

# METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

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Part 2

## I.—PROPERTIES OF METALS

(Continued from pp. 1-9.)

**Production and Technical Importance of Beryllium.** Anon. (*Maschinen-konstrukteur*, 1932, 65, (15/16), 100).—The sources and preparation of beryllium are reviewed. The following useful properties of the metal are emphasized: (1) strengthening, hardening, and anti-corrosive effects on copper, aluminium, and nickel; (2) high melting-point (1285° C.) with accompanying retention of strength at comparatively high temperatures; (3) very low sp. gr. (1.84); (4) a transparency to X-rays 17 times as great as that of aluminium, with possible radiographic applications. The oxide is stated to possess good insulating properties.—P. M. C. R.

**On the Thermal Variations of the Density and Molecular Weight of Molten Bismuth.** A. Jouniaux (*Bull. Soc. chim. France*, 1932, [iv], 51, 677-681).—The specific volume  $v_t$  of molten bismuth at  $t^\circ$  as deduced from measurements of the density between 400° and 1100° C. is given by the expression  $v_t = 0.1011 + 1.28(t - 420)10^{-5}$ . The molecular weight of bismuth decreases with rise in temperature until 420° C., when the molecules become monatomic; above 1400° C., the molecular weight rises again to a maximum, then decreases until at 2100° C. it again becomes equal to the atomic weight.—A. R. P.

**[Discussion of L. L. Wyman's Paper on] Copper Embrittlement.** C. S. Smith. W. A. Scheuch. L. L. Wyman (*Min. and Met.*, 1932, 13, 481-483).—Cf. this *J.*, 1932, 50, 722. C. S. S. gives photomicrographs of copper containing 0.103% silicon after annealing for 2 hrs. at 600°-1050° C. packed in cuprous oxide scale. The depth of penetration of the oxide zone has been measured and the results plotted against the temperature of annealing; the curve is a parabola concave to the depth axis. On subsequently annealing copper having an outer oxidized zone in a reducing atmosphere, the embrittling effect extends inwards only to the depth of the oxidized zone so that however high the annealing temperature or however long the line of annealing, the brittle zone will never extend beyond the limits of the original oxidized zone. W. A. S. suggests a hydrogen annealing test as a means of evaluating commercial supplies of copper. L. L. W. suggests that the time of demarcation between the oxidized and unoxidized zones is always parallel to the surface of the metal, but C. S. S., while generally agreeing with this statement, has proved that the line is liable to become very irregular after prolonged exposure of the metal to oxidizing conditions.—A. R. P.

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

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



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

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

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

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

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

**The Thermionic and Photo-Electric Work Functions of Molybdenum.** Lee A. DuBridge and W. W. Roehr (*Phys. Rev.*, 1932, [ii], 42, 52–57).—The photo-electric and thermionic emissions of molybdenum were studied during prolonged degassing at high temperatures. In the final degassed state, photo-electric curves, analysed by Fowler's method, gave the true work function as  $4.15 \pm 0.02$  v. at both room temperature and 940° K. Thermionic data gave the work function as 4.15 v. in complete agreement with the photo-electric method; the value of the constant  $A$  in the Richardson equation was 55 amp./cm<sup>2</sup>.deg.<sup>2</sup>, in good agreement with the theoretical value of 60. Incompletely degassed specimens may reach apparently stable states, and these account for the slightly different values previously found by Dushman, Rowe, Ewald, and Kidner (*Phys. Rev.*, 1925, [ii], 28, 338; this *J.*, 1925, 34, 378), and Martin (*Phys. Rev.*, 1929, [ii], 33, 881; this *J.*, 1929, 42, 405).—W. H.-R.

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

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



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

**Vacuum Apparatus for Measuring Thermal Expansion at Elevated Temperatures, with Measurements on Platinum, Gold, Magnesium, and Zinc.** J. B. Austin (*Physics*, 1932, 3, 240-267).—An apparatus for measuring linear thermal expansion *in vacuo* between room temperature and 950° C. by an optical interference method is described. Although designed primarily for metals which oxidize readily, it appears to be applicable to all metals in temperature ranges through which their vapour pressure is low.  $l_t$  denoting the length at  $t^\circ$  C. of a rod of length  $l_0$  at 0° C., the following relationships were determined experimentally: for platinum,  $l_t = l_0(1 + 8.868 \times 10^{-6}t + 1.324 \times 10^{-9}t^2)$ ; for gold,  $l_t = l_0(1 + 14.06 \times 10^{-6}t + 1.672 \times 10^{-9}t^2 + 1.197 \times 10^{-12}t^3)$ ; for magnesium (annealed at above 250° C.),  $l_t = l_0[1 + (24.80 + 0.00961t^2) \times 10^{-6}]$ . A study of the expansion of zinc single-crystals yields no evidence for the existence of more than one polymorphous form between 20° and 350° C. The vaporization of magnesium and zinc *in vacuo* was much greater than was anticipated from their behaviour in air at 1 atmosphere pressure, and it is suggested that the true vapour pressure of metals at temperatures of a few hundred degrees may be greater than is commonly supposed.—J. S. G. T.

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

**The Atomic Weights of Selenium and Tellurium.** O. Hönigschmid (*Naturwiss.*, 1932, 20, 659).—New determinations of the atomic weights of these elements are in very close agreement with those obtained by the mass spectra method; the values obtained were: selenium,  $78.962 \pm 0.002$ ; tellurium  $127.587 \pm 0.019$ .—J. W.

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

**Changes in the Specific Heat of Tin in the Superconducting State.** W. H. Keesom (*Pontificia Acad. Sci. Novi Lyncaei, Sci. Nuncius Radiophonicus*, 1932, (14), 6-7; *C. Abs.*, 1932, 26, 5824).—Between 3.70° K. and 3.72° K. the sp. heat of tin diminishes from 0.0078 to 0.0054.—S. G.

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

**The Equilibrium  $\text{Sn} + 2\text{CO}_2 \rightleftharpoons \text{SnO}_2 + 2\text{CO}$ .** G. Meyer and F. E. C. Scheffer (*Rec. trav. chim.*, 1932, 51, 569-573).—The composition of gas in equilibrium with tin and stannic oxide at 500° C. is carbon dioxide 73.6, carbon monoxide 26.4%; at 800° C. it is carbon dioxide 79.8, carbon monoxide 20.2%. Temperature has no great influence. The heat of reaction is determined as 3800 grm.-cal. per mol.—E. S. H.

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

**Conduction of Heat and Electricity in Zinc and Cadmium Crystals.** E. Goens and E. Grüneisen (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1932, 16,



220-236).—Reprint from *Ann. Physik*, 1932, [v], 14, 164-180; see this *J.*, 1932, 50, 596.—M. H.

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

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

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

**On the Absolute Magnitude of Metal Surfaces.** O. Erbacher (*Naturwiss.*, 1932, 20, 944-945).—From the quantity and magnitude of the more noble atoms deposited in a monatomic film on a metal surface the absolute magnitude of the surface can be determined. The active part of the absolute surface of the more noble metals (referred to the measured surface) can be determined by charging the surface with hydrogen atoms. Polished nickel, silver, and gold have an absolute surface which is 1.7 times as great as the measured surface; after rubbing with emery this value increases to 2.5, and in both cases it is independent of the grain size. The active surface of polished platinum is 0.07-0.44, that of platinum rubbed with emery 2.1, and that of platinized platinum 17 times as great as the measured surface.—J. W.

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

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



## II.—PROPERTIES OF ALLOYS

(Continued from pp. 9-16).

**Studies on Light Alloys.** Luigi Losana (*Industria chimica*, 1930, 5, 145-150; *C. Abs.*, 1930, 24, 5701).—The coeff. of thermal expansions, heat conductivity, and sp. heat at various temperatures of a number of aluminium-silicon, and aluminium-magnesium alloys have been measured. The equilibrium curves are shown. The following conclusions are reached: the coeff. of expansion of aluminium-silicon alloys up to 500° C. decreases with increasing silicon; magnesium-aluminium alloys show a similar decrease with increasing aluminium. The heat conductivity of aluminium-silicon alloys decreases with increasing silicon (a very large drop is noted with 0-1% silicon); magnesium-aluminium alloys show decreases when small quantities of aluminium are added to magnesium, and *vice versa*, with a sudden jump at about 55% magnesium, corresponding with  $\text{Al}_2\text{Mg}_3$  (electrical conductivity shows a similar phenomenon). Sp. heats decrease rapidly with increased silicon, whilst with magnesium-aluminium there is a rapid drop with increased aluminium up to 20% aluminium, followed by a slow increase up to 60% magnesium, and then a gradual drop. This maximum is most noticeable at lower temperatures.—S. G.

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

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

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

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

—W. A. C. N.

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



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

The Mechanics of Plastic Deformation: The Flow of Duralumin Through Orifices. S. I. Goubkin (*J. Rheology*, 1932, 3, 501-548).—Experimental determinations of the tensile strength, Young's modulus, hardness, and the flow characteristics at various temperatures and pressures, of Duralumin annealed at 350° C., are detailed and discussed. A theory of plastic flow is developed.

—J. S. G. T.

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

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

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

[Birmasil Special] A High-Strength Light Casting Alloy. Anon. (*Nickel Bulletin*, 1932, 5, 202-203; and (abstract) *Met. Ind. (Lond.)*, 1932, 41, 518).—Discusses the properties of "Birmasil Special" alloy—an aluminium alloy containing up to 3.5% nickel with 8-13% silicon.—J. H. W.

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

—S. G.

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

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

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

The Diffusion of Metals in the Solid State. The Diffusion of Copper and Aluminium. G. Grube and R. Haefner (*Z. Elektrochem.*, 1932, 38, 835-842).—The diffusion of copper and aluminium in one another at 600° C. when copper is plated on to aluminium has been investigated. Chemical analysis and microscopic examination show distinct zones of diffusion as: (1) pure copper; (2) the compound  $\text{CuAl}_2$ ; (3) the eutectic (32% copper); (4) the  $\eta$ -solid solution; (5) pure aluminium. Adherence of the diffusion layer on the eutectic is poor owing to the brittleness of the latter. On the other hand, surface hardening of the aluminium occurs when the conditions are such that the saturation concentration of the  $\eta$ -solid solution is not or only a little exceeded. The Brinell hardness of the copper surface of the specimens was raised from 25 to 72 by heating them with aluminium powder and dehydrated cupric chloride. The hardness was also raised when a copper-aluminium alloy containing about 80% of copper was heated with aluminium powder and ammonium chloride. The diffusion of copper into aluminium resulting in the formation of the  $\eta$ -solid solution is as rapid as that of aluminium into copper resulting in the formation of the  $\alpha$ -solid solution.—J. H. W.



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

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

Magnetic Properties of the System [of Alloys] Mn-Cu-Al. S. Valentiner and G. Becker (*Physikal. Z.*, 1932, 33, 872).—Read before the VIII Deutsche Physikertag, September, 1932. The magnetic susceptibility of the manganese-copper alloys containing 10-35% of manganese shows a large temperature coeff. at low temperatures. A systematic determination of the physical, including magnetic, properties of the manganese-aluminium-copper alloys has been carried out, and the results are correlated. Structural peculiarities found by Personn in the case of the alloy Mn-Al-Cu<sub>2</sub> are confirmed by the magnetic characteristics of this alloy.—J. S. G. T.

Investigation of the Workability of Copper-Manganese Alloys of High Electrical Resistance. M. P. Slavinsky, A. P. Belaiew, and R. R. Syromiatnikov (*Metallurg (Metallurgist)*, 1932, 7, (2), 3-16).—[In Russian.] The theory of electrical conduction through metals is briefly examined. In alloys used as electrical resistances the conductivity, temperature coeff. of resistance, and thermal e.m.f. should be as low as possible. These conditions are most satisfactorily fulfilled by solid solutions in which the greatest obstacles to the passage of the current are presented by the irregular distribution of the atoms. Although it should be theoretically possible to cast alloys with the desired electrical properties, the requirement that the casting may readily be worked into strip, wire, &c., introduces complications. In the copper-manganese alloys, the maximum resistance attained is 135.70 microhm with 36.8% copper, but the limit of workability lies at 32-34% manganese, above which a change in structure occurs. Small quantities of calcium are without effect on the properties of the alloys, but facilitate their preparation. The addition of aluminium is desirable, since it reduces the temperature coeff. and removes the thermal e.m.f. The workability of the alloys is improved by annealing below 600° C. X-ray analysis and micrographic examination alone are insufficient to indicate the changes in electrical resistance and workability of the alloys of the Manganin type.—M. Z.

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

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

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

The Resistance of Copper and Its Alloys to Repeated Stress. III.—The Brasses and Nickel Brasses. H. W. Gillett (*Metals and Alloys*, 1932, 3, 257-262).—A correlated abstract. The latest available data are tabulated for the static and dynamic mechanical properties of 60 : 40, 65 : 35, 70 : 30, 75 : 25,



80:20, 85:15, and 90:10 brasses, Muntz metal, and brasses containing 10-20% nickel with 53-74% copper. All these alloys are stronger than copper, and all are liable to fail by corrosion-fatigue, but this tendency decreases with increasing copper content. The alloys can be over-cold-worked, and notches and similar surface irregularities tend to produce early fatigue failure.—A. P.

**Free-Cutting Brasses.** P. M. (*Machinery (Lond.)*, 1932, 40, 169-171).—Free-cutting brasses are all in the  $\alpha$ - $\beta$  group, and contain a small proportion of lead, which, if properly distributed, causes turnings to break off short. The addition of up to 2.5% of nickel increases ductility and tends to make the distribution of lead more uniform. Brass containing up to 1% of silicon has recently been introduced and, while not quite so ductile as the nickel alloy, is harder and possesses valuable abrasion-resisting properties. Details of the composition and mechanical characteristics of these alloys are tabulated.—J. C.

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

**[Lead-Tin-Cadmium] Ternary Alloy in Rochdale.** H. A. Braddock (*Plumbing Trade J.*, 1932, 12, 173-174).—The best material for pipes for Rochdale (Lancashire) water has been found to consist of lead 98.25, tin 1.5, and cadmium 0.25%. The ultimate strength (1.69 tons/in.<sup>2</sup>) is considerably higher than that of lead. The fatigue limit is 0.57 tons/in.<sup>2</sup>. The greater tensile strength has made it possible to manufacture pipes of two-thirds the weight of ordinary lead pipes. Experiments show that the amount of lead dissolved from these pipes by the moorland water is much less than that dissolved from lead pipes.—E. S. H.

**Electrical Conductivity and Constitutional Diagram of Binary Alloys. VII. —The Lithium-Cadmium System.** G. Grube, H. Vasskuhler, and H. Vogt (*Z. Elektrochem.*, 1932, 38, 869-880).—The lithium-cadmium alloys have been investigated by means of heating and cooling curves, temperature-resistance curves, and the expansion of the solid alloys. Thermal analysis revealed 5 different solid-solution ranges. The conductivity isotherms of the alloys containing up to 61.4% of lithium show 2 marked peaks, at 25 and 50% lithium. These were confirmed by thermal analysis, and proved the existence of the hitherto unknown compound  $\text{LiCd}_3$ .  $\text{LiCd}$  crystallizes directly from the melt;  $\text{LiCd}_3$  forms during cooling by precipitation from the  $\beta$ -solid solution at 370° C. A third, hitherto undetected, compound,  $\text{Li}_3\text{Cd}$ , was revealed by thermal analysis, and is formed by the cooling of the  $\gamma$ -solid solution at 270° C. The results were correlated to form the constitutional diagram of the series.—J. H. W.

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

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

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

**Mercury as a Dispersion Medium (The Colloidal Nature of Iron Amalgam).** N. M. Tehuiko (*Ukrainskii Khimicheskii Zhurnal (J. Chim. Ukraine)*, 1931, 6, (5/6), 229-240).—[In Ukrainian, with Russian summary.] True amalgams, if added to iron amalgam which is a colloidal system, either cause the iron to separate (zinc amalgam) or stabilize the amalgam (tin amalgam). To ascertain the effect on the rate of separation of the iron, of changes in viscosity due to



the addition of true amalgams, the viscosity of the system before and after sedimentation, with and without addition of zinc and tin amalgams, has been determined. The viscosity is greater before sedimentation, whereas in the case of a true amalgam the viscosity differs little from that of pure mercury. The increased rate of sedimentation caused by the addition of zinc amalgam is attributed, not to a change in viscosity, but to an increase in the size of the iron particles. The stability of iron amalgams is ascribed to the difference in potential between the iron and the mercury, and from preliminary cataphoresis experiments the iron appears to be positively charged.—M. Z.

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

**Konal—or Konel. A High-Temperature Alloy.** Anon. (*Met. Ind. (Lond.)*, 1932, 41, 440).—A short note on Konal, a nickel-base alloy, a typical composition of which is cobalt 18, iron 6, titanium 2.5, and nickel 73.5%.

—J. H. W.

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

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

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

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

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

**Hoyt Metals.** Anon. (*Indian Eng.*, 1932, 92, (2), 36-37).—A survey of the properties and functions of white bearing metals, together with a description of the proprietary alloy "No. 11" (tin 91.40, antimony 3.49, copper 4.31, lead 0.18, nickel 0.55%, iron and aluminium, trace), for which are claimed exceptional toughness and resistance to breakage, with high anti-frictional properties.—P. M. C. R.

**Zinc-Base Die-Casting Alloys.** Anon. (*Met. Ind. (Lond.)*, 1932, 41, 642).—A trade booklet has been issued describing certain zinc-base die-casting alloys. The physical and mechanical properties are given of 4 of these alloys,



containing, respectively (%): aluminium 4-10 each; copper 2-70, nil, 1-00, 1-25; magnesium 0-03, 0-04, 0-03, nil; the remainder being 99-99 + zinc.—J. H. W.

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

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

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

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

**Permeability and Hysteresis Associated with Magnetization in the Energetic Preferential Direction.** Franz Preisach (*Physikal. Z.*, 1932, 33, 913-923).—Paper read before the VIII Deutsche Physikertag, September, 1932. Atten-



tion is directed to the effect of tensile stresses on the magnetic properties of metals and alloys, and to the phenomena of spontaneous demagnetization and a reversible inversion of magnetization exhibited by thoroughly annealed Permalloy.—J. S. G. T.

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

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

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

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

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

### III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 16-19.)

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

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

Report of Committee E-4 [of A.S.T.M.] on Metallography. C. H. Davis and O. E. Harder (*Proc. Amer. Soc. Test. Mat.*, 1932, 32, (1), 507-509).—See this J., 1932, 50, 485.—S. G.



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

—R. G.

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

Investigations Relating to Improvement (Vergütung) of the Zinc-Aluminium Alloy of Composition  $\text{Al}_2\text{Zn}_3$ . Herbert Meyer (*Z. Physik*, 1932, 78, 854).—Schwarz and Summa (*Metallwirtschaft*, 1932, 11, 369-371; this *J.*, 1932, 50, 615), by X-ray analysis, have found a cubic face-centred lattice characterizing the quenched alloy  $\text{Al}_2\text{Zn}_3$ ; in time the hexagonal lattice associated with zinc mixed crystals is present to an increasing extent. The authors correlate this result with the electrical properties of the alloy in terms of a "suppressed polymorphism" of the zinc (see *Z. Physik*, 1932, 76, 268; this *J.*, 1932, 50, 472).—J. S. G. T.

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

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

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

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

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



## IV.—CORROSION

(Continued from pp. 19-22.)

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

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

**Technical Notes on the Alloy Chromal.** Anon. (*Alluminio*, 1932, 1, 249-250).—Corrosion tests on Chromal, "ML 460," (aluminium with chromium 0.79 and nickel 2.3%) carried out by Bosshard and published in *Bulletin du Bureau International d'Aluminium*, No. 23, indicate that in salt-water with or without hydrogen peroxide this alloy behaves no better than chromium-free aluminium alloys.—G. G.

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

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

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

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

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

**Corrosion Tests of Light Metal Plates Containing Various Bolts and Nuts.** E. K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1932, 13).—Salt-spray corrosion tests of plates of K.S.-Seewasser alloy and Silumin containing nuts



and bolts of Lantal, brass, nickel-bronze, zinc-coated iron, and nickel steel are described.—B. Bl.

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

—H. W. G. H.

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

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

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

—P. M. C. R.

**Chlorine-Resisting Lead-Silver Electrodes.** I.–II. M. A. Rabinovitsch and A. S. Rubantchik. P. B. Zhivotinsky (*Ukrainskii Khimichnii Zhurnal* [*J. Chim. Ukraine*], 1931, 6, (5/6), 245–261).—[In Russian.] The utility of lead, silver, and some lead-silver alloys for electrodes in the electrolysis of alkali chlorides, has been investigated. The metal anode appears to be first depolarized by the action of the electrolyte, the degree of depolarization depending on the extent of corrosion. Later, a protective layer is formed which inhibits further attack, and the electrolysis then proceeds normally. The dissociation potentials of potassium chloride with an anode of silver 61, and lead 39% endorse this view, lead chloride, silver chloride, lead peroxide, and silver oxide being formed in succession, after which the anode becomes stable. As the protective layer is liable to damage, its stability under various conditions has been investigated to determine the commercial utility of such electrodes. The rate of corrosion of the lead-silver electrodes becomes stable after treatment for 160–190 hrs. in sodium chloride solution (*d* 1.36) at 10°–15° C. and 200–300 amp./m.<sup>2</sup>; it is not affected by the structure of the alloys nor by the nature of the surface. Corrosion is intensified by increasing the concentration of the salt, but reduced considerably by saturation of the solution with lead chloride, owing to the formation of a protective layer of lead peroxide. A similar effect is obtained by enclosing the anodes in an asbestos sheath lined with PbO<sub>2</sub>.—M. Z.

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

**The Corrosion of Tin. "Etchings" and "Black Spots."** Sven Brenner (*Teknisk Tidskrift*, Uppl. C., *Bergsvetenskap*. 62, 1932, 57–59, 69–72; *C. Abs.*, 1933, 27, 54).—The black spots occasionally appearing on the tinned surface of dairy apparatus, milk containers, &c., form as a result of potential differences between the tin surface and the corroding solution (milk or sodium chloride solution at ordinary temperature). It is shown experimentally that the spots occur only when the tension on the tin surface reaches a certain value above that of the solution. A newly tinned surface submerged in milk pos-



sessed a "dissolution tension" below that of milk; thus no black spots occurred. The conditions which cause an increase in the solution tension are: (1) contact with a sufficiently large surface of an "ignoble" (relative to tin) metal, *e.g.*, copper; (2) the formation of the resistant film on the tin surface as a result of a prolonged contact with milk or sodium chloride solution. An exposure of pure metallic tin through damage of this film thus results in corrosion. The black spots consist mainly of  $\text{SnO}$ . In milk a considerably higher solution tension is required to produce black spots than in sodium chloride solution. A milk container which was in constant contact with sweet milk showed black spots after 4-5 months, whereas with 5% sodium chloride solution the spots appeared after 2 hrs. Although sweet and sour milk possess approximately the same solution tension, they act quite differently in respect of their ability to form the resistant film on the tin surface. The tension on this film in sweet milk is always considerably higher than in sour milk. For this reason it is practically impossible to produce black spots with sour milk. In mineral acids and in warm sodium hydroxide the film is unstable, resulting in an even attack on the whole surface in the form of "etchings." In cold, dilute sodium hydroxide and in sodium carbonate solution a strongly resistant film is rapidly produced. The tension on the tin surface in the latter case can be so high that gaseous oxygen is generated without formation of black spots. Practical tests also showed that tinned surfaces could be kept for months in sodium carbonate solution without showing spots or etchings. Investigations of the effect of the purity of tin on the speed of the corrosion showed no essential difference whether pure tin, technical tin, or tin alloys containing lead, nickel, antimony, bismuth, silver, or copper, respectively, were used. A number of photomicrographs show the gradual growth and appearance of the black spots.—S. G.

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

—A. R. P.

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

**An X-Ray Investigation of the Iron-Copper System. A Study of the Corrosion of Galvanized Sheet Iron.** James H. Carter (*Iowa State Coll. J. Sci.*, 1932, 6, 413-416; *C. Abs.*, 1932, 26, 5892).—Armco iron and pure copper were melted together in a crucible of magnesia under nitrogen to form melts over the whole range of compositions. The melts were cooled in air and a part of each melt was annealed at  $1700^{\circ}\text{C}$ . for 12 hrs. The X-ray analysis was made by the Hull-Debye-Scherrer method. When the amount of copper is less than 12.02% only iron lines appear; when it is greater than 83.39% only copper lines appear. Annealing at  $1700^{\circ}\text{C}$ . for 12 hrs. produced no change in the X-ray diagrams, but photomicrographs indicated that a change in structure had started. Galvanized sheet iron was subjected to the action of mixtures of carbon dioxide, oxygen and nitrogen in distilled water for more than 4 months at  $26^{\circ}\text{C}$ . For constant carbon dioxide content and increasing oxygen content, corrosion passes through a minimum. The minimum corrosion occurred at 20% oxygen and 0.03% carbon dioxide. Corrosion proceeds most rapidly where a film of ferric hydroxide forms and protects a spot from oxygen. This spot becomes anodic and ferrous hydroxide forms indefinitely.—S. G.

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



262).—Alloys containing zirconium, nickel, silicon, and iron are resistant to solutions of sulphuric or hydrochloric acids and may prove to be useful in chemical industry. An alloy having the composition nickel 71.41, iron 12.03, silicon 9.15, zirconium 2.70, carbon 0.355, aluminium 0.32% is especially recommended for this purpose. The introduction of zirconium in steel improves the resistance towards sodium hydroxide solutions.—E. S. H.

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

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

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

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

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

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

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

**Effect of Copper Sulphate on Pipe Materials.** C. C. McKee (*Power Plant Eng.*, 1932, 36, 658-659).—About one part per million of copper sulphate is added to the water in many cooling tower systems to prevent the growth of algæ. Samples of piping made of galvanized steel, ordinary black steel, brass



and copper were suspended (on wire) in the direct flow of such a system for a period of 60 days. After 2 days the galvanized sample showed vigorous attack of the zinc, but no further action was evident. After the full period, the percentage losses of weight were: galvanized pipe 0.66, black steel 4.9, brass (no change), copper (increased 0.47); hence brass or copper should be used in such cooling systems.—P. M. C. R.

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

**Petroleum Pays Increasing Toll to Corrosion.** Stanley Gill (*Chem. and Met. Eng.*, 1932, 39, 481-483).—Losses arising from corrosion of equipment in the oil industry have steadily increased, and this is attributed to production of oils of high sulphur content and to higher temperatures and pressures in refining operations. An abbreviated list of the more destructive corrosive conditions is as follows: (a) oxygen-free oil-well brines; (b) aerated oil-well brines; (c) hydrogen sulphide, air and water; (d) soils; (e) low-temperature distillation; (f) high-temperature distillation. Strainers or screens, used to exclude sand from the wells, are made in brass or bronze, in the absence of hydrogen sulphide, commercially pure nickel being the best for exceptionally severe conditions. Working barrels of oil-pumps are of brass and other alloys or of steel with  $\frac{1}{8}$ -in. liners of brass, bronze, chrome-nickel steel or nickel. Aluminium foil cemented to the undersides of roofs of storage tanks has given satisfactory protection, all-aluminium roofs being prohibitively expensive. In low-temperature distillation equipment, Admiralty metal, special bronzes, nickel-chromium, "stainless" steels, and pure nickel are used for heat exchangers and condensers and for return bends and plugs in pipe stills. Severe corrosion occurs in high-temperature pressure still equipment. The interior surfaces of the heavy reaction chambers or soaking drums have been satisfactorily protected by chromium-plating.—F. J.

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

—P. M. C. R.



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

**Corrosion of Metals and Metal Alloys by Phosphoric Acid and Phosphorus.** M. W. Ryssakov and I. N. Bushmakina (*Zhurnal Prikladnoi Khimii (Journal of Applied Chemistry)*, 1932, 5, (6/7), 715-721).—[In Russian, with German summary.] To determine the most suitable materials for chemical plant used for handling them, the action of phosphoric acid at 105°-350° C. under 1-200 atm. pressure, and of molten yellow phosphorus at 80° C., has been investigated on the following metals: steel, copper, lead, and the special alloys V4AE2, V4AF3B, Thermisilid E, Thermisilid (Krupp), Monel metal, Calite E (Calorizing Co.), Duriron (Duriron Co.), Hastelloy C, and Hastelloy D (Haynes Stellite Co.), silver-copper and silver-nickel alloys of the Russian Institute of Metals. Most of the special acid-resisting alloys are comparatively inert to 65% phosphoric acid at 105° C., but at 300° C. all the alloys except the two silver ones are severely corroded. Copper is comparatively stable, as the rate of dissolution in phosphoric acid is but slightly affected by rise in temperature; corrosion is pronounced, however, in phosphorous acid at temperatures above the decomposition point. Silver remains absolutely unaffected by either acid, but is slightly attacked by metaphosphoric acid. Oxygen increases the rate of dissolution of copper and above 200° C. also of silver in phosphoric acid. Molten phosphorus has no effect on any of the above metals and alloys, except copper and the silver-copper alloys, which become covered with a layer of copper phosphide which permeates later into the interior of the metal. At low temperatures, the layer is protective against further attack, but at higher temperatures, the attack becomes rapid.—M. Z.

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



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

—F. J.

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

**Dollars and Cents—"The Operating Cost of Corrosion."** C. L. Mantell (*Chem. and Met. Eng.*, 1932, 39, 479-480).—There are several methods of arriving at the "operating cost of corrosion," the one herein attempted being to determine how much can be charged directly to corrosion over a period of time when each of several different construction materials is used. Equipment cost is considered as made up of 2 parts, viz. the cost of the "bogey" equipment which would satisfy the requirements of a corrosionless process, plus the additions to this cost that are occasioned by corrosion. One of the greatest difficulties is to determine the reasonable life expectancy of each material, and properly conducted, properly interpreted laboratory tests, using actual plant



solutions, are acceptable as the basis of such estimates. Certain important factors in arriving at the cost of equipment in place, are discussed. Finally the operating cost of corrosion (O.C.C.) for a 10-year period is obtainable from the formula  $O.C.C. = 10/L(M + F + Sh + I + R - S) - B$ , where  $L$  is the expected life in years of the material,  $M$  the total cost of material,  $F$  the fabrication cost,  $Sh$  the shipping cost,  $I$  the installation cost,  $R$  the cost of removal and salvage,  $S$  the salvage or scrap value, and  $B$  the cost of the hypothetical piece of "bogey" equipment. Applying this formula, it is shown that the most expensive material is cheaper in the long run.—F. J.

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

## V.—PROTECTION

(Other than Electrodeposition.)

(Continued from pp. 23-27.)

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

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

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

**Protection of Aluminium by Oxidation.** E. Herrmann (*Bull. tech. Suisse Romande*, 1932, 58, 304).—The M.B.V. (modified Bauer-Vogel) oxidation process is claimed to give a sufficiently firm and adherent coating of oxide to copper-free aluminium alloys. Articles are immersed for 5-10 minutes in a solution containing 5% anhydrous sodium carbonate and 1.5% sodium chromate, at a temperature of 90°-100° C. Thorough washing in running water must precede drying. The skin produced, although less strong than that formed by anodic oxidation, resists corrosion by fruit juices, alcoholic liquors, mortar, oil, or milk; it is attacked by acids, alkalis, and calcium chloride. Treatment with sodium silicate appreciably hardens the coating and increases its resistance to attack.—P. M. C. R.

**Electrochemical Oxidation and the Protection of Iron and of Duralumin in Aerated Saline Solutions.** Anon. (*Industrie chimique*, 1932, 19, S06-S07).—A review of recent work.—E. S. H.



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

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

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

**Galvanized Railway Materials.** Geo. Williams (*Railway Eng.*, 1931, 52, 393-394).—There is no generally accepted standard covering the protection of the many galvanized articles used by railways. The copper sulphate test and determination of the weight of zinc per ft.<sup>2</sup> are of value, but the result obtained in the latter must be considered in the light of the purpose of the coating; if the zinc is to be the final protective coating, 2.5-3 oz./ft.<sup>2</sup> are necessary, whereas if it is merely intended as a base for paint, 1 oz./ft.<sup>2</sup> is sufficient. Details are given of a proposed specification. The covering of defective spots by solder is satisfactory if carried out carefully. Cut edges should be tinned, but metallic paints should on no account be used to cover bare places.—H. F. G.

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

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

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

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

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

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

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

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



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

—S. G.

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

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

—P. M. C. R.

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

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

—E. S. H.

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

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

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



## VI.—ELECTRODEPOSITION

(Continued from pp. 27-31.)

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

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

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

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

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

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

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

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



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

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

**Protection of Aluminium Alloys by Electrolytically-Deposited Chromium.** G. Gallo and D. Corbi (*Aerotecnica*, 1932, 12, 1145-1174).—Varnish films on aluminium are not really water-proof, anodic oxidation affords insufficient protection against sea-water, and electroplating of light alloys has not yet found industrial applications. G. and C., however, claim to have succeeded in increasing the resistance of light alloys, particularly Duralumin, by plating them directly with a continuous film of chromium, under the following conditions: the article is first cleaned with abrasives or by sand-blasting, then rinsed in water and plated in a bath containing 200 grm. of chromium trioxide, 3 c.c. of sulphuric acid, and 0.6 c.c. of 40% hydrofluoric acid per litre. The bath begins to work well after use for about 20 days; it is operated with a current density of 40-45 amp./dm.<sup>2</sup> at 45°-47° C., and every article is plated for 7-8 minutes.—G. G.

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

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

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

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

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

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

—J. W. D.



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

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

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

**Researches on Nickel Stripping Baths.** H. Krause (*Oberflächentechnik*, 1932, 9, 191-193).—Cf. Schmidt and Weber, this volume, p. 87, and this *J.*, 1932, 50, 682. The commonest type of bath used in stripping faulty nickel plate from iron or steel is sulphuric acid of  $d$  1.575, the article being made the anode and a current of 2 amp./dm.<sup>2</sup> being used. Addition of arsenious acid is condemned, and, in spite of numerous tests, no satisfactory addition agent has been found. Details are given of tests made with acids of different concentration in stripping nickel plate from various base metals.—A. R. P.

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

**Depolarized Nickel Anodes.** Anon. (*Nickel Bulletin*, 1932, 5, 218-219).—Rolled nickel anodes have hard faces which do not readily dissolve in nickel-plating solutions, and cast nickel has a tendency to become passive under the effect of the current owing to the formation of a skin of black nickel peroxide. Depolarized nickel anodes of a purity of 99.9%, to which a small addition of nickel oxide is made, do not suffer from either of these disadvantages. The other advantages of these anodes which are cast in oval section, and the control of the bath and current density, are discussed.—J. H. W.

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

**Preparing Silver for Electroplating.** Anon. (*Met. Ind. (Lond.)*, 1932, 41, 330).—Short note describing the elimination of flaky and powdery anodes in silver plating by the use of silver of higher purity (99.97%) and by proper heat-treatment.—J. H. W.



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

**Electroplating Aluminium.** Anon. (*Amer. Machinist (Eur. Edn.)*, 1932, 76, 1005-1006).—Chromium can be applied directly to aluminium from an ordinary chromium bath at about twice the usual current density used for plating over nickel, but an additional acid dip may be required with certain alloys. A satisfactory bath for direct zinc plating is zinc cyanide 4, sodium cyanide 4, ammonium hydrate (sp gr. 0.9) 4, and peptone  $\frac{1}{2}$  oz./gall.; current density 1.5 amp./ft.<sup>2</sup> for 1-10 minutes. For nickel plating, the surface should be roughened. Recipes for roughing solutions and for 2 satisfactory nickel baths and plating details for various alloys are given.—J. H. W.

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

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

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

**Throwing Power of Electroplating Solutions.** Seiji Kaneko (*Kōgyō Kwagaku Zasshi (J. Soc. Chem. Ind. Japan)*, 1932, 35, (4); *C. Abs.*, 1932, 26, 3995).—[In Japanese, with English summary in supplemental binding, p. 146.] Throwing power ( $T$ ) is defined as  $T = \{[(1/L) - A]/(1/L) \times 100$ , where  $L$  and  $A$  have the same values as defined previously (*ibid.*, 1931, 34, (4); this *J.*, 1931, 47, 446), and  $(1/L)$  is the value of  $A$  when  $\epsilon$  (current efficiency) = 1 and  $\delta v_1/\delta I = 0$  ( $v_1$  = potential drop at cathode and  $I$  = current density). By substituting the value of  $A$  (cf. *ibid.*, 1931, 34, (4); this *J.*, 1931, 47, 446)

$$T = \frac{(1/\rho L)(\delta v_1/\delta I) - (I\epsilon)(\delta \epsilon/\delta I)}{1 + (1/\rho L)(\delta v_1/\delta I)} \times 100 \quad (\rho = \text{specific resistance}). \quad (1/\rho)(\delta v_1/\delta I)$$

is the characteristic quantity independent of distance, and it is suggested that this will give a better measure of throwing power.—S. G.

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

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

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



circulating devices; (7) filters; (8) agitating devices and moving cathodes; (9) barrels; (10) various accessories.—J. H. W.

**Electrodeposited Protective Coatings and Their Use in the Wire and Cable Industry.** Erhard Bertl (*Elektrotech. Z.*, 1932, **53**, 579).—Numerous tests made by the leading firms of the cable industry have proved that a homogeneous electrodeposited coating of pure lead 0.009 mm. thick is sufficient protection against corrosion if not subjected to mechanical stress. A protective layer 0.3 mm. thick is sufficient for cable-covering wires and cable iron strip. For less strongly stressed wires and strips a layer of lead 0.1–0.15 mm. thick suffices. Tin can now be deposited in a lustrous, adherent form. Tin-lead alloys can be also deposited, without objection, in engineering practice.—B. Bl.

**Application of Electro-Deposited Metals to Mechanical and Marine Engineering.** C. H. Faris (*Trans. Liverpool Eng. Soc.*, 1931, **52**, 42–60; discussion 61–70).—Cf. this *J.*, 1931, **47**, 666. A description is given of the Fescol process for producing nickel coatings up to  $\frac{1}{4}$  in. in thickness, and of the results of tests showing the strength of the bond between the nickel and the base to exceed 18–19 tons per in.<sup>2</sup>. Many applications of the process are described, e.g. to pistons of high-pressure steam engines, pump plungers for handling caustic soda, and ammonia compressor rods. The advantages of nickel over other, more commonly used, constructional materials are noted; the chief are resistance to wear and corrosion. For these reasons the process has been adopted as standard for the cylinder liners of high-speed Diesel engines for airship and locomotive work; for rolls for paper mills; ships' propellers; impellers for centrifugal pumps; filter press plates; and for many purposes where superheated steam is used. Although originally employed only for repair work, the process is now applied for much new work. Nickel may be deposited on all kinds of iron and steel (including "stainless"), bronze, and gun-metal. The process is used also for depositing copper, cobalt, zinc, and, more particularly, cadmium, lead, and chromium. Lead coatings up to  $\frac{1}{4}$  in. thick are used for chemical plant, whilst chromium deposits are employed either for decoration, when they are applied over nickel to produce a hard, impervious coating, or as "engineering chromium"; in this case deposits up to 0.01 in. thick, having a Brinell hardness of 600–750, are used. For machining deposited nickel, tungsten [? tungsten carbide] tipped tools are necessary, as steel tools rapidly become dull and tear away the nickel and base metal. In general, grinding is to be preferred to turning.—H. G.

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

**The Scientific Bases of Galvanoplastics.** J. Salauze (*Mem. et Compt. rend. Soc. Ing. civils France*, 1932, **9**, 446–506).—The principles and applications of galvanoplastics are considered under the following headings: (1) potential: definition, polarization, penetrability, deposition of metals electro-positive



to hydrogen (nickel, cadmium, zinc), hydrogen-ion concentration; (2) formation of the deposits: theory (crystal building), influence of the cathodic metal on the crystallization of the deposit, influence of the different factors of the electrolyte; (3) baths: quality, cyanide baths, summary of the principal baths (gold, silver, copper, nickel, cadmium, zinc, chromium); (4) preparation of the work: mechanical and chemical treatment, testing the deposit (analysis, corrosion-resistance, adherence, hardness, microstructure).

—J. H. W.

## VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

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

(Continued from p. 32.)

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

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

## VIII.—REFINING

(Including Electro-Refining.)

(Continued from pp. 32-35.)

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

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



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

#### ELECTROLYTIC METHODS

**Electrolytic Refining of Copper, Using the Complex Salt of Cuprous Chloride.**—VIII.—IX. The Behaviour of Silver Present in the Crude Copper of the Anode. Naoto Kameyama and Shoji Makishima (*Kōgyō Kwagaku Zasshi* (*J. Soc. Chem. Ind. Japan*), 1931, 34, (11); *C. Abs.*, 1932, 26, 5850).—[In Japanese, with English summaries in supplemental binding, pp. 462-465.] (VIII.—) The behaviour of silver in the cuprous chloride bath was investigated. The alkali chloride in the bath (about 4 mols. per kg. of water) dissolves appreciable quantities of silver chloride to form a complex salt. Here the silver will not act in the same way as in a sulphate bath. Solubility of silver chloride in potassium chloride solutions was determined at 25° and 50° C. The activity of silver ions was determined from the e.m.f. of the cell  $\text{Ag} | 0.01\text{NAgNO}_3 || \text{saturated NH}_4\text{NO}_3 | \text{KCl}$ , or process electrolyte with saturated  $\text{AgCl} | \text{Ag}$ . Solubility of silver increases rapidly with temperature or increase of cuprous chloride content, but the single potential of silver becomes less "noble." The potential of the silver electrode is about 100 mv. more noble than that of the copper, independent of temperature and electrolyte composition. Silver should be unattacked on the anode surface, but any  $\text{Cu}^{++}$  in the electrolyte gives the reaction  $\text{Ag} + \text{Cu}^{++} \longrightarrow \text{Ag}^+ + \text{Cu}^+$ , and silver goes into solution. Silver in solution should deposit simultaneously with copper. (IX.—) Actual tests with anodes of pure silver, partly silvered copper plate, silver and copper plates side by side and connected, and cast copper-silver alloys, showed that most of the current passes through the copper surface, but the silver in the anode dissolves and deposits on the cathode. A diaphragm will not prevent this, nor will the addition of sulphur, ferrous sulphide, nickel, tin, sulphur dioxide, stannous chloride,  $\text{Fe}(\text{CN})_6^{IV}$ , ferrous chloride, hydroxylamine, formaldehyde, or hydroquinone, or superposition of a.c. on the d.c., or bromides, cuprous iodide, or  $\beta$ -iodopropionic acid. Circulation of the bath through an outside layer of cuprous iodide removes silver as silver iodide.—S. G.

**Electrolytic Refining of Copper, Using Complex Salt of Cuprous Chloride.** X.—Behaviour of Antimony. Naoto Kameyama and Shoji Makishima (*Kōgyō Kwagaku Zasshi* (*J. Soc. Chem. Ind. Japan*), 1932, 35, (8); *C. Abs.*, 1932, 26, 585).—[In Japanese, with English summary in supplemental binding, pp. 369-371.] The electrolyte used was sodium chloride 4 mols.; cuprous



chloride 0.8 mol., hydrochloric acid 0.5 mol., gelatin 1 grm., water 1000 grm., and the conditions were: temperature  $50^{\circ} \pm 1^{\circ} \text{C.}$ , current density 2.3 amp./dm.<sup>2</sup>, time 30-70 hrs., mechanical stirring, and passage of small quantities of carbon dioxide to displace atmospheric oxygen. Various amounts of tartrate were added to the electrolyte, and various amounts of antimony to the electrolyte or anode. The physical properties of the cathode deposit were good, and the cathode never contained antimony higher than 0.000x%. The electrolytic potential of antimony in the bath is higher than that of copper. Antimony accumulates in the bath or goes to the anode.—S. G.

## IX.—ANALYSIS

(Continued from pp. 35-37.)

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

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

**Assay of Rubber-Insulated Conductors [Consisting of Tinned Copper Wires].** A. R. Matthis (*Ann. Chim. analyt.*, 1932, [ii], 14, 201-203).—A quantity of wire such that the surface of tinned Cu is exactly 1 dm.<sup>2</sup> is wound on a piece of glass rod and the bare Cu at the ends is covered with wax. The rod is then rotated for 5 minutes in  $\text{NH}_4\text{OH}$  ( $d$  0.910) at 30 r.p.m. in such a way that one half of the wire is passing below the liquid while the other half is passing through the air. The amount of Cu dissolved is then determined by electrolysis or by colorimetry; it is a function of the corrosion-resistance of the tinned coating.—A. R. P.

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

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

**On the Copper-Reactive Group  $\text{HO}-\text{C}-\text{C}=\text{N}-\text{OH}$ .** Fritz Ephraim (*Ber. deut. chem. Ges.*, 1931, [B], 64, 1210-1214).—Cf. *ibid.*, 1930, [B], 63, 1928. The



oximes corresponding with certain series of aldehydes and ketones are found to give characteristic precipitates with Cu salts, as does salicylaldoxime, but the latter body is considered the most satisfactory reagent on account of the intensely coloured precipitate obtained. The relative solubilities of the complex metallic salts of these series are reviewed.—P. M. C. R.

**On the Copper Reagent Salicylaldoxime.** F. Ephraim (*Ber. deut. chem. Ges.*, 1931, [B], 64, 1215-1218).—See also *ibid.*, 1930, [B], 63, 1928; and preceding abstract. The separation of Cu by salicylaldoxime requires some modification in the presence of  $\text{Fe}^{III}$ ; the metallic solution should be acidified with HCl instead of with  $\text{CH}_3\text{COOH}$ , thus avoiding the characteristic red coloration due to Fe. The separation and identification of salicylaldoxime compounds with certain metals other than Cu are described.—P. M. C. R.

**Colorimetric Tests for Precious Metals.** W. E. John and E. Beyers (*J. Chem. Met. Min. Soc. S. Africa*, 1932, 33, 26-27).—The solution is treated with  $\text{SnCl}_2$  and then shaken with  $(\text{C}_2\text{H}_5)_2\text{O}$ . Purple of Cassius, due to any Au present, forms a black scum at the top of the aqueous phase. Platinoid metals give orange or red colours, which collect in the ether layer. If Fe is present, it gives no colour when completely reduced. If reduction is incomplete, the dirty-brown colour produced masks the test for platinoid metals.—E. S. H.

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

**2:7-Diamino-Fluorene as a Reagent for Zinc, Cadmium, and Copper.** Julius Schmidt and Walter Hinderer (*Ber. deut. chem. Ges.*, 1931, [B], 64, 1793-1796).—2:7-Diamino-fluorene, preferably used as the hydrochloride in 1% solution in alcohol, gives characteristic precipitates of very low solubility with solutions of the chlorides or nitrates of Zn, Cd, and Cu. Sulphates must not be present, as the base forms an insoluble sulphate. The metallic solution should be  $\frac{2}{3}$  alcoholic. White precipitates are obtained with Zn and Cd salts, whilst  $\text{Cu}^{II}$  solutions give a bluish-green coloration and a dark blue flocculent precipitate. The Cu reaction is considered more sensitive than the ferrocyanide test. The preparation of the reagent and the exact conditions of its use are fully described.—P. M. C. R.

**Volumetric Determination of Aluminium.** J. Clarens and J. Lacroix (*Bull. Soc. chim. France*, 1932, [iv], 51, 668-670).—The HCl solution is treated with KOH, using methyl orange as indicator until a sudden decrease in the intensity of the red colour occurs. Methyl red is then added and the boiling solution is titrated with KOH until the colour changes to yellow; 1 c.c. of  $N$ -KOH = 0.009 grm. of Al. Ca does not interfere, but if Mg is present, part may be precipitated with the  $\text{Al}(\text{OH})_3$ ; the titrated solution should therefore be titrated with  $N$ -HCl until red, and the c.c. of acid used deducted from the c.c. of KOH used in the first titration.—A. R. P.

**A New Method for the Determination of Bismuth.** C. Mahr (*Z. anorg. Chem.*, 1932, 208, 313-317).—Bi is precipitated from  $\text{HNO}_3$  or  $\text{H}_2\text{SO}_4$  solutions by a 10% solution of  $\text{K}_3\text{Cr}(\text{SCN})_6$  as brick-red, crystalline  $\text{BiCr}(\text{SCN})_6$  which may be dried and weighed or its SCN content may be titrated. Mo, Cr, Al, Fe, Mn, Ni, Co, Mg, alkaline-earth metals, and alkali metals do not interfere, and the method may be used for very small amounts of Bi.—M. H.



**A New Reagent for the Qualitative and Quantitative Estimation of Copper.** Fritz Ephraim (*Ber. deut. chem. Ges.*, 1930, [B], 63, 1928-1930).—Cu may be quantitatively precipitated from  $\text{CH}_3\text{COOH}$  or aqueous solution in the presence of any other metal by the addition of the (acetic) acid solution of salicylaldoxime, when the bright greenish-yellow Cu salt is set free as a voluminous flocculent precipitate, which readily collects on stirring and filters easily. The reaction is perceptible as a definite opalescence at a Cu concentration of 1 part in 500,000 parts. Full directions for qualitative detection and for quantitative estimation are given: characteristic reactions of salicylaldoxime with other metals, especially in alkaline solution, are described.—P. M. C. R.

**Volumetric Determination of Tungsten.** B. G. Mokeev (*Ucheniye Zapiski Kazan Gosudarst. Univ. (Sci. Rep. State Univ. Kazan)*, 1930, 90, 1022-1024; *C. Abs.*, 1932, 26, 5870).—[In Russian.] Volumetric determination of W by the method of Kanchev, *i.e.* precipitation of W with benzidine chloride and titration of the precipitate with 0.1N-NaOH, gives results varying with the  $\text{WO}_3$  contents of the samples. Totally unsatisfactory results are obtained with samples containing less than 0.2-0.3 gm.  $\text{WO}_3$ .—S. G.

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

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

(Continued from p. 37.)

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

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

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

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

**Increasing the Accuracy in the Measurement of the Smallest Visible Magnitudes with the Screw Micrometer Eyepiece.** Heinrich Quastler (*Z. wiss. Mikroskopie*, 1932, 49, 195-207).—Conditions are given under which it is possible to measure diameters of less than  $1\ \mu$  with an error of not more than  $0.023\ \mu$ .—B. Bl.

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



## XI.—PHYSICAL AND MECHANICAL TESTING AND RADIOLOGY

(Continued from pp. 38-39.)

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

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

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

**Mechanical Tests of Aircraft Structural Components.** I. J. Gerard (*J. Roy. Aeronaut. Soc.*, 1932, 36, 673-690; discussion, 690-703).—Attention is directed to the relation between failing load and geometrical proportions in aircraft members. A new form of compression test on strip materials, in which the strip is bent transversely into the arc of a circle of 180° with two flat tangential extensions at each straight edge of the test-piece, is described. The extensions are 0.1 in. wide, and engage in a jig which prevents premature buckling but does not appreciably restrain axial shortening. Methods for the strength testing of aircraft wings, spars, hulls, and fuselages are described.

—H. S.

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

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

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

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



## XII.—PYROMETRY

(Continued from p. 40.)

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

—J. H. W.

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

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

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

## XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 40-42.)

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

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

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



## XIV.—SECONDARY METALS: SCRAP, RESIDUES, &amp;c.

(Continued from pp. 42-43.)

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

## XV.—FURNACES AND FUELS

## FURNACES

(Continued from pp. 44-46.)

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

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

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

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

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



## XX.—JOINING

(Continued from 53-56.)

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

**Solder and the Art of Wiping Cable Splices.** H. Baillard (*Bell Laboratories Record*, 1932, 11, 43-47).—As a result of an elimination test made by expert splicers, a wiping solder containing tin 38 and lead 62% was standardized by the American Telephone and Telegraph Co. in 1919. This selection was based on the analyses of joints made from melts of 50 : 50 solder "tempered" by the splicers with lead. Increasing the lead content is held to produce coarse-grained, porous joints. The presence of antimony in excess of 0.3% is said to decrease the cohesiveness, more than 0.005% zinc to produce lumpiness, more than 0.10% bismuth to depress the freezing-point unduly, and copper to be harmless up to 0.10% and even beneficial in the presence of antimony. [*Note by abstractor*: These conclusions are not all in accordance with British experience.] A solder containing cadmium 9 and tin 24% was found satisfactory, but with the present price of tin has no longer an economic advantage.—J. C. C.

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

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

—H. S.

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

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

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

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

—P. M. C. R.



## XXI.—INDUSTRIAL USES AND APPLICATIONS

(Continued from p. 56.)

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

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

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

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

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

**Rendering Automobile Tyres Puncture Proof [with Aluminium Discs].** Anon. (*Aluminium Broadcast*, 1932, 3, (38), 16).—Aluminium discs,  $\frac{3}{8}$  in. in diam. and 5 to 10 mils. thick, introduced into automobile tyres are forced against any hole by the escaping air and form an efficient seal.—J. C. C.

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

**Aluminium Alloys for Pistons.** N. F. Bolchovitinov (*Liteinoe Delo (Foundry Practice)*, 1932, (2), 7-8).—[In Russian.] The basic requirements to which aluminium alloys for pistons must conform are: sufficient hardness at temperatures up to 400° C., low coeff. of expansion, and high thermal conductivity. The alloys considered most suitable for this purpose contain: (1) "SAE 34" (American): copper 10, magnesium 0.25, iron 1.2%, rest aluminium; (2) "SAE 32" (American): copper 10, magnesium 2, iron 1.2, silicon 0.6%, rest aluminium; (3) alloy "No. 132": silicon 14, nickel 2.3, magnesium 1, copper 0.8, and iron 0.7%, rest aluminium; (4) "Y" alloy (English): copper 4, nickel 2, magnesium 1.5%, rest aluminium.—N. A.

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

**The Design of Aluminium Alloy Travelling Cranes.** E. C. Hartmann (*Metal Stampings*, 1932, 5, 595-598).—Cf. this J., 1932, 50, 181. Describes the prin-



ciples and practices to be followed in the application of aluminium alloys to the manufacture of travelling cranes.—J. H. W.

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

**Metallized Papers.** Anon. (*World's Paper Trade Rev.*, 1932, June 2; and (abstract) *Aluminium Broadcast*, 1932, 3, (33), 15).—Metallized cardboard coated with aluminium foil having a thickness of about 0.01 cm. should be distinguished from cardboard coated with silver or aluminium paper.—J. C. C.

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

—S. G.

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

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

—S. G.

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



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

—S. G.

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

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

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

**Aluminium Inks and Paints.** Anon. (*Paint Manuf.*, 1931, 1, (8), 215; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1931, (24), 287).—A series of dyeing processes makes it possible to obtain the whole range of metallic tints using, as the base, aluminium powder which should be 97% pure. The flakes, after degreasing, are treated with a mordant and an inorganic fixer and then shaken in a concentrated solution of coal-tar colour. The metallic powder should be mixed into the vehicle just before use. Inks generally contain about 40% of powder and a minimum amount of drier, the actual formulation depending on the kind of paper and the character of the design. A long wood oil varnish base yields the best aluminium paints with  $2\frac{1}{2}$  to  $2\frac{3}{4}$  lb. of powder per gall. A special high-temperature-resistant aluminium bituminous paint consisting of 3 parts aluminium, 5 parts rosin, and 5 parts petroleum tar when applied to hot metal gives protection up to 900° F. (482° C.). Other typical uses of aluminium powder are described, as also is a test for the "leafing" quality.

—S. G.

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

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

**Low-Melting-Point Alloys Developed [Bendalloy].** Anon. (*Automotive Ind.*, 1932, 66, 881).—The use of Bendalloy, a bismuth-tin-lead-cadmium alloy, is described. The melting point is stated to be 77.4° C. and tubes filled with Bendalloy before bending can easily be charged and emptied. A somewhat similar alloy ("Sealalloy") is used for making liquid-proof joints between glass and metal tubing.—P. M. C. R.



**On Possible Applications of Beryllium Alloys in Machine Construction.** Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1931, 7, 124).—The beryllium alloys, combining lightness, strength, and high resistance to corrosion, seem especially suitable for use in the pharmaceutical and food industries. The properties of beryllium are enumerated, and some of its alloys, especially the beryllium-bronzes, are considered. The cast bronzes containing 2.5% of beryllium have an ultimate tensile stress of 88 kg./mm.<sup>2</sup>, with an elongation of 36%; correct treatment produces from this a spring material, with an ultimate stress of 135 kg./mm.<sup>2</sup> and an elongation of about 2%; these values can be modified as required by varying the heat-treatment. Springs of this material, whether of spiral or laminated form, showed marked superiority to steel springs of corresponding type.—P. M. C. R.

**Tentative Specifications for Seamless Copper Tubing, Bright-Annealed (B 68-32 T).** — (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 239-241; and *Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 679-681).—Cover annealed copper tubing suitable for use in refrigerators, oil lines, gasoline lines, &c., where tubing absolutely free from scale or dirt is required. The tubing shall be made from copper that has been deoxidized; it shall be bright-annealed after the last drawing operation or after cold-coiling, if coiling is required; and it shall be thoroughly recrystallized and have an average grain-size not exceeding 0.040 mm. in diam. The material shall conform to the following requirements as to chemical composition: copper, 99.90% min.; phosphorus, 0.10% max. The sample for chemical analysis shall consist of drillings, millings or clippings taken from each lot of 5000 lb. or fraction thereof, and shall be divided into 3 equal parts, each of which shall be placed in a sealed package for (1) seller; (2) purchaser; (3) umpire. The minimum requirements as to physical properties are: tensile strength, 30,000 lb./in.<sup>2</sup>; elongation, 40% on 2 in. The material shall be capable of expanding on a hardened and ground, tapered steel pin having an inclined angle of 60°, to the following amounts (expansion of outside diam., %): up to 1 in. outside diam. 40%; over 1 in., 30%.—S. G.

**Tentative Specifications for Fire-Refined Copper Other than Lake (B 72-32T).** — (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 223-225; and *Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 663-666).—Cover fire-refined copper, other than Lake, and not usually electrolytically refined. Fire-refined copper, other than Lake, is intended for use in rolling into sheets and shapes for mechanical purposes, and is not intended for electrical purposes or wrought alloys. The requirements as to chemical composition for all shapes are (%): copper + silver, 99.7000 min.; arsenic, 0.1000 max.; antimony, 0.0120 max.; bismuth 0.0020 max.; iron, 0.0100 max.; lead, 0.0100 max.; nickel, 0.1000 max.; oxygen, 0.0750 max.; selenium, 0.0400 max.; tellurium, 0.0140 max.; tin, 0.0500 max. The chemical analysis is to be carried out in accordance with "Standard Methods of Battery Assay of Copper" (B 34). Wire-bars, cakes, slabs, and billets shall be substantially free from shrink holes, cold sets, sloppy edges, concave tops, and similar defects in set or casting. This requirement does not apply to ingots or ingot bars, in which case physical defects are of no consequence.—S. G.

**Copper in the Electrical Industry.** H. C. Jennison (*Engineering J.*, 1931, 14, 137).—Very brief note of an address, mentioning the drawing of a 1 in. diam. copper bar to a diam. of 0.002 in., without annealing.—H. F. G.

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



lined. Some interesting examples of "gassed" plates are illustrated in the discussion.—J. C. C.

**The Development of Standard Sheet DIN 1705.** — Schwietzke (*Z. ges. Giesserei-Praxis: Das Metall*, 1931, 52, 4-5).—Abstract of a paper read before the Fachausschuss für Werkstoffe im Verein Deutsche Ingenieure. Standard bronze is an alloy of copper and tin alone. If it is deoxidized with lead, it has the characteristics of a phosphor-bronze. Red brass is an alloy of copper, tin, and zinc and, if necessary, lead. Special bronzes contain at least 78% of copper; only copper-zinc alloys are brasses. The compositions, specifications, and mechanical properties of various bronzes and brasses are given. Bismuth, aluminium, magnesium, and sulphur must be present only in traces in these alloys, and arsenic only up to 0.2%.—J. H. W.

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

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

**Use of Tin-Bronze with High Lead Content for Bearings.** R. Schulze (*Giesserei u. Masch. Zeit.*, 1932, 5, (6/7), 10-11).—The use of bronzes containing high percentages of lead is advocated for bearing purposes. Results are given indicating that losses due to friction are less than normal, principally owing to the fact that lead is insoluble in copper and remains as rounded globules. These work out and produce an extended film of lead. The alloys must be cast from temperatures above 1000° C. into green-sand moulds. An addition of 1-2.5% nickel increases the hardness considerably. Alloys containing up to 20% lead, together with copper 75% and tin 5%, are recommended.—W. A. C. N.

**The Metal Constituents in Bright Gold. I.—The Heat-Resisting Metals. II.—The Fastening Effect of Bismuth. III.—Metals Other Than Bismuth and Rhodium.** Akira Nakatsuchi (*Kōgyō Kwagaku Zasshi (J. Soc. Chem. Ind. Japan)*, 1931, 34, (5); *C. Abs.*, 1931, 25, 4992).—[In Japanese, with English abstracts in supplemental binding, pp. 164-165, 165-166, 166.] (I)—Balsam gold, used to decorate ceramic ware, shows grain-growth if heated above 500° C. Rhodium is the best preventative up to 768° C., but a slight excess causes the metal film to blacken and grain. Aluminium, thorium, and tin can be used for temperatures up to 700° C.; iron, chromium, antimony, ruthenium, nickel, cobalt, and iridium up to 650° C.; alkali metals, strontium, barium, lead, cadmium, uranium, silver, manganese, palladium, and platinum have a slight effect; zinc, magnesium, bismuth, copper, and



calcium have no effect. (II)—Bismuth resinate causes a gold film to adhere to the surface of pottery. Too much produces grain-growth and a greyish-white colour. The best results are obtained by the addition of rhodium also and then slowly heating to 760° C. (III)—If the mixture gold, rhodium and bismuth gives grain-growth this may be prevented by the addition of chromium, aluminium, iron and ruthenium. As much as 1.27% chromium darkens the film.—S. G.

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

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

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

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

—P. M. C. R.

**Lead Poisoning from Drinking-Water.** F. Tödt (*Zentr. Gesundheitsstech.*, 1931, 3, 8-10; *C. Abs.*, 1932, 26, 5630).—Cf. this J., 1932, 50, 379. Lead from water-pipes is especially soluble in soft water, and because of its accumulation in the body may cause poisoning. A lead content of not more than 0.3 mg./litre is allowed in Germany. The limits in America are 0.025-0.1 mg./litre.

—S. G.

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

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

**Tentative Specifications for Low-Carbon Ferro-Molybdenum (A145-32T).** — (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 194-195; and *Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 638-639).—Unless otherwise specified, the material shall be furnished crushed to a size of 1 in. or less. The requirements as to chemical composition are: carbon, 0.25% max.; molybdenum, 55.00-65.00%; silicon 1.50% max.; sulphur, 0.25% max.; phosphorus, 0.10% max.; copper, 0.25% max. The sampling shall be carried out in accordance with the procedure for high-carbon ferro-chromium, chromium metal, low-carbon ferro-manganese, and manganese metal described in "Standard Methods of Sampling Ferro-Alloys" (A103). The chemical analysis is to be carried out in accordance with the procedure for ferro-molybdenum in "Tentative Methods of Chemical Analysis of Ferro-Tungsten and Ferro-Molybdenum" (A104-32T).—S. G.

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

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



*Mat.*, 1932, 32, (I), 636-637).—Unless otherwise specified, ferro-tungsten shall be furnished crushed to a size of 1 in. or less. The requirements as to chemical composition are: tungsten, 75.00-85.00%, as specified; carbon, 0.75% max.; phosphorus, 0.06% max.; sulphur, 0.06% max.; silicon, 1.00% max.; manganese, 1.00% max.; copper, 0.15% max.; arsenic, 0.10% max.; antimony, 0.08% max.; tin, 0.10% max.; sum of arsenic, antimony and tin, 0.20% max. The sampling is to be carried out in accordance with the procedure for high-carbon ferro-chromium, chromium metal, low-carbon ferro-manganese, and manganese metal described in "Standard Methods of Sampling Ferro-Alloys" (A103). The chemical analysis is to be carried out in accordance with the procedure for ferro-tungsten in "Tentative Methods of Chemical Analysis of Ferro-Tungsten and Ferro-Molybdenum" (A104-32T).—S. G.

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

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

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

**Material Questions in the Construction of Aeroplanes.** Paul Brenner (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1932, VI-V12).—Duralumin has given excellent service in the construction of land aeroplanes and the corrosion difficulties met with in seaplane construction can be effectively overcome by using plated alloys or by artificial oxidation of the surface as well as by structural precautions. Magnalium, which is free from copper, will probably give excellent service in seaplane floats. The disadvantage of low endurance strength in aluminium alloys is practically counterbalanced by their relative small sensitivity to local stress concentration at points where there is a sudden change in cross-sectional area, or where there are notches. Magnesium alloys, taking into account the difference in weight, have just as good, and sometimes better, mechanical properties than Duralumin. Their endurance strength is good, but their sensitivity to notches is greater than that of Duralumin. Owing to their poor resistance to sea-water, they cannot be used in building seaplanes.—B. Bl.



## XXII.—MISCELLANEOUS

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

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

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

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

**The Copper Situation.** Arthur Notman (*Canad. Min. Met. Bull.*, 1932, (245), 353-357).—A discussion of the economics of the copper industry.—E. S. H.

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

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

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

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

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



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## XXIV.—BOOK REVIEWS

(Continued from pp. 60-61.)

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

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

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

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

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

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

The reports of the standing, research, and sectional committees which function in the *ferrous metals* field include such subjects as the following: steel; wrought iron; cast iron; malleable iron castings; ferro alloys; iron-chromium, iron-chromium-nickel, and related alloys; heat-treatment of iron and steel; corrosion of iron and steel; zinc coating of iron and steel; magnetic properties; fatigue of metals; effect of temperature on the properties of metals. Papers appended to reports in this group include a summary of present-day knowledge of corrosion-fatigue of metals and on the significance and limitations of fatigue test results, a correlation of tension, creep and fatigue tests of 0.17 per cent. carbon steel at elevated temperatures, and a co-operative study of Charpy notched-bar impact properties, magnetic properties and structural stability of the 18 per cent. chromium, 8 per cent. nickel, "stainless" steels under different conditions of treatment.

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

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



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

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

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

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

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

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

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

The scope and character of this book are now so well known as not to require further description (cf. reviews of earlier editions in this *J.*, 1924, 32, 729, and 1928, 39, 737). In compiling this edition the author claims to have meticulously revised and rigorously condensed or, where necessary, amplified certain sections, and to have introduced a considerable amount of new matter, so that it contains 200 more pages than its predecessor. Compared with the third edition, the metallurgical sections are improved, and many erroneous statements have been eliminated from the old matter, but other errors have been introduced with the new matter, so that there are still numerous quaint statements to be found throughout these sections. For example, another new method of making alumina (Pederson's) is stated to depend "upon the reduction of bauxite to aluminium oxide by means of iron ore instead of coal, crude iron being obtained as a by-product"; under the heading "Aluminium-Bronzes" the first sentence reads, "One consists of 9 parts of copper and 1 part of zinc, resembling gold in appearance"; many beryllium compounds "such as the fluorides ( $\text{BeF}$  and  $\text{BeF}_2$ )" are said to "resemble the corresponding aluminium compounds"; iridium tetroxide is said to be produced by heating the hydroxide in nitrogen at  $350^\circ\text{C}$ ; nickel is stated to be "best known as a black powder, but can be obtained as a bright, lustrous, white, ductile, malleable but tenacious metal of very hard character"; Stellite is a "hard, star-like, brilliant alloy"; uranium is stated to be the heaviest known element and to have an indefinite number of oxides. The author is very cautious in the statements he makes about radioactivity and associated phenomena; nearly all are made with the use of the words "surmized that," "stated that," "supposed to be" "regarded as," and the like; thus under uranium, appears the sentence, "As an element, uranium is the more interesting, as by some sort of molecular disintegration it is surmized to give rise to the production of not only radium and helium, but also some peculiar radium emanations (distinct in some respects from radium), and a peculiar form of lead." In most of the other headings of a metallurgical nature similar erroneous, misleading, or obscure statements may be found which detract greatly from the usefulness and reliability of the book to the non-chemical reader, to whom, presumably, the book should be of greatest value.

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

—A. R. POWELL.

