. & A. Churchill. (15s.)

This book contains detailed accounts of the progress of analytical chemistry in various sections of inorganic chemistry. The material is put forward in 16 chapters, written respectively by authors who have specialized in the branch treated. Chapter I (pp. 1–20), on hydrogen-ion concentration, is written by N. Evers, and contains an account of the method of determination of hydrogen-ion concentration using respectively the hydrogen electrode, the glass electrode, and the quinhydrone electrode. Colorimetric methods and their applications in analytical chemistry are described together with a short account of the methods of potentiometric estimation. Chapter II (pp. 21–60) contains an account of the advances in analytical procedure for lead, mercury, copper, cadmium, and bismuth, the section on lead and bismuth being written by B. S. Evans, that on mercury and copper by S. G. Clarke, and that on cadmium by A. T. Etheridge. Chapter III (pp. 61–98) deals with arsenic, antimony, tin, selenium, and tellurium, the progress in the case of the first three elements being described by B. S. Evans and that of the two latter elements by W. R. Schoeller. Chapter IV (pp. 99–113), on platinum and its congeners, is written by W. R. Schoeller. Chapter V (pp. 114–151) is written as regards iron and chromium by B. S. Evans; aluminium by S. G. Clarke, and beryllium by W. R. Schoeller. Chapter VI (pp. 152–193) deals with the progress in the analysis of steel; the determination of carbon, manganese, aluminium, molybdenum, and phosphorus in iron and steel is described by A. T. Etheridge, that of nickel, chromium, cobalt, arsenic, tantalum, uranium, copper, tin, and sulphur in iron and steel by B. S. Evans, that of silicon, zirconium, cerium, tungsten, titanium, and vanadium in iron and steel by S. G. Clarke and the estimation of gases in steel by Brynmor Jones. Chapter VII (pp. 194–208), on carbon and silicon, is written by C. A. Mitchell, who describes the new work in connection with carbon, graphite, and carbon blacks, whilst that on silicon is given by S. G. Clarke. Chapter VIII (pp. 209–223), on cerium and the rare-earth metals, scandium, gallium, indium and thallium, together with Chapter IX (pp. 224–235), on titanium, hafnium, zirconium, thorium, and germanium, are written by A. R. Powell. Chapter X (pp. 236–261), on vanadium, niobium, and tantalum, is written by W. R. Schoeller. Chapter XI (pp. 262–284) deals with cobalt and nickel, written by S. G. Clarke, and zinc and manganese, written by A. T. Etheridge. Chapter XII (pp. 285–

203), on molybdenum, tungsten, and uranium, is written by A. R. Powell. Chapter XIII (pp. 204-208), on magnesium, by A. T. Etheridge and Chapter XIV (pp. 209-303), on the rarer alkali metals, by W. R. Schoeller. Chapter XV (pp. 304-386), on microchemistry, is written by Miss J. W. Brown. This chapter gives not only an account of the progress within the last few years, but also a very detailed account of microanalytical procedure of both inorganic and organic analysis. The final chapter, XVI (pp. 387-430), deals with the analysis of water and sewage and is written by J. W. Haigh Johnson. Here, in addition to details of new methods and procedure, an unusual feature is the inclusion of long, classified lists of botanical and zoological organisms occurring in polluted water. This is a feature to be welcomed, for it will aid the analyst to interpret his analytical results on the basis of such of these as may be present.

The work of compilation has been carried out in a most excellent manner, and considerable and far-seeing editing has produced a book of the highest value, which is greatly enhanced by the inclusion in the text of very many references to the original literature. There is, however, one point to which the reviewer would take exception—namely the use of the name "niobium" for the element of atomic number 41. Hatchett, the discoverer of this element, named it "columbium" in 1801; the name "niobium" was not introduced until 1844, by Rose. There are but few prerogatives left to discoverers in chemistry, and of these it would appear that the right to name an element should certainly be respected.

The book is beautifully produced, well indexed, and remarkably free from printer's errors. It is a book which can be confidently recommended.—JAMES F. SPENCER.

**Quantitative Chemical Analysis. An Intermediate Text-Book.** By Frank Clowes and J. Bernard Coleman. Revised by D. Stockdale and J. Dexter. Thirteenth Edition. Demy 8vo. Pp. xiv + 605, with 133 illustrations. 1931. London: J. and A. Churchill. (18s.)

That this text-book has reached its thirteenth edition, after a life of forty years, testifies to its great usefulness as an intermediate text-book for students of chemical analysis. There is no doubt that the book is the general favourite with teachers of analytical chemistry in all the most important higher schools and colleges in the country, and it may be said at once that it justifies its popularity, for there is certainly no other book which deals with the preliminary and general operations of the science in such a complete and readily understandable manner as this book does in Part I, which extends over 64 pages. Practically no changes have been made in this section by the revisers, but they have added quite a large amount of valuable new material to Parts II and III, including the use of Devarda's alloy in the analysis of nitrates, the use of titanous chloride in volumetric analysis, and the thiocyanate methods for copper and zinc. Part IV is essentially new, and in it are collected the various electrolytic and colorimetric methods which were previously scattered throughout the book; in addition, this section includes information on the theory of the hydrogen electrode and of oxidation-reduction potentials, as well as descriptions of various electrometric methods. Parts V-VIII inclusive, which deal with the general analysis of organic and inorganic substances, have been very little altered, except that the section on iron and steel analysis has been enlarged. Although on the whole the revisers have done their work very well and have provided an exceedingly diverse selection of analytical methods by practice in which the student should gain a thorough experience in all the common procedures of analytical chemistry, yet there are one or two places where improvement may still be made and others in which an antiquated method is retained. Thus, the separation of arsenic from antimony by precipitation with hydrogen sulphide in 2:1-hydrochloric acid is preferable to and more rapid than precipitation as magnesium ammonium arsenate in alkaline tartrate solution, the sodium peroxide fusion followed by iodine titration for the determination of tin in ores has quite superseded the old dry assay, and the bromate and permanganate titrations for antimony have replaced the iodine-Rochelle salt method. In the description of the method for the determination of lead and zinc in brass (pp. 203-204) the student is advised to start with 7 gm., remove the lead by evaporation with sulphuric acid, then the copper with hydrogen sulphide in a volume of 400 c.c., and finally to titrate the zinc with ferrocyanide; inasmuch as the amount of copper in the trial will generally exceed 4 grms. and the zinc will vary from 1 to nearly 3 grms., the student will find some difficulty in handling the large copper sulphide precipitate and in getting an accurate titration with the large amount of zinc. Again, the method given for the analysis of white metals is very tedious, and not likely to give results of the accuracy required nowadays, especially in inexperienced hands. The bromate method for antimony is much more rapid and accurate than the indirect method described; arsenic can readily be determined by distillation, and lead and copper separated from the sulpho-bases by sodium sulphide in alkaline tartrate solution.

The style of the book is too well known to need description, and apart from the few criticisms mentioned, it is thoroughly worthy to take its place as the foremost intermediate text-book of analytical chemistry in this country; a student who has carefully worked through the majority of the procedures described should indeed have a sound insight into the principles of analysis and a thorough experience of their practical application.—A. R. POWELL.