

# METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

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Part 10

## I.—PROPERTIES OF METALS

(Continued from pp. 481-489.)

**Beryllium and Its Alloys.** Jean Challansonnet (*Aciers spéciaux*, 1933, 8, 166-179).—Describes the discovery, minerals, and deposits of beryllium, the chemical, physical, and mechanical properties of the pure metal, its metallurgy and electrochemical extraction, the use of the pure metal in electro-deposition and as a deoxidizer, the light and ultra-light alloys of beryllium, its alloys with copper, nickel, and iron, and its use in special steels.—J. H. W.

**The Deposition of Sputtered [Cadmium] Films.** R. W. Ditchburn (*Proc. Roy. Soc.*, 1933, [A], 141, 169-187).—Phenomena associated with the depositions of films of sputtered cadmium are investigated experimentally.—J. T.

**The Heat of Dissociation of the Cadmium Molecule, Determined Thermooptically.** Heinrich Kuhn and Sven Arrhenius (*Z. Physik*, 1933, 82, 716-728).—*Inter alia* the molecular heat of dissociation of cadmium ( $\text{Cd}_2$ ) is calculated from the decrease of the band absorption of cadmium vapour with increase of temperature and found to be  $2.0 \pm 0.5$  k. cal.—J. S. G. T.

**Measurement of the Temperatures of Copper and Its Alloys During Casting.** H. Miething and C. Winkler (*Bull. Assoc. Tech. Fonderie*, 1932, 6, (Suppt.), 80-83).—From *Giesserei*, 1931, 18, 181-184. Cf. this *J.*, 1931, 47, 418.—W. N.

**The Freezing Point of Iridium [With an Appendix on: Preparation and Purity of Iridium].** F. Henning and H. T. Wensel (Appendix: Ernest Wichers) (*U.S. Bur. Stand. J. Research*, 1933, 10, 809-821; and *Research Paper*, No. 568).—The ratio of brightness for red light of a black body immersed in freezing iridium to that of a similar black body immersed in freezing gold was measured both directly and indirectly. The indirect method consisted in determining the ratio of brightness at the iridium and platinum freezing points and calculating the result from the previously determined platinum to gold ratio. The two methods, agreeing with each other within the limits of experimental error, yielded a value for the iridium to gold ratio of 4380 at wave-length  $0.652\mu$ . This fixes the freezing point of iridium on the International Temperature Scale as  $2454^\circ\text{C}$ .—S. G.

**Photo-Electric Sensitivity of Magnesium.** R. J. Cashman and W. S. Huxford (*Phys. Rev.*, 1933, [ii], 43, 811-818).—Gas-free surfaces of magnesium prepared by distillation in a high vacuum have a long wave limit of from 5000 to 5200 Å. The formation of a thin surface film of oxide or nitride sensitizes the metal to light of longer wave-lengths, an effect which has also been observed for the alkali metals. With continued oxidation the threshold changes to about 3800 Å., which is the value previously taken to be that of the pure metal.—W. H.-R.

**The Sublimation of Magnesium in a Vacuum and Casting in an Atmosphere of Argon.** J. Hérenghuel and G. Chaudron (*Industrie chimique*, 1933, 20, 86).—Abstracted from *Compt. rend.*, 1932, 195, 1272. See *J.*, this volume, p. 227.—E. S. H.

**The Gyromagnetic Ratios for Nickel and Cobalt.** S. J. Barnett (*Phys. Rev.*, 1933, [ii], 43, 384).—Abstract of a paper read before the American Physical Society. In an elaborate investigation of the rotation of both iron and Permalloy by magnetization (*Proc. Amer. Acad. Arts Sci.*, 1931, 66, 273-348) the gyromagnetic ratios for the two substances were found to be, respectively,  $1.04 \times m/e$  and  $1.05 \times m/e$ , with errors probably less than 0.5%. Successful

observations have now been made on the less tractable substances nickel and cobalt, but the ratios are somewhat less precise. The ratios obtained for those substances are about  $1.06 \times m/e$  and  $1.07 \times m/e$ . The experimental method had to be modified to reduce the effects of certain sources of error, including magnetostriction, before any success was obtained with cobalt. Inasmuch as serious errors, not suspected by other investigators, have been eliminated in all of this work, the results obtained are far more reliable than those obtained by others, who have always obtained  $1 \times m/e$  within the limits of their supposed experimental errors (except Einstein and de Haas, who, in 1915, thought that they had found  $2 \times m/e$ ). The ratios obtained in this investigation agree, within the experimental error, with those of L. J. H. Barnett and S. J. B. in 1925 (*Proc. Amer. Acad. Arts Sci.*, 1925, 127-216) as the result of an elaborate investigation of the magnetization of many ferromagnetic substances by rotation. The mean then obtained was  $1.06 \times m/e$ , with an error estimated as some 2%.—S. G.

**Sodium.** H. N. Gilbert, N. D. Scott, W. F. Zimmerli, and V. L. Hansley (*Indust. and Eng. Chem.*, 1933, 25, 735-741).—The more important industrial uses of sodium are mentioned briefly. Its physical and chemical properties are given and safe and convenient methods for using sodium in chemical reactions are suggested, as well as the precautions necessary to prevent accidents in handling and storing. In metallurgy, sodium has been used for removing antimony from lead, for modifying the structure of silicon-aluminum alloys, and for a similar purpose in the case of special brasses. Sodium-lead alloys and sodium amalgams are often used instead of sodium because reactions are thus more easily controlled. Their preparation is described.

—F. J.

**Influence of Rate of Shear on Shearing Strength.** James Jamieson (*Amer. Soc. Mech. Eng. Preprint*, 1933, 30).—Modern theory indicates that strength of materials is intimately connected with the conditions of shearing stresses in the material. J. has conducted simple shear tests on lead tube, which are sheared at a constant rate and the variation in the torque applied is measured during the test. The results indicate the importance of the rate of shear, and increasing rates are accompanied by an increase in strength. The curves show that lead possesses a definite upper yield-point, a characteristic of steels, but not usually of non-ferrous alloys.—W. P. R.

**Plasticity, Strain-Hardening, and Creep.** H. Hencky (*Amer. Soc. Mech. Eng. Preprint*, 1933).—A mathematical treatment of the inelastic behaviour of metals.—W. P. R.

**Calorimeter with High-Frequency Measurement of the Heat Expansion of the Metal Block into which the Specimen is Dropped.** Hans Esser and Walter Grass (*Arch. Eisenhüttenwesen*, 1933, 6, 353-356).—Up to the present the heat content of the specimen has been determined by measuring the rise in temperature of the metal block into which the hot specimen is dropped. A more accurate method consists in measuring the expansion of the block by making it act as a condenser in a high-frequency alternating circuit. The expansion causes a change in the capacity of the condenser and this is compensated for by the aid of a second condenser working in a second alternating circuit of constant frequency. The heat expansion of the block corresponding with the measured change in capacity gives the relative heat content of the specimen with an accuracy of 0.5%.—J. W.

**Diffusion in Crystals.** Georg v. Hevesy (*Naturwiss.*, 1933, 21, 357-362; and *Z. Elektrochem.*, 1933, 39, 490-500).—The loosening of the lattice necessary for diffusion can be determined only in a general manner from the rate of self-diffusion just above or just below the melting point. Diffusion and conductivity run parallel in electrolytes, and in this case the rise in conductivity at the melting point and the temperature coeff. of conductivity are a measure



of the temperature dependence of the lattice loosening. For the comparison of various electrolytes the increase in the rate of movement of one kind of ion at the melting point gives the best results. The relation between the rate of diffusion and the temperature is discussed theoretically, and is similar to the reaction velocity. Self-diffusion is generally slower than the diffusion of foreign atoms. Cases of one-sided diffusion, e.g. hydrogen in palladium, and of diffusion spreading out over a surface have also been investigated. In pure self-diffusion the change in entropy is zero and in approximate self-diffusion (gold into silver) it is negligible. In place exchange reactions between solid bodies the heat effect is a measure of the change in entropy; in this case the chemical affinity at the surfaces of the reactants and the rise in temperature produced by the heat of reaction play a greater part the greater is the temperature coeff. of the rate of place exchange. Further aspects of the subject are also discussed.—J. W.

**Total Reflection of X-Rays by Thin [Metal] Sheets.** A. I. Alichanow and L. A. Arzimowicz (*Z. Physik*, 1933, 83, 489).—The total reflection of various thicknesses of metals deposited on various supports, viz., layers of silver and tungsten deposited on glass, layers of silver deposited on aluminium, and *vice versa*, and layers of silver deposited on platinum and tungsten is investigated and discussed. Experimental and theoretical results are in agreement.—J. T.

**The Electron Theory of Metallic Conduction.** J. C. Slater (*Science*, 1933, 77, 595-597).—An address delivered at the Massachusetts Institute of Technology, giving an elementary account of the older Drude-Lorentz theory of metallic conduction, and the recent wave-mechanics theory of Sommerfeld.

—W. H.-R.

**Magnetism and Crystal Lattice Rearrangements. X-Ray Investigations Relating to  $\alpha$ -Iron.** F. Regler (*Z. Physik*, 1933, 82, 337-354).—Rearrangements occurring in the crystal lattices of ferromagnetic substances subjected to the action of magnetic fields, and the numerical interpretation of these rearrangements, as revealed by the X-ray determination of fine structure, are discussed.—J. S. G. T.

**Magneto-Striction.—III.** Alfred Schulze (*Z. Physik*, 1933, 82, 674-683).—The equation  $\Delta l/l = C(J^2 - J_0^2)$ , for the change of length,  $\Delta l$ , of material subjected to a magnetic field,  $J$ , is established for iron single crystals, single- and poly-crystalline nickel, and for alloys of nickel with iron and with tungsten.—J. S. G. T.

**On Irregularities in Magnetization.** K. J. Sixtus (*Phys. Rev.*, 1933, [ii], 44, 46-51).—Cold-drawn polycrystalline nickel-iron wires were submitted to tension and torsion in a magnetic field, and a study was made of the patterns formed when iron oxides were deposited from a suspension in ethyl acetate, as recommended by Bitter (*ibid.*, 1931, 38, 1903; 1932, 41, 507). The patterns consisted of parallel lines, but differed from those of Bitter (*loc. cit.*) for single crystals, in that the spacing was irregular and the lines appeared consistently in the same places after changing the direction and magnitude of the applied field. By applying the theory of Becker (*Z. Physik*, 1930, 62, 253; 64, 660) it is concluded that the lines are perpendicular to the direction of induction.

—W. H.-R.

**Thermomagnetic Hysteresis in Steel.** W. Y. Chang and William Band (*Proc. Phys. Soc.*, 1933, 45, 602-609).—A new hysteresis of negative form of the thermomagnetic e.m.f. in a steel wire is described. The phenomenon is discussed in terms of Gerlach's theory of spontaneous magnetization, and Broili's results for nickel (*Ann. Physik*, 1932, 14, 3) are explained.—J. T.

**Photo-Conductivity.** Foster C. Nix (*Rev. Modern Physics*, 1932, 4, 723-766).—A general account of photo-conductivity, including photo-conduction in metallic selenium, and other semi-conductors. It deals essentially with previously published work, and contains a lengthy bibliography.—W. H.-R.

**Recent Developments in the Study of the External Photo-Electric Effect.** Leon R. Linford (*Rev. Modern Physics*, 1933, 5, 34-61).—The general experimental facts, and the classical theories of the photo-electric effect in metals are briefly described. The quantum mechanical theories introduced by Sommerfeld, Fowler, and Nordheim are described in greater detail, including developments due to Wentzel (Sommerfeld's "60 Geburtstag Festschrift der Modernen Physik," edited by P. Debye, Leipzig, 1928), Fröhlich (*Ann. Physik*, 1930, 7, 103), Tamm and Schubin (*Z. Physik*, 1931, 68, 97), and Penney (*Proc. Roy. Soc.*, 1931, [A], 133, 407); the work of Tamm and Schubin is considered to give the best general theory. The last section of the paper deals with "Special Photo-Electric Phenomena," including (a) the effect of temperature, (b) saturation phenomena, (c) the preparation of surfaces, (d) space-charge effects, (e) spectral selective effects of composite surfaces, and (f) the vectorial effect. In (b) the "patch" theory originally proposed by Langmuir is considered more satisfactory than the "film barrier" theory of Nottingham (*Phys. Rev.*, 1932, [ii], 41, 793). The paper is essentially a review of previously published work.—W. H. R.

**Extension of Fowler's Theory of Photo-Electric Sensitivity as a Function of Temperature.** A. T. Waterman and C. L. Henshaw (*Phys. Rev.*, 1933, [ii], 41, 39-40).—A theoretical note. Fowler's application of the Fermi-Dirac statistics to explain the temperature variation of the apparent photo-electric threshold for frequencies near the threshold value is extended so as to include frequencies removed from the threshold.—W. H. R.

**Experiments on the Transmutation of Elements by Protons.** M. L. E. Oliphant and Lord Rutherford (*Proc. Roy. Soc.*, 1933, [A], 141, 259-281).—Results obtained by the bombardment of molecules of lithium, iron, oxygen, sodium, aluminium, nitrogen, beryllium, fluorine, gold, lead, bismuth, thallium, uranium, thorium, and boron with protons or molecular ions at energies up to 200 k.v. are described and discussed.—J. S. G. T.

## II.—PROPERTIES OF ALLOYS

(Continued from pp. 458-496)

**Prevention of Grain-Growth in Wrought Aluminium Alloys.** D. R. Tullis (*Metallurgia*, 1933, 8, 124-130).—The addition of certain elements to light aluminium alloys will retard the grain-growth phenomena which occur in forgings, &c., and also prevent the formation of excessively large grain structure in the cast billet. Titanium is used in the "R.R." type of alloys to prevent the formation of excessively coarse grains in the cast material, but titanium will not prevent the formation of columnar crystals in chill-cast billets, and in subsequent forging and heat-treatment it will not prevent the grain-growth phenomena. Such phenomena are prevented, however, when boron is introduced into the molten alloy. The effectiveness of the result depends on the amount of treatment given to the metal prior to casting and subsequent forging. Metal which has been treated by this process also resists the combined effects of plastic deformation and heat-treatment without exhibiting the grain-growth phenomena. Photomicrographs are given of the results of a number of tests carried out on an aluminium-zinc alloy containing 14% of zinc treated by this process.—J. W. D.

**An Investigation on the Ternary Alloys of Aluminium-Silver-Magnesium, "Silver-Duralumin."** Bentaro Otsu (*Kwaka no Kenkyu*, 1933, 12, (6), 252-276).—[In Japanese.] The equilibrium diagram of the alloys of aluminium and the compound  $\text{Ag}_3\text{Mg}$  has been investigated by means of thermal analysis, electrical resistance measurements, and microscopic examination. O. found a ternary compound  $\text{AlAg}_3\text{Mg}$ , the product of a peritectic reaction melt +  $\text{Ag}_3\text{Mg} \rightleftharpoons \text{AlAg}_3\text{Mg}$  at  $374^\circ\text{C}$ . and the solubility of this compound



in aluminium is 14% at 538° C., 5.4% at 520° C., 4.4% at 500° C., 2.4% at 400° C., and 0.4% at 300° C. of AgMg. The effect of heat-treatment on the mechanical and physical properties of the forged alloys has also been studied. With a suitable heat-treatment it has been found that the alloy containing 6% of AgMg and 4% of copper shows high strength.—S. G.

**The Manufacture and Use of Light Alloys.** W. C. Devereux (*J. Roy. Aeronaut. Soc.*, 1933, 37, 145-167).—A lecture read before the Coventry Branch of the Royal Aeronautical Society, together with a report of the discussion. See *J.*, this volume, p. 121.—H. S.

**Testing of Light Piston Alloys.** M. v. Schwarz and P. Sommer (*Automobiltech. Z.*, 1933, 36, 341-342).—Extract from *Forschungsarb. Metallkunde u. Röntgenmetallographie*, 1932, (4), 1-47. See this *J.*, 1932, 50, 726. —P. M. C. R.

**Strong Light Alloys of To-Day.** Leslie Aitchison (*Proc. Inst. Automobile Eng.*, 1932-1933, 27, 383-417; discussion, 418-433; and (abridged) *Metalurgia*, 1933, 8, 15-17).—The characteristics and industrial applications of wrought alloys are discussed under the headings of medium-strength alloys, high-strength alloys, alloys strong at high temperatures, and corrosion-resisting alloys. Alloys containing 80% or more of aluminium or magnesium are included. Among subjects discussed are: the effect of heat-treatment on the mechanical properties of aluminium alloys containing copper or magnesium silicide, the mechanism of ageing, the mechanical properties of extruded aluminium alloys containing small percentages of magnesium or silicon, the effect of heat-treatment on the mechanical properties of Duralumin "H," Elektron alloys, the effect of cold-work on Birmabright sheet and "MG 7" sheet, alloys strengthened by precipitation heat-treatment, e.g., super-Duralumin, "Y" alloy, "RR 56," Lautal, hardness of various alloys. All are treated in considerable detail. The desirability of reducing weight on automobile construction is stressed and the materials discussed are available for this purpose.—J. S. G. T.

**On Some New Aluminium Alloys.** Edmund Richard Thews (*Chem.-Zeit.*, 1933, 57, 501-502).—The following table shows the composition and mechanical properties of some recently introduced aluminium alloys:

Alloy.	Condition.	Composition, %	Yield-Point, kg./mm. <sup>2</sup> .	Tensile Strength, kg./mm. <sup>2</sup> .	Elongation, %.
Hydronalium	soft sheet	Mg 7-9, Si < 1, Mn < 1	15-20	31-35	16-22
	hard sheet		30-36	38-43	4-9
B.S. Seewasser I	soft	Mg 7.5, Si 0.2, Mn 0.2-0.6	...	33-36	18-25
	hard		...	45-55	3-6
" " II	soft	Mg 9.5, Si 0.2, Mn 0.6	...	35-40	18-25
	hard		...	50-60	3-6
Mangal	hard	Mn 1.5	16-20	18-25	5-2
Pantal	aged	Mg 0.8-2, Mn 0.4- 1.4, Si 0.5-1, Ti 0.3	18-25	30-35	15-12
	aged and worked		33-36	36-42	10-2
Bondur	aged	Cu 4.2, Mn 0.3- 0.6, Mg 0.5-0.9	28-30	40-45	21-61
	aged and worked		35-45	44-60	15-2

Duralumin is somewhat similar to B.S. Seewasser. Albondur is Bondur coated on both sides with a thin layer of the purest aluminium.—A. R. P.

"Wilmit M." Anon. (*Met. Ind. (Lond.)*, 1933, 43, 112).—A short note describing the mechanical properties of "Wilmit M," an improved aluminium-silicon alloy.—J. H. W.

Resistance Alloys for Temperatures up to 1300° C. [Megapyr]. A. Grunert, W. Hessenbruch, and K. Ruf (*Heraeus Vacuumschmelze [10th Anniv. Volume]*, 1933, 169-180).—The alloy "Megapyr" containing 30% chromium, 5% aluminium, and 65% iron has been developed for making heating spirals for electric furnaces operating at temperatures up to 1350° C. The alloy melts at 1530° C. and solidifies in a coarsely crystalline form, hence its working requires a special technique (not described). The rate of grain-growth of strips and wire rises rapidly with the temperature of annealing, so that when mounted in the furnace the winding requires adequate support. The tensile strength is 130 kg./mm.<sup>2</sup> in the cold-worked state and 70 kg./mm.<sup>2</sup> after annealing at 1200° C.; the elongation rises with annealing temperature from 1% at 20° C. to 14% at 800° C. and then falls to 3% at 1200° C., and the life of the alloy at 1200° C. is about double that of the best 80:20 nickel-chromium alloy. Gases containing sulphur have practically no action on Megapyr at high temperatures and very little scaling occurs after prolonged heating. The alloy has a density of 7.1, specific electrical resistance 1.4 (20° C.) and 1.42 (1200° C.) ohms. mm.<sup>2</sup>/m., and a loading capacity of 1.1 watts/cm.<sup>2</sup> of heating surface at 1200° C.—A. R. P.

Creep and Structural Stability of Nickel-Chromium-Iron Alloys at 1600° F. (870° C.) W. A. Tucker and S. E. Sinclair (*U.S. Bur. Stand. J. Research*, 1933, 10, S51-S62; *Research Paper*, No. 572).—A study was made of the creep characteristics at 870° C. of 15 alloys covering a range from 1 to 75% nickel and from 3 to 55% chromium. The results were compared with those of a previous investigation at 540° C. on similar alloys. In the investigation at 540° C. of the nickel-chromium-iron system, it was found that the alloys containing little or no iron, 50-80% nickel, and 20-50% chromium exhibited the greatest resistance to creep. At 870° C. the strongest alloys are those containing approximately equal parts of nickel and chromium, and not more than 30-40% iron. As part of a metallographic study the attempt was made to distinguish between the effect on structure of elevated temperature alone and of elevated temperature and stress combined. A comparison was made between the structure of specimens used in the creep test and that of the unstressed specimens of the same alloys annealed at 870° C. for periods ranging from 100 to 1000 hrs. or quenched in iced brine from that temperature. In nearly all cases the quenched specimens were similar in structure to the annealed materials, which indicates that these alloys were not readily heat-treated. Carbide precipitation and agglomeration of the carbide at the grain boundaries were most pronounced in both the binary iron-chromium alloys and the ternary iron-chromium-nickel alloys of higher chromium content. Prolonged heating of both stressed and unstressed specimens did not produce any pronounced changes in the structure of the binary iron-chromium alloys or the ternary alloys except those containing 50% or more of nickel.—S. G.

The Equilibrium Diagram of the Copper-Tin Alloys. Matsujiro Hamasumi (*Kinzoku no Kenkyu*, 1933, 10, (4), 137-147).—[In Japanese.] This is a supplement to the previous paper (see this J., 1930, 44, 495, and 1931, 47, 651) on the same subject, in which the equilibrium of bronzes containing 15-40% of tin was fully studied. (1) For the purpose of filling in the omissions, the liquidus and solidus lines of the copper-rich side containing less than 15% tin and the tin-rich side containing more than 40% tin were established by means of thermal and differential thermal analyses. (2) The molecular formula of the compound containing about 60% of tin, formerly named  $\epsilon$  or Cu<sub>3</sub>Sn, has been found by microscopic examination to be Cu<sub>3</sub>Sn<sub>2</sub>. A special heat-treatment



was adopted to obtain the completion of the reaction  $\text{Cu}_3\text{Sn} + \text{melt} \longrightarrow \text{Cu}_5\text{Sn}_5$ . (3) The nature of the change of the compound  $\text{Cu}_5\text{Sn}_5$  occurring at nearly  $170^\circ\text{C}$ . was studied by the dilatometric method, and by a method of precision differential thermal analysis having a sensitivity 10 times greater than that of the usual method. The results of these methods show that the change is similar in nature to the  $A_2$  transformation of iron, but, from an X-ray study which is still in progress, it is considered likely to be an allotropic transformation of the compound  $\text{Cu}_5\text{Sn}_5$ . (4) The eutectic point of the phases  $\text{Cu}_5\text{Sn}_5$  and Sn was thermally and microscopically established as  $227^\circ\text{C}$ . and 0.8% copper. The results of the previous and present papers are graphically summarized in Figs. 13 and 14 of the present paper.—S. G.

**The Strength of Bronze [Bearing] Alloys.** Anon. (*Maschinenkonstrukteur*, 1933, 66, (9/10), 72).—The resistance to deformation of bearing bronzes of various compositions is quoted from a recent publication of the U.S. Bureau of Standards.—P. M. C. R.

**The Effect of Addition Elements on the Polymorphism of Iron.** V. N. Svetchnikoff (*Rev. Mét.*, 1933, 30, 200-210).—The saturation curves of the  $\gamma$ -phase in binary alloys of iron have been submitted to mathematical analysis. The curves may be considered with sufficient precision to be curves of the second degree. This conclusion has been verified for the binary systems of iron with aluminium, vanadium, molybdenum, chromium, and nickel. In systems in which the  $A_2$  point falls and the  $\gamma$ -field is enlarged, the curves representing the  $A_2$  and  $A_4$  points are regarded as portions of the same curve of the second degree and joined by an imaginary curve. The curves for the systems mentioned above are ellipses, whilst those of the iron-beryllium and iron-tin systems are hyperbolæ. The effects of the additions are to rotate the axes of the curves with respect to the axis of concentration and to change the lengths of the axes of the curves. Yensen's hypothesis of the absence of  $\gamma$ -phase in iron appears probable.—H. S.

**Surface Tension of Type Metal Alloys.** H. Vance White (*Bull. Virginia Polytech. Inst. Eng. Exper. Sta. Series Bull. No. 13*, 1933, 1-35; *C. Abs.*, 1933, 27, 3692).—The surface tension of various alloys does not vary greatly. Impurities in type metal alloys do not appreciably affect the surface tension. Slight oxidation on casting has little effect. Zinc greatly increases the surface tension.—S. G.

**On the Electrical Resistance of Magnesium and Its Alloys.** Kiyoshi Takahashi and Washirô Eda (*Kinzoku no Kenkyû*, 1933, 10, (4), 127-136).—[In Japanese.] The specific electrical resistivity of pure magnesium and its binary alloys with aluminium, zinc, cadmium, silver, tin, copper, and nickel has been determined by means of the potentiometer. The results show that the effect of aluminium is the greatest, and that of copper is smallest, the order being aluminium, tin, zinc, silver, cadmium, nickel, copper. The difference in specific resistance due to the constitution of the alloys is discussed. The specific resistance has been determined for 10 useful alloys, including Elektron, Dow metal, &c.—S. G.

**The Solubility of Silver in Mercury.—II.** Robert E. Deright (*J. Physical Chem.*, 1933, 37, 405-415).—Amalgams containing as little as 0.06% (atomic) of silver have been prepared and analysed with an accuracy of about 1 part in 1000, and 128 determinations of the solubility ( $N$ ) of silver in mercury over the range  $20^\circ$ - $80^\circ\text{C}$ . have been made. Several forms of silver and intermetallic compounds have been used as the solid phase.  $N$  is related to  $T$ , the absolute temperature, by the equation  $\log N = 0.5894 - 1105.8/T$ . The term "solubility" in a metallic system has a limited significance unless the particle size is specified.—J. S. G. T.

**Standard and Precision Weights of Molybdenum-Chromium-Nickel Alloy [Contracid].** L. Dede (*Heraeus Vacuumschmelze [10th Anniv. Volume]*, 1933, 81-83).—The nickel-chromium alloy "Contracid B 7 M" containing 7% of molybdenum has a density of 8.40, i.e. about the same as the ordinary brass weights, and hence the usual tables for reducing weighings to *vacuo* can be employed when using weights of this alloy. Unlike platinum alloy weights, Contracid weights do not adsorb moisture; they are, like platinum alloy weights, quite unattacked by any of the ordinary laboratory atmospheres. This alloy should therefore be useful for making standard weights.—A. R. P.

**Electrode Material [Contracid] for Spark Spectroscopy.** L. Dede (*Heraeus Vacuumschmelze [10th Anniv. Volume]*, 1933, 84-85).—For absorption spectra in the region above 2200 Å. the two Contracid alloys B 7 M and BMWC are recommended for electrodes, since they give a uniformly bright spectrum with a regular line distribution.—A. R. P.

**Properties of the Alloys of Nickel with Tantalum.** Eric Therkelsen (*Met. Ind. (Lond.)*, 1933, 43, 175-178).—Abstracted from *Metals and Alloys*, 1933, 4, 105. See *J.*, this volume, p. 494.—J. H. W.

**The Temper-Hardening of Alloys. II.—Abnormal Phenomena with the Silver-Rich Aluminium-Silver Alloys during Heat-Treatment.** Denzo Uno and Sadamu Yosida (*Kogyō Kagaku Zasshi (J. Soc. Chem. Ind. Japan)*, 1933, 36, (4); *C. Abs.*, 1933, 27, 3692).—[In Japanese, with English abstract in supplemental binding, p. 172.] A transition occurs at 450° C. during heating where heat absorption and contraction take place, although on cooling the transition takes place at 400° C. with heat evolution and expansion. This is in contrast to the previously observed transition at 600° C., where expansion and heat absorption occur on heating and the reverse changes take place at the same temperature on cooling. The abnormal expansion at 200° C., as well as the contraction at 450° C., depend on the spontaneous evolution or absorption of heat during the tempering.—S. G.

**The White Alloys of Tin. I.—The Bearing Metals.** Anon. (*Tin*, 1933, (May), 13-18).—The white alloys of tin are roughly classified and the requirements and properties of white bearing metals are described.—J. H. W.

**Special Alloys.** Anon. (*Z. ges. Gesesseri-Praxis: Das Metall*, 1933, 54, 227-228).—The composition and principal mechanical properties and applications of the following "trade alloys" are given: Coleco bearing metal, Coles metal, composition metal (ounce metal), Constructal 2 and 8, Colorado metal, Cornish bronze, Cooper's alloy, Corronil, Corronium, and Chronit.—J. H. W.

**Hardness of Low Melting Point Alloys at Different Temperatures. II.—Binary Alloys Whose Components Combine Chemically.** W. P. Schischokin and W. Ageewa (*Zvezdye Metall (The Non-Ferrous Metals)*, 1932, 119-136; *C. Abs.*, 1933, 27, 3692).—[In Russian.] Cf. this *J.*, 1931, 47, 16. The following alloys made of purest materials were investigated: lead-bismuth, thallium-bismuth, thallium-lead, and tellurium-bismuth, and also pure aluminium, magnesium, and tellurium. For all systems the following data were determined: Brinell hardness at various temperatures, melting points and temperature coeff. of hardness. The specimens were previously annealed for 100-200 hrs. at temperatures between 100° and 250° C. The results were as follow: (1) *Lead-bismuth*. The hardness curves of the system at room temperature showed maxima at 25, 40, and 80% bismuth and minima at 35 and 50% bismuth. With increasing temperatures the hardness decreased, and the minima and maxima flattened out gradually. The minimum observed at room temperature at 50% bismuth, with increasing temperature is gradually displaced toward the eutectic composition (56.25% Bi). The minima are due to the formation of compounds. The temperature coeff. of hardness shows a maximum at the eutectic composition. (2) *Thallium-bismuth*. The room temperature-hardness curve shows a maximum at 23.6% thallium and



a minimum at 35.5–37.5% thallium; this indicates an intermetallic phase. The maxima and minima gradually flatten out and disappear with increasing temperatures. The curves for temperature coeff. of hardness show a minimum corresponding apparently with an intermetallic phase, and two maxima corresponding with two eutectics. Logarithmic hardness curves for high-thallium alloys have a break indicating a transformation. (3) *Thallium-lead*. Hardness curves showed a flat minimum at 28–40% lead, flattening out at high temperatures. The temperature coeff. of hardness is rather uniform, with a minimum at the above composition and a maximum at 70% lead. (4) *Tellurium-bismuth*. Hardness curves showed sharp maxima at 49.1 and 90.7% tellurium, and a minimum at 60% tellurium. This system represents a unique case among metallic systems, in that the hardness of the compound  $\text{Bi}_2\text{Te}_3$  (60% Te) does not exceed the hardness of the components. The temperature coeff. of hardness is a minimum at 60% tellurium and a maximum at 90% tellurium. Consideration of the above results indicates that the formation of intermetallic compounds, in almost all cases investigated, is shown by the minima in the temperature coeff. of hardness. The study of hardness of metals at elevated temperatures made it possible to determine certain relationships between the temperature coeff. of hardness and the following properties—melting point, atomic volume, coeff. of expansion, and hardness. Results are given for magnesium, aluminium, zinc, cadmium, tin, tellurium, thallium, lead, and bismuth. With the exception of tellurium and bismuth, the atomic volume varies inversely with hardness. With the exception of tin, the curves for the temperature coeff. of hardness run parallel with change in coeff. of expansion and the change in attractive atomic forces. Inverse proportionality is found between the temperature coeff. of expansion and the melting point. This is in agreement with the empirical generalization of Grüneisen, that the total percentage change in volume from absolute zero to the melting point is the same for all elements. In the binary eutectic systems the temperature coeff. of hardness is higher than in pure metals, the maximum coeff. being observed in eutectic and nearly eutectic compositions.

—S. G.

**On the Age-Hardening of Cold-Worked Metals and Alloys.** Tadashi Kawai (*Kinzoku no Kenkyu*, 1933, 10, (7), 302–330).—[In Japanese.] Tensile strength and hardness are usually employed as a measure of age-hardening by cold-working, but the yield-point is also a convenient measure of the age-hardening phenomenon. K. therefore studied the effects of the dimensions of the test-piece, degree of stretching, heating after stretching, repeated stretching, grain-size of material, rate of cooling in previous annealing, &c., on the age-hardening and determined the age-hardening for iron and various steels and non-ferrous metals and alloys by means of the yield-point. He then investigated the relation between the results of high-temperature tests and age-hardening. With regard to the mechanism of age-hardening, K. is of opinion that the hardening is principally due to the stabilization of internal stress and the change in the coherence between slip planes caused by cold-working. Moreover, K. confirmed, from the results of experiments, that the serration which is observable on the stress-strain diagram in high-temperature tests of iron, steel, some copper alloys, nickel, and Duralumin is the combined effect of age-hardening and yielding.—S. G.

**On the Boiling of Some Metals and Alloys at Atmospheric Pressure.** W. Leitgeb (Z. *Metallkunde*, 1933, 25, 168–169).—Abstracted from Z. *anorg. Chem.*, 1931, 202, 305–324; cf. this J., 1933, 50, 736.—M. H.

**Mechanical Properties of Metals at Low Temperatures.** J. B. Johnson and Ture Oberg (*Met. Ind. (Lond.)*, 1933, 42, 393–394, 402).—Abstracted from *Metals and Alloys*, 1933, 4, 25–30; see J., this volume, p. 295.—J. H. W.

## III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 497-498.)

**The Effect of Temperature on the Reflection of X-Rays from Bismuth Crystals.** A. Goetz and R. B. Jacobs (*Phys. Rev.*, 1933, [ii], 43, 213).—Abstract of a paper read before the American Physical Society. Previous experiments by Goetz and Hergenrother on the influence of temperature on the reflectivity of bismuth crystals for X-rays have been continued with higher accuracy. It has been found that the Debye-Waller relation for the temperature effect does not hold, and that the deviation from it cannot be ascribed in any simple manner to the occurrence of anharmonics of higher orders at high temperatures which should be expressed as well in the temperature coeff. of the thermal expansion. The existence of a thermal hysteresis for the integrated as well as the maximum reflection for Bi (111)  $\text{Mo } k_\alpha$  was found, and thus the existence of a two-phase system within a crystal (amorphous and ideal crystal phase), as has been suggested previously, seems to find support.—S. G.

**The Structure of Magnesium, Zinc, and Aluminium Films.** G. I. Finch and A. G. Quarrell (*Proc. Roy. Soc.*, 1933, [A], 141, 398-414).—An electron diffraction camera in which a metal film is swept by a diffuse beam of electrons is described. Oxide-free surfaces of magnesium, zinc, and aluminium on platinum, and vapours of these metals in transit between source and receiver, were examined by electron diffraction. Oxides of magnesium and zinc formed on the corresponding metal have also been examined. It has been found that (i) the structure of the thin aluminium foil is that of a face-centred tetragonal lattice, and thus differs from that of the normal structure, which, however, is obtained with sufficient film thickness; (ii) thin oxide layers of magnesium and zinc also exhibit abnormal crystal structures; (iii) heating the receiver causes the crystals to be preferentially oriented; (iv) metal vapours do not diffract, but scatter the electrons. The mechanism of crystal growth in the films as influenced by the substrate is discussed. Magnesium, zinc, and aluminium vapours are found to be monatomic.—J. S. G. T.

**A Critical Study of the Intensity Formula for the Powder Method of Crystal Analysis.** F. C. Blake (*Phys. Rev.*, 1933, [ii], 43, 376).—Abstract of a paper read before the American Physical Society. By combining the Thomson and Lorentz factors into a single factor, and the usual structure factor and the atomic form factor into another single factor, the intensity formula consists of the product of these two together with the form or multiplicity factor, the Debye temperature factor, and the absorption factor, treated by Claassen and Rusterholz. It is possible from a knowledge of these 5 factors to study intensity as a function of the wave-length for metals of different atomic numbers. Calculated results can be compared with experiments by means of densitometer experiments properly interpreted. The comparison has been made for aluminium using molybdenum and copper rays, and agreement found for molybdenum rays. The reasons for disagreement when copper rays are used are discussed. There are other factors not properly handled in the intensity formula. These are discussed.—S. G.

**On the Theory of Real Crystals.** Adolf G. Smekal (*Phys. Rev.*, 1933, [ii], 44, 308-309).—A note criticizing the views of Zwicky (*Phys. Rev.*, 1933, [ii], 43, 765; *Helv. Phys. Acta*, 1933, 6, 210). S. considers that there is no theoretical proof of the existence of a secondary structure in crystals, and that the experimental evidence is open to question.—W. H.-R.



## IV.—CORROSION

(Continued from pp. 499-502.)

**Corrosion of Nickel and Monel Metal by Sulphured Grape Juice.** E. M. Mrak and W. V. Cruess (*Indust. and Eng. Chem.*, 1933, 25, 367-369).—Experiments made for the purpose of determining the rates and extent of corrosion of nickel and Monel metal in "fogs" of natural and sulphured grape juice are described. Red and white grape juices were used, with and without the addition of sulphur dioxide, the juices being sprayed under highly aerated conditions into a bell-jar in which the strips of metal were suspended. The tests showed that sulphurous acid greatly increases the corrosive action of grape juice on nickel but not on Monel metal. In the case of Monel metal some constituent of red grape juice, possibly anthocyanin pigments, causes a greater corrosion by the juice than sulphurous acid. In most cases Monel metal proved more resistant than nickel to corrosion by the media used in these tests.—F. J.

**Corrosion-Accelerated Wear.** Horace J. Young (*Automobile Eng.*, 1933, 33, 295-297).—The causes of the localized wear of cylinders, cylinder liners, and bearings are discussed, and it is suggested that such wear may be due to corrosion. Corrosion of pins and journals of a crankshaft is said to result from lubricating oil contaminated with combustion products and with contaminants entering the combustion zone. A method of testing corrosive oil by using white-metalled steel specimens is described. The effects of such a corroding medium on the steel and white bearing metal are considered, and the influence of such corrosion on the bearings and cylinder liners of all types of internal combustion engines, both large and small units, is discussed.

—J. W. D.

**The Influence of Corrosion Pits, &c., on Fatigue.** D. J. McAdam, Jr. (*Amer. Soc. Mech. Eng. Preprint*, 1933).—The paper is divided into 8 sections: (1) is a brief introduction emphasizing the importance of the effects of notches on the fatigue limit; (2) discusses the theoretical effect of notches on "two-dimensional" and "three-dimensional" stress distribution; (3) considers static stress distribution as determined by various experimental methods; (4) presents original data showing the influence of prior stressless corrosion on the fatigue limit of steels and aluminium alloys; (5) discusses the effect of mechanically formed notches, and the influence of work-hardening whilst forming the notch; (6) deals with the effect of completely and incompletely encircling grooves, surface roughness, surface hardness on the percentage drainage due to notches; (7) discusses the effect of size of notch and size of specimen; and (8) deals with practical applications of the subject.

—W. P. R.

**The Current Limits in the Anodic Polarization of Metals in Aqueous Solutions.** Erich Müller and Kurt Schwabe (*Z. Elektrochem.*, 1933, 39, 414-423).—The criticisms by W. J. Müller (cf. *J.*, this volume, p. 423) of the theory of passivity put forward by M. and S. (see this *J.*, 1932, 50, 610) are answered and his conclusions are in their turn criticized. Fresh observations on the coating resistance are put forward, based on the results obtained with 2 zinc electrodes in an  $\frac{m}{2}$  zinc sulphate solution.—J. H. W.

**New Methods of Examining Metals from the Point of View of their Heterogeneity and their Resistance to Corrosion.** — Prot and (Mlle.) N. Goldovsky (*Compt. rend.*, 1933, 196, 136-137).—A heterogeneous alloy or set of metals is immersed in an electrolytic solution and the alteration of the hydrogen-ion concentration is measured by means of an indicator. This use of an indicator and of a colloidal stabilizer (gelatine) constitutes a practical test of heterogeneity liable to become a source of dangerous corrosion, especially in the case

of light alloys, and also furnishes a rapid, convenient, and non-destructive control of heat-treating, riveting, and welding operations. The indicators are chosen to give a range of  $p_{H_2}$  4 to  $p_{H_2}$  12. The usual tests for corrosion are not suitable for measuring pinhole corrosion. For this purpose, the test-pieces are immersed in sea-water for some days, in the case of Duralumin, and then placed on photographic paper which shows the nature and extent of this form of corrosion.—J. H. W.

## V.—PROTECTION

(Other than Electrodeposition.)

(Continued from pp. 502–506.)

**Calorizing.** Anon. (*Mech. World*, 1933, 93, 214).—The applications of Calorizing, including the protection of heat-resisting alloys when heated above 1000° C. and of nickel-chromium alloys for service in an atmosphere of sulphurous gases, are enumerated. The nature of the coating formed is described and the corrosion-resistance of Calorized steel compared with that of untreated steel is graphically represented.—F. J.

**Sherardizing and Oxidizing Castings.** Anon. (*Z. ges. Giesserei-Praxis: Eisen-Zeit.*, 1933, 54, 221–222).—For sherardizing, a mixture of 0.15 m.<sup>3</sup> of zinc dust, containing not more than 0.19% of lead and 9% of zinc oxide, with 0.85 m.<sup>3</sup> of fine quartz and 50 gm. of naphthalene, is heated to 380° C. in a drum. The castings are then put in and left for at least 2 hrs. While cooling, the drum is rotated 15–20 times per minute for  $\frac{1}{2}$ –1 hr. The Chemag and the Citoxit processes for protective oxidized finishes to iron castings are described.—J. H. W.

**Critical Observations on the So-Called "Ageing Phenomena" of Zinc-Sprayed Castings, with Special Regard to the Mechanical-Technical Properties of Cast Iron.** Willi Claus (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 54, 286–288).—The elongation, tensile strength, Brinell hardness, percussion resistance, and bending strength of cast iron and cast iron sprayed with zinc and aged for 5-weekly periods up to 60 weeks have been investigated. It was found that the elongation during this period was very small (about 0.13–0.14%), that the static mechanical properties showed a tendency to increase, and that the dynamic property, although lower at the end of this period, was still greater than that of cast iron. Six references are given.—J. H. W.

**The Scientific Study of Protective Painting.** S. C. Britton and U. R. Evans (*Electrochem. Soc. Preprint*, 1933, Sept., 9–21).—The factors which produce failure in paint films on iron and steel have been studied and details of tests designed to assess the effects of the nature of the metal, the presence of scale, rust, water, and salt between the paint film and the metal, the composition of the paint, and the nature of the conditions to which the painted metal is exposed, are given. Promising results in the protection of iron and steel by sprayed aluminium coatings have been obtained.—A. R. P.

**On the Study of Protective Films Against Corrosion Formed on the Surface of Aluminium Alloys.** Hikozi Endō and Masayoshi Tagaya (*Kinzoku no Kenkyū*, 1933, 10, (5), 179–199, 227–242).—[In Japanese.] In this investigation specimens were dipped in various salt solutions and the metal surfaces examined for formation of insoluble protective salt coatings. As a result of a preliminary examination various protective coatings were successfully obtained from the following salt solutions: (1) 2% potassium permanganate, 2% sulphuric acid, 2% manganese dioxide; (2) 1% calcium oxide, 1% calcium sulphate or zinc oxide, and 0–1% potassium permanganate, &c. These were adopted for aluminium and its alloys. The period of immersion was 30–40 minutes. With baths in the boiling condition: (3) 10% dibasic phos-



phate or potassium phosphate, 3% sodium hydroxide or 4% sodium carbonate and saturation with magnesium phosphate; (4) 0-10% dibasic sodium phosphate, 0.5-5% sodium hydroxide, 0-3% magnesium phosphate, 1.0-3.0% potassium bichromate, and 0.5-3% aluminium sulphate or  $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$ ; (5) 1% selenious acid and 1% sodium carbonate, &c. These were adopted for magnesium and its alloys. The time of immersion was a few hours. It was found that the most promising method of protective coating consisted of a chemical treatment of the metal surface as above, followed by a coating of lanolin, Bakelite varnish, or special rubber. The protective coatings were only a few thousandths of an inch in thickness and were not appreciably affected by dimensional changes of the alloys. It has been found by other authors that such films can resist severe bending or other mechanical treatment and form a satisfactory base for certain paints, lacquers, &c.—S. G.

## VI.—ELECTRODEPOSITION

(Continued from pp. 506-512.)

**The Electrodeposition of Bismuth from Perchloric Acid Solutions.** M. Harbaugh and F. C. Mathers (*Electrochem. Soc. Preprint*, 1933, Sept., 155-160).—Good deposits of bismuth can be obtained from baths containing bismuth oxide 5.3 and perchloric acid 13.5 oz./gall.; the bath has a decomposition voltage of 1.62 v., a cathode efficiency of 100%, and a throwing power of 7-9%. The deposits are a little smoother when 0.03% of glue and 0.08% of cresol are added to the bath; in all cases they contain 0.3-0.5% of perchlorate as well as traces of addition agents, if present in the bath. Large amounts of ammonium perchlorate and traces of nitric acid or nitrates have no effect on the operation of the baths, but chlorides or sulphates cause precipitation of basic bismuth salts. Since most perchlorates are soluble, the method cannot be used for refining bismuth, but it can be used for the deposition of alloys of bismuth with lead, copper, or arsenic.—A. R. P.

**Ensuring Clean Cadmium-Plated Coatings.** E. E. Halls (*Synthetic and Applied Finishes*, 1933, 4, (37), 16-17, 20; *C. Abs.*, 1933, 27, 3883).—Satisfactory cadmium deposits are assured when attention is given to operating conditions as well as to initial cleansing and final thorough washing of the work. The use of iron, stoneware, or rubber-lined wood for vat construction, and raw material of controlled purity with periodic filtration of the electrolyte assist in the prevention of contamination. Chemical control is essential to maintain a sufficient cyanide concentration to keep cadmium in solution, and to determine effective anode area. Ball-form anodes in iron-wire cages are economical and facilitate control.—S. G.

**Chromium Plating from Ammonium Chromate-Sulphate Baths.** Raymond R. Rogers and John F. Conlon (*Electrochem. Soc. Preprint*, 1933, Sept., 319-324).—The range of composition at which bright chromium plates can be obtained in the system chromic acid-sulphuric acid-ammonia has been determined, and the results are shown in a ternary diagram; they may be summarized as follows: (a) except when the concentration of chromic acid or ammonium sulphate is very small, all solutions containing ammonium bichromate, chromic acid, and ammonium sulphate give bright deposits until the solution becomes saturated with respect to one of its constituents; (b) solutions of chromic acid and ammonium sulphate with small proportions of sulphuric acid give bright deposits, but these become frosty and brittle when more of the latter is added. Three typical baths in the bright deposit range have been investigated to determine the conditions under which the best deposits are obtained, and the current efficiency, throwing power, and continuity of the deposit under these conditions; none of the baths is superior to the ordinary chromic acid bath.—A. R. P.

**The Electrodeposition of Magnesium.** D. M. Overcash and F. C. Mathers (*Electrochem. Soc. Preprint*, 1933, Sept., 131-136).—Magnesium can be deposited by electrolysis of the Grignard reagent derived from ethyl iodide in the form of loose, poorly adherent crystals. Addition of dimethylaniline produces brighter and more adherent deposits, but in neither case is there any anodic corrosion so that the life of the bath is short. Cathode current efficiencies start at 80-85%, but fall off slowly with continued electrolysis. The ethyl bromide Grignard reagent gives deposits starting at a current efficiency of 55% but the bath (with dimethylaniline) has a high resistance and is less stable than the iodide bath. Neither type of bath appears to be of any commercial value.—A. R. P.

**The Electrodeposition of Nickel and Chromium.** J. W. Cuthbertson (*Metalurgy*, 1933, 8, 109-110).—See *J.*, this volume, p. 88. There are 2 processes by which articles may be electrolytically plated with chromium: (1) from a dull solution; (2) from a bright solution. The former is worked at a higher current density than the latter, and the deposit obtained is dull greyish in colour and must be finished. As finishing presents difficulties owing to the hardness of the deposit, this type of plating is gradually being replaced by plating from a bright solution. The production of a bright deposit is possible only if the solution is worked between certain comparatively narrow limits as regards temperature, current density, and composition. The solution required and the operations of the bath in these processes using different anodes are discussed and the procedure in chromium plating an article is given in detail. Consideration is also given to the danger of contamination by foreign elements, to the prevention of gassing, to the results obtained from chromium electrodeposits, and to the difficulties of plating complex articles.

—J. W. D.

**Practical Plating. The Deposition of Nickel.—Solutions.** E. A. Ollard (*Md. Ind. (Lond.)*, 1933, 43, 59-60, 107-109).—See *J.*, this volume, p. 449. The composition of various solutions used in nickel deposition, the function of addition agents, the effects of different impurities, the chemical composition and physical structure of the anodes, and the working conditions of the baths are discussed.—J. H. W.

**Throwing Power and Current Efficiency of the Nickel Plating Solution at Low and High  $p_H$ .** Russel Harr (*Electrochem. Soc. Preprint*, 1933, Sept., 203-217).—An apparatus for determining the throwing power of plating solutions using bent wire cathodes giving readily reproducible results is described, and the results obtained with nickel-plating solutions containing 40 and 60 oz. gall. of nickel sulphate crystals at various temperatures and current densities and at  $p_H$  2 and  $p_H$  6 are tabulated. Under all the conditions tried the throwing power at  $p_H$  6 is better than at  $p_H$  2, and in both cases is improved by raising the temperature, especially in solutions of  $p_H$  2, which have a poor throwing power at room temperature. At  $p_H$  6 throwing power decreases with increase in current density, whereas at  $p_H$  2 it increases; a similar, but much less marked, effect is produced by increasing the nickel sulphate content from 40 to 60 oz. gall. Ferric sulphate has no effect on throwing power, but ferric sulphate (stable only at  $p_H$  2) considerably reduces it. Hydrogen peroxide has little effect at  $p_H$  6, since it decomposes rapidly during plating, but at  $p_H$  2 it reduces throwing power seriously by its action in keeping any iron present in the ferric state.—A. R. P.

**The Adhesion of Electrodeposited [Nickel] Coatings to Steel.** A. W. Benthamsall (*Electrochem. Soc. Preprint*, 1933, Sept., 85-87).—To determine the adhesion of electrodeposited nickel to steel a cylindrical test-piece 1.5 in. long and 1 in. diam. is stopped off with wax and nickel is deposited on the exposed end to a thickness of not less than 0.1 in.; the wax is then removed and the test-piece machined so as to form an annular ring overlapping the



cylinder at the outside and with a central hole drilled into the steel. The overlap is allowed to rest on the top of a thick-walled hollow cylinder, into which the steel cylinder fits loosely, and this is then forced downwards by a plunger which passes through the hole in the deposit. The adhesion value in tons/in.<sup>2</sup> of nickel deposited on thoroughly cleaned metals is as follows: mild steel 28.1, nickel steel 32.1, nickel-chromium-molybdenum steel 21.3, 60:40 brass 19.2, 70:30 brass 23.7, copper 18.5, nickel 22.8, manganese-brass 22.3, aluminium 3.5. In all cases the base metal failed before the deposit was torn off. Poor adhesion is caused by inefficient cleaning (presence of a film of oxide, grease, or adsorbed colloidal matter), a layer of defective metal formed in the early stages of deposition, or a surface layer of the basis metal which is initially weak or which is embrittled by co-deposited hydrogen. Adhesion is considered to be due to the cohesive force between the two metals; only in rare cases do the crystals of the deposit continue the crystal structure of the basis metal.—A. R. P.

**A New Bath for the Direct Nickeling of Zinc.** George W. Nichols (*Electrochem. Soc. Preprint*, 1933, Sept., 149-154).—The rate of chemical replacement of nickel by zinc is retarded by addition of hydroxy-organic acids such as citric, malic, and, particularly, lactic acids, of certain alcohols such as ethyl and methyl alcohol, but not glycerol, and of some sugars, particularly dextrose. Good electrolytic deposits of nickel directly on to zinc can be obtained by addition of 0.7 oz./gall. of ammonium lactate to a bath containing nickel ammonium sulphate 10, sodium chloride 5, and boric acid 2 oz./gall.; excessive amounts of lactate cause treeing at points of high current density. Increasing the nickel content of the bath increases the lactate-nickel ratio necessary to prevent streaking, and tends to produce deposits containing numerous hair cracks; the best deposits are obtained at  $p_H$  3.7-4.3. Baths buffered with citrate, malate, or dextrose give yellower and more matte deposits than do lactate baths, and the yellow tone cannot be removed by burnishing.—A. R. P.

**Platinum Plating.** Alan E. W. Smith (*Met. Ind. (Lond.)*, 1933, 43, 201-202).—A number of corrosion tests in different media and at temperatures up to 500°C. were carried out on brass, platinum plated on a silver-plate undercoat, and a comparison was made between the corrosion resistance of this form of plating and that of nickel- and chromium-plating and 2 stainless steels when immersed in a 2% solution of iodine in alcohol. It was found that platinum plating is similar to chromium plating in being "non-corroding," but in failing through the porous nature of the deposit. Chromium plating is harder and cheaper, but platinum plating has a far more pleasing colour and a better throwing power.—J. H. W.

**New Continuous High-Speed Zinc-Plating Process.** Anon. (*Automotive Ind.*, 1933, 69, 182).—An account of a new method of electrodepositing zinc on steel plate. Several sheets of standard size are plated per minute by a continuous automatic process, which is briefly described. By the same process steel can be coated with smooth and bright deposits of brass or copper.

—P. M. C. R.

**Metal Cleaning before Electro-Plating.** Anon. (*Engineer*, 1933, 156, 45-46).—Non-adherence of electrodeposited metal can usually be ascribed to insufficient cleaning of the surface to be plated. Simple removal of grease by means of an organic solvent is far from satisfactory, and the essentials of a perfect cleaning process involve emulsification and peptization. A form of metal cleaner which has proved to be efficient contains aluminate and silicate of potassium and sodium, and this solution acts in two ways simultaneously: it emulsifies vegetable and animal fats and at the same time the suspended colloidal matters scour the surface and mechanically remove all dirt and mineral oils.—W. P. R.

## VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-Refining.)

(Continued from pp. 512-513.)

**Depolarization by Graphite Anodes in the Electrolysis of Aluminium Oxide.** M. de Kay Thompson and R. G. Seyl (*Electrochem. Soc. Preprint*, 1933, Sept., 123-129).—The decomposition voltages of alumina in molten fluoride baths have been calculated (C) by the third heat theorem for platinum and graphite anodes at 1000° and 1300° C. Actual measurements (M) have also been made of these voltages at temperatures between 971° and 1231° C. using both types of anodes. For a 20% solution of alumina the values for 1000° C. are: platinum C 2.24, M 2.25; graphite C 1.09, M 1.38 volts; and for 1300° C.: platinum C 2.09, M 1.75; graphite C 0.81, M 0.88 volts. Hence the depolarization (difference between the decomposition voltages at attackable and unattackable anodes) is 0.87 (C) at both temperatures and 1.15 (M) at 1000° C. and 1.28 (M) at 1300° C. This shows that depolarization by the graphite anode is not complete at any temperature in this range, i.e. the evolved oxygen is not reduced to the pressure at which it is in equilibrium with carbon. There is no overvoltage on platinum anodes and no overvoltage of aluminium deposition.—A. R. P.

**The Reduction of Chromium from Chromium Oxide by Means of Gases.** H. Gruber and W. Rohn (*Heraeus Vacuumschmelze [10th Anniv. Volume]*, 1933, 117-127).—When chromic oxide is reduced by a current of hydrogen over a bath of molten iron or nickel, action ceases when the alloy contains 17% chromium. By carefully purifying the hydrogen from water vapour, &c., by passing it through a tube cooled with carbon dioxide snow and acetone or packed with phosphoric anhydride the chromium content of the alloy can be increased to 25-31%. With carbon monoxide as reducing agent, reaction ceases when the alloy contains 3.5% chromium, and with ammonia when the alloy contains about 18-19% chromium. Addition of hydrocarbons to the hydrogen to give a mixture containing not more than 50 gm. of carbon per m.<sup>3</sup> of hydrogen, or the use of coal gas—producer gas mixtures of similar composition, results in a more rapid reduction of the chromium oxide without introducing more than 0.05% carbon into the alloy. For large-scale work an induction furnace lined with magnesite is necessary to give efficient circulation of the molten metal; temperatures above 1750° C. increase at first the rate of absorption of chromium by the metal, but cause crusts to form round the sides, so that the efficiency of absorption falls off. For a surface of 350 cm.<sup>2</sup> gas speeds exceeding 30 m.<sup>3</sup>/hr. produce no further increase in the rate of reduction.—A. R. P.

**Preparation of Carbon-Free Chromium Alloys from Carbonized Ferrochromium.** H. Gruber (*Heraeus Vacuumschmelze [10th Anniv. Volume]*, 1933, 128-138).—Treatment of molten ferrochromium (70-75% chromium, 6-4% carbon, remainder iron) with chromite-fluorspar mixtures or with hammer-scale in the high-frequency induction furnace yielded alloys containing not less than 0.51% carbon with a serious loss of chromium into the slag. By using chromic oxide in an atmosphere of hydrogen, 10 kg. of alloy can be decarburized to 0.04% carbon in 6½ hrs. with the consumption of 8 m.<sup>3</sup> of hydrogen and without any loss of chromium. Hydrogen is more efficient than water-gas, and pure chromic oxide is much better than powdered chromite; a temperature of at least 2000° C. is required. Both carburized nickel-chromium alloys and chromium metal can be decarburized in a similar way. Nickel-chromium alloys containing up to 70% chromium can be prepared by reducing chromium oxide with carbon over a bath of molten nickel and subsequently decarburizing with chromic oxide in hydrogen.



Vanadium or titanium alloys with iron or nickel or both can be prepared in a similar way. Decarburization is in all cases accelerated by reducing the gas pressure above the molten metal bath.—A. R. P.

**The Metal Displacement Equilibrium of Lead with Cadmium or Silver in Their Molten Chlorides, Bromides, or Iodides.** Dymitr Hewskjy and Karl Jellinek (*Z. Elektrochem.*, 1933, 39, 444-453).—A method of measuring the metal displacement equilibrium in salt melts is described. It is shown that with electrolysis of molten salt mixtures the equilibrium at the cathode sets in rapidly. The equilibrium  $\text{Cd} + \text{PbCl}_2 \rightleftharpoons \text{CdCl}_2 + \text{Pb}$  at 600° C. with and without dilution of the metal phase with bismuth was determined chemically and by electrolysis of a melt of cadmium and lead chlorides with a cathode of molten bismuth. In all cases, the same molar fraction number resulted, and the melts behaved as ideal solutions. The equilibria  $\text{Cd} + \text{PbBr}_2 \rightleftharpoons \text{CdBr}_2 + \text{Pb}$  at 600° C., and  $\text{Cd} + \text{PbI}_2 \rightleftharpoons \text{CdI}_2 + \text{Pb}$  at 500° C. were measured. All these reactions obey the molar fraction-effect law, and for equal temperatures, the value of the factor is independent of the halogen. The equilibria  $\text{Pb} + 2\text{AgCl}(\text{Br})(\text{I}) \rightleftharpoons \text{PbCl}_2(\text{Br}_2)(\text{I}_2) + \text{Ag}_2$  were measured at 800° C. They also obey the molar fraction-effect law and behave as ideal solutions. The silver in the molten lead is diatomic, but the silver ion in the melt is monatomic. The value of the molar fraction factor is strongly dependent on the halogen. Lead can precipitate much less silver from the iodide than from the chloride melt. Analytical methods for determining small amounts of cadmium when a large amount of lead is present, and small amounts of bismuth in ternary alloys containing a little lead and cadmium are given.—J. H. W.

**The Kinetics of the Deposition of Small Amounts of Mercury by Means of Iron and Copper.** Vladimir Majer (*Z. Elektrochem.*, 1933, 39, 439-444).—The kinetics of the deposition of mercury from very dilute solutions of  $\text{HgCl}_2$  ( $10^{-5}$  to  $10^{-7}$  gm.mol./litre) with metallic copper and iron have been investigated. Observations were made of the effect of the phase boundary surface, the vigour of stirring, and the temperature of the reaction constant. For the deposition by iron, with a phase boundary surface of 1.30 cm.<sup>2</sup>, at 55° C. and with stirring, the reaction constant was found to be 0.045 min.<sup>-1</sup>. The deposition with copper was investigated under the same conditions, and showed a progressive reduction in the reaction velocity. The reaction tends to a condition of equilibrium which does not agree with thermodynamic considerations. On the assumption that a known amount of mercury cannot be deposited from solution, it is possible to transform the reaction equation to the usual form from considerations of diffusion. The observed reaction constant was 0.037 min.<sup>-1</sup>. The difference in the kinetics of mercury deposition with iron and copper was traced to the various factors investigated.—J. H. W.

**A Study of the Changes in Mass of the Anode of the Aluminium-Lead Cell.** Charles E. Welling (*J. Sci. Lab. Denison Univ.*, 1933, 28, 147-151; *C. Abs.*, 1933, 27, 3884).—Aluminium-lead cells containing an approximately 2% solution of ammonium phosphate were studied to determine the relation of the loss of weight of aluminium to the leakage current. Decrease in weight of the anode was negligible, and in no way proportional to that required by Faraday's law for the current measured. A bibliography is given.—S. G.

**Faraday and His Electrochemical Researches.** Robert S. Hutton (*Electrochem. Soc.*, 1933, Sept., 1-18).—An address commemorating the 100th Anniversary of Michael Faraday's discovery of the fundamental principles of electrochemistry, giving a brief account of his life and work, with copious extracts from his diary.—A. R. P.

**March of Electrochemistry.** Charles L. Mantell (*Chem. and Met. Eng.*, 1933, 40, 120-122).—A historical account of the commercial developments of the electrochemical industries from 1800 to the present day.—F. J.

## VIII.—REFINING

(Continued from p. 513.)

**An Electrolytic Copper Refinery.** Anon. (*Engineer*, 1933, 156, 153-155).—Description of the now completely electrified copper refinery at Montreal with a capacity of 75,000 tons per year.—W. P. R.

**Copper Product Perfected.** B. H. Strom (*Eng. and Min. J.*, 1933, 134, 281-282).—Describes the production of copper sheets by electro-deposition at the Raritan Copper Works, New Jersey, U.S.A. The plant capacity is 6000 linear ft. of copper sheet, 3 ft. wide, and varying in gauge from 0.0017 to 0.013 in. or from 1 to 7 oz./ft.<sup>2</sup>. The production is accomplished in two steps; the first operation involving electrolysis on a revolving antimonial lead cathode. Sheets up to 1 oz. thickness are produced. Heavier sizes are made by building up these sheets in a loop cell.—R. Gr.

**Continuous Lead Refining.** Anon. (*Eng. and Min. J.*, 1933, 134, 285-286).—Summarizes the development of the continuous method of refining for arsenic, antimony, copper, gold, silver, and zinc, now practised at Port Pirie, South Australia, and its advantages.—R. Gr.

**Electrodeposition of Lead from Dithionate Baths.** R. L. Bateman and F. C. Mathers (*Electrochem. Soc. Preprint*, 1933, Sept., 301-308).—Lead can be satisfactorily refined by electrolysis in baths containing 4-5% of lead dithionate and 1.5-2% of free dithionic acid using at 20° C. a current density of 1 amp./dm.<sup>2</sup> at 0.3 v. with an electrode separation of 4.4 cm. To prevent treeing and to obtain smooth adherent deposits, colloidal addition agents must be present; the best results are obtained with 0.005% of glue together with 0.005% of one of the following:  $\beta$ -naphthol, cresol, phenol, resorcinol, clove oil, aloes residue. Anode and cathode current efficiencies are approximately 100%, but there is a tendency for the concentration of the free acid to diminish and that of the lead salt to increase; this is overcome by withdrawing a portion of the bath, removing the lead by addition of sulphuric acid, and returning the filtrate to the bath. The bath is prepared by treating manganese dithionate solutions (produced by the action of sulphur dioxide on manganese dioxide suspensions at 0° C.) with an excess of barium hydroxide, crystallizing out the barium dithionate, removing the barium with the theoretical quantity of sulphuric acid, and adding the requisite quantity of lead carbonate to the resulting dithionic acid solution.—A. R. P.

**The Electrolytic Refining of Mercury.** E. Newbery and S. M. Naude (*Electrochem. Soc. Preprint*, 1933, Sept., 57-68).—After a trial of numerous electrolytes, satisfactory results were obtained only with mercurous perchlorate solution made by dissolving 20 gm. of mercuric oxide in 20 c.c. of 75% perchloric acid, diluting to 80 c.c., and reducing to the mercurous salt by electrolysis. Two types of laboratory cell are described, in one of which the electrolyte is mechanically stirred, while in the other it is stirred by convection currents set up by the electrolysis; stirring is essential to prevent formation of crusts of solid salts on the anode. No solid metal makes a satisfactory cathode, hence pure mercury is used; if not otherwise available, this is obtained by electrolysis, using a platinum or stainless steel cathode to begin the operation and withdrawing the metal cathode when sufficient mercury has accumulated. Electrolysis is conducted at room temperature using 1 amp./dm.<sup>2</sup> at 0.5 v.; the impurities, except precious metals, accumulate in the electrolyte, which must therefore be occasionally purified by crystallizing out the mercurous perchlorate and redissolving it in very dilute perchloric acid. With very impure mercury a preliminary purification is advisable; this may be done by blowing air through the metal at just below the boiling point or by spraying the metal several times through dilute nitric acid. Electrolytic mercury is shown to be practically "spectroscopically pure."—A. R. P.



## IX.—ANALYSIS

(Continued from pp. 514-515.)

**On the Carrying Out of Technical Spectrographic Analysis.** Otto Feussner (*Arch. Eisenhüttenwesen*, 1932-1933, 6, 551-557).—To obtain reproducible spectrograms which can be evaluated quantitatively the following points are important: (1) alternating extinction of the light by the electrodes during the discharge must be avoided; (2) the spectral lines must be obtained of regular darkness throughout their length by correct focussing of the quartz condenser lens; (3) the relation between the capacity and inductance and the magnitude of the discharge tension during the discharge must be kept constant; (4) during the photometric measurements the course of the darkening curve must be considered and the entrance of extraneous light avoided. These points and other important questions for obtaining good results are critically discussed with reference to experimental work, and new electrical apparatus for obtaining reproducible discharges is described.—J. W.

**X-Ray Analysis of Metals and Alloys.** John Iball (*Met. Ind. (Lond.)*, 1933, 43, 121-123).—A description is given of the spectrum camera which examines the type of structure of metals and alloys, and of the precision camera which measures the size of the unit cell of the structure. The precision camera is useless without the information given by the spectrum camera, but with this knowledge, the dimensions of the unit cell can be measured with an accuracy of about 1 in 10,000.—J. H. W.

**Control Through Spectroscopy.** E. S. Dreblow and A. Harvey (*Indust. and Eng. Chem.*, 1933, 25, 823-825).—Certain details regarding the actual use for control purposes of spectroscopy in three industries are known and are here reported, viz., the detection of Sb and impurities in Pb (the British Post Office Engineering Dept. has specified that Pb sheathing of aerial cable must contain between 0.8 and 1.07% Sb, and has recommended the adoption of the spectrographic test); control of impurities in steels; and control of impurities, e.g. Pb, in Cu-Zn alloys.—F. J.

**Spectrographic Analysis.** Anon. (*Eng. and Min. J.*, 1933, 134, 353).—Brief note on the use of spectrographic analysis.—R. Gr.

**Short Microchemical Contributions—VIII.** [Detection of Sodium and Cadmium]. L. Rosenthaler (*Mikrochemie*, 1933, 13, 83-84).—Working details for the identification of Na as Na- $\text{UO}_2$  acetate are given. Cd in 0.1% solution gives an immediate crystalline precipitate with hexamethyldiaminoisopropyl diiodide consisting of stars and skeletal clusters; Zn gives crystals only on evaporation of the solution almost to dryness.—A. R. P.

**Some Dithizone (Diphenylthiocarbazone) Reactions.** H. Wölbling and B. Steiger (*Angew. Chem.*, 1933, 46, 279-281).—A solution of dithizone in  $\text{CCl}_4$  yields characteristic colour reactions with the following six groups of metals: (I) Ag, Zn, Cd,  $\text{Sn}^{\text{IV}}$ , Pb, Mn; (II)  $\text{Sn}^{\text{II}}$ ,  $\text{Fe}^{\text{II}}$ ; (III) Sb, Bi; (IV) Cu; (V) Au and the Pt metals, and (VI) Hg. Group I gives no reaction in acid solutions; the effect of group II may be overcome by oxidizing the metals to  $\text{Sn}^{\text{IV}}$  and  $\text{Fe}^{\text{III}}$ . Group III gives no reaction in the presence of tartaric acid, Cu fails to react in the presence of  $\text{HCOOH}$ , and the members of group V can be removed by reduction to the metallic state. Hence the test can be made specific for Hg. In the presence of other metals, the solution is treated with Cu to precipitate Hg and the members of group V; the Hg is then extracted with  $\text{HNO}_3$  and the solution shaken with a  $\text{CCl}_4$  solution of dithizone. A pink  $\text{CCl}_4$  layer indicates Hg; sensitivity 0.01 mg.—A. R. P.

**Quantitative Separation of Small Amounts of Zinc from Material Rich in Iron.** Franklin G. Hills (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1933, 5, 201).—The method depends on the precipitation of the Zn with  $\text{H}_2\text{S}$  in a slightly acid solution containing citric acid and a large excess of Na citrate.

Co and some Ni, as well as all the Pb and Cu, precipitate with the Zn and must be separated in the usual way.—A. R. P.

**Improvements in the Vacuum Fusion Method for Determination of Gases in Metals.** Lewis Reeve (*Amer. Inst. Min. Met. Eng. Preprint*, 1933, July, 1-21).—A modified apparatus is described and illustrated for the determination of oxides, nitrides, and dissolved gases in metals, more especially steel. Some tests on welded joints in steel showed that iron and manganous oxides are reduced at 1050°-1150° C., silica at 1300° C., and alumina at 1570° C.

—A. R. P.

**Estimation of Small Amounts of Antimony in Copper.** Bartholow Park and E. J. Lewis (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1933, 5, 182-183).—For the determination of Sb in the purest refined Cu 500 grm. are dissolved in  $\text{HNO}_3$  (*d* 1.4), the solution is diluted to 2 l., and  $\text{NH}_4\text{OH}$  added until a slight permanent precipitate is formed, which is redissolved in  $\text{HNO}_3$ , and 10 c.c. of 3%  $\text{KMnO}_4$  solution are added to the boiling liquid, followed, after 5 minutes, by 15 c.c. of 5%  $\text{MnSO}_4 \cdot 5\text{H}_2\text{O}$  solution. After boiling for 10-20 minutes, the solution is set aside over-night and the precipitate collected on a suction filter, washed free from Cu with cold  $\text{H}_2\text{O}$ , and dissolved in 50 c.c. of  $\text{HCl}$  (*d* 1.19). The solution is diluted, saturated with  $\text{H}_2\text{S}$ , and filtered next day; the precipitate is dissolved in  $\text{HCl}$ , and the solution evaporated to 10 c.c.; 0.1-0.2 c.c. of this Sb solution is placed in a hole in a graphite electrode and, after drying, arced for 1 minute using 10-12 amp. at 50 v. The intensities of the lines at 2598 and 2878 Å. in the spectrogram are compared with those of standards prepared from pure Cu (Sb-free) to which known weights of Sb have been added.—A. R. P.

**Iodometric Determination of Copper, Iron, Zinc, and Aluminium in the Presence of One Another.**—R. Lang and J. Reifer (*Z. anal. Chem.*, 1933, 93, 161-172).—The sulphate solution of the metals (free from  $\text{Cl}^-$ ) containing 3-5 c.c. of  $\text{H}_2\text{SO}_4$  (*d* 1.84) is neutralized with  $\text{NH}_4\text{OH}$ , diluted to 50-60 c.c., cooled, treated with 2 grm. of  $\text{KHF}_2$  and 2-3 grm. of  $\text{KI}$ , and titrated with  $\text{Na}_2\text{S}_2\text{O}_3$  for Cu. The liquid is then acidified with 10-15 c.c. of 5N- $\text{H}_2\text{SO}_4$ , 3 grm. of  $\text{H}_3\text{BO}_3$  and 1 grm. of  $\text{KCNS}$  are added, and the liberated  $\text{I}_2$  is titrated with  $\text{Na}_2\text{S}_2\text{O}_3$  for Fe. A few crystals of  $\text{Na}_2\text{SO}_3$  are added, the solution is boiled and filtered, and the filtrate is treated with 5 grm. of  $\text{H}_2\text{PO}_4$ , then with Br to oxidize the  $\text{Na}_2\text{SO}_3$  and  $\text{Fe}^{2+}$ , cooled, treated with  $\text{Na}_2\text{S}_2\text{O}_3$  until any blue colour is just discharged, and titrated for Zn with  $\text{K}_3\text{Fe}(\text{CN})_6$  and  $\text{Na}_2\text{S}_2\text{O}_3$  as previously described (*J.*, this volume, p. 453). A filtered aliquot portion of the solution is then made ammoniacal after addition of tartaric acid to prevent precipitation of Al, &c., then treated with 8-hydroxyquinoline to precipitate the Al.—A. R. P.

**Microchemical Determination of Gold in Gold Alloys.** Julius Donau (*Mikrochemie*, 1933, 13, 165-178).—The alloy (up to 5 mg.) is inquarted with Ag in a quartz-glass tube through which a current of  $\text{H}_2$  is passed, and the bead is parted in the usual way. This method obviates cupellation losses [and is unsatisfactory if tin is present.—*Note by Abstractor*].—A. R. P.

**An Investigation into the Electrolytic Separation of Lead as Peroxide in Non-Ferrous Alloys. I.—A New Method for the Determination of Small Amounts of Lead in Copper and Copper-Rich Alloys.** B. Jones (*Analyst*, 1933, 58, 11-26).—The metal is dissolved in  $\text{HNO}_3$  and the solution evaporated until the colour just changes from blue to green, 3 c.c. of  $\text{HNO}_3$  (*d* 1.42) are added, the liquor is diluted to 200 c.c., and any  $\text{Sb}_2\text{O}_5$  or  $\text{SnO}_2$  filtered off and dissolved in fuming  $\text{H}_2\text{SO}_4$  using  $\text{HNO}_3$  to destroy the paper. The  $\text{H}_2\text{SO}_4$  solution is diluted and poured into an excess of  $\text{NaOH}$  solution containing  $\text{Na}_2\text{S}$  to precipitate adsorbed Pb, Cu, Fe, &c.; the precipitate is collected, washed, and dissolved in  $\text{HNO}_3$ . The two  $\text{HNO}_3$  solutions are then electrolyzed with 2 amp. using a rotating (400 r.p.m.) gauze anode inside



a gauze cathode. The  $\text{PbO}_2$  deposit on the anode is dissolved in  $\text{HCl}$  and the solution evaporated to dryness. The residue is boiled with 8 drops of 1:1  $\text{HCl}$  and 50 c.c. of  $\text{H}_2\text{O}$ , and the solution treated with  $\text{K}_2\text{Cr}_2\text{O}_7$  to precipitate  $\text{PbCrO}_4$ , which is determined colorimetrically with diphenyl carbazide. If much  $\text{Mn}$  is present,  $\text{HMnO}_4$  will form during electrolysis; this must be reduced from time to time by adding  $\text{N}_2\text{H}_4 \cdot 2\text{HNO}_3$ . Modifications of the process are described for use when  $\text{Bi}$ ,  $\text{P}$ , or  $\text{As}$  are present in large amounts.—A. R. P.

**Microanalysis of Magnesium as a Triple Ferrocyanide of Magnesium, Calcium, and Hexamethylenetetramine.** L. Debucquet and L. Velluz (*Compt. rend.*, 1933, 196, 2006-2007).— $\text{Mg}$  can be completely precipitated by a 10% solution of ferrocyanide of calcium, potassium, and hexamethylenetetramine,  $\text{CaK}_2\text{Fe}(\text{CN})_6 \cdot (\text{CH}_2)_6\text{N}_4 \cdot 6\text{H}_2\text{O}$  (mol. wt. 578) in hexamethylenetetramine. The solution is made up by simple mixing of solutions of 8.4 gm. of  $\text{K}_4\text{Fe}(\text{CN})_6 \cdot 3\text{H}_2\text{O}$  in 100 c.c. of water and 4.4 gm. of  $\text{CaCl}_2 \cdot 5\text{H}_2\text{O}$  and 11.2 gm. of  $(\text{CH}_2)_6\text{N}_4$  in 200 c.c. of water. The  $\text{Mg}$  is precipitated with the solution, filtered, washed, redissolved in water in a graduated tube, and shaken with a solution of gum arabic and  $\text{FeCl}_3$ . The resulting Prussian blue is compared with that of a blank containing a known quantity of the triple cyanide reagent. The error by this method is always less than 5%, and usually less than 3%.—J. H. W.

**Potentiometric Determination of Small Quantities of Mercury.** Karl Schwarz and Theodor Kantor (*Mikrochemie*, 1933, 13, 225-234).—The method depends on the titration of the  $\text{Hg}$  solution with  $\text{KI}$  using an amalgamated  $\text{Pt}$  wire as indicator electrode; 1-1000  $\mu$  gm. of  $\text{Hg}$  can be determined with an accuracy of 1-3%.—A. R. P.

**Two Special Analytical Methods. I.—Rapid Determination of Nickel in Heat-Resistant Alloys. II.—The Determination of Small Quantities of Aluminium (0.05-0.4%) in Heat-Resistant Alloys.** H. Ipavic (*Heraeus Vakuumschmelze* [10th Anniv. Volume], 1933, 302-306; 306-309).—(I.—) The alloy (0.06-0.07 gm.) is dissolved by boiling with 7 c.c. of  $\text{HCl}$  ( $d$  1.19), 3 c.c. of  $\text{HNO}_3$  ( $d$  1.40), and 3 c.c. of  $\text{HClO}_4$  ( $d$  1.59), and the solution is evaporated until fumes of the latter are evolved, whereby all the  $\text{Cr}$  is oxidized to  $\text{CrO}_4^{2-}$ . After dilution with 150 c.c. of water, 5 c.c. of 20% tartaric acid, and, if much  $\text{Mn}$  is present, 5 c.c. of 30%  $\text{K}_4\text{P}_2\text{O}_7$  are added, followed by  $\text{NH}_4\text{OH}$  to slight alkalinity, and the  $\text{Ni}$  is titrated with  $\text{KCN}$  and  $\text{AgNO}_3$  in the usual way with  $\text{KI}$  indicator.  $\text{Cu}$  and  $\text{Co}$  are counted as  $\text{Ni}$ , but are rarely present in amounts exceeding 0.4%. (II.—) The alloy (3 gm.) is dissolved in *aqua regia* and the solution evaporated with 25 c.c. of 1:1  $\text{H}_2\text{SO}_4$  until copious fumes are evolved. After cooling, dilution with water, and boiling, the  $\text{SiO}_2$  is removed and the solution neutralized with  $\text{KOH}$ , then treated with 30 drops of 1:1  $\text{H}_2\text{SO}_4$ , diluted to 400 c.c., and electrolyzed for 4 hrs. using a  $\text{Hg}$  cathode and a  $\text{Pt}$  spiral anode with a current of 6 amp./40  $\text{cm}^2$  of  $\text{Hg}$  surface; in this way all the  $\text{Cu}$ ,  $\text{Mo}$ ,  $\text{Fe}$ ,  $\text{Ni}$ ,  $\text{Co}$ ,  $\text{Mn}$ , and  $\text{Cr}$  are deposited in the  $\text{Hg}$ , leaving only  $\text{Al}$  with traces of the other metals in solution. The  $\text{Al}$  is precipitated with  $\text{NH}_4\text{OH}$  and purified by digestion with  $\text{KOH}$  solution, being finally weighed as  $\text{Al}_2\text{O}_3$ .—A. R. P.

**Determination of Potassium by Sodium Cobaltinitrite.** J. E. Schueler and R. P. Thomas (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1933, 5, 163).—The various procedures which have been proposed for determining  $\text{K}$  volumetrically as  $\text{K}_2\text{NaCo}(\text{NO}_2)_6$  have been critically examined and the following modification is recommended: The  $\text{K}$  solution (25 c.c.) is made just alkaline to phenolphthalein with  $\text{NaOH}$ , then just acid with  $\text{CH}_3\text{COOH}$ , 10 c.c. of 95%  $\text{C}_2\text{H}_5\text{OH}$  are added, and the solution is cooled to 5°-6° C. The  $\text{K}$  is then precipitated with 5 c.c. of 30%  $\text{Na}_2\text{Co}(\text{NO}_2)_6$  and the mixture set aside over-night at 5°-6° C. The precipitate is collected in a Gooch crucible,

washed with a cold, saturated solution of  $K_2NaCo(NO_2)_6$ , dissolved in 150 c.c. of hot  $H_2O$  to which are added 5-10 c.c. of  $HNO_3$ , and titrated with 0.1N- $KMnO_4$  (1 c.c. = 0.0005672 gm. K).—A. R. P.

**The Oxalate Method of Determining Strontium from the Point of View of Residues and Substitution.** K. N. Potchinok (*Zhurnal Prikladnoi Khimii* [*Journal of Applied Chemistry*], 1932, 5, (8), 1078-1087).—[In Russian, with German summary.] The determination of Sr as  $SrC_2O_4$  was investigated from the point of view of the methods of residues and substitution, in accordance with the alternative techniques developed by Tananaev. It is considered that these methods enable both a theoretical interpretation and a quantitative estimation of the errors involved, to be made. Four variants of the method of residues were employed: (1) a known volume of  $SrCl_2$  ( $N/10$ ) solution was heated with twice the equivalent of  $N/10$ -( $NH_4$ ) $_2$  $C_2O_4$ , the precipitate filtered off, and the filtrate titrated direct with standard  $KMnO_4$ ; (2) the same as method 1, except that the two solutions, on mixing, are diluted to a mark, and aliquot parts are withdrawn, filtered, and titrated; (3) the same as method 1, except that the precipitate is washed and the whole of the filtrate and washings are titrated; (4) three times the equivalent of ( $NH_4$ ) $_2$  $C_2O_4$  is used, and thereafter the procedure is as in 1. It is concluded that methods 1 and 4 are the most accurate, the average errors being 0.21% and 0.06%, respectively. The method of substitution gives accurate results if the precipitate is washed with a saturated solution of  $SrC_2O_4$ . The deviations from the true content are 0.2%. The separation and volumetric estimation of Ca and Sr when present together are possible if  $H_2SO_4$  is used. The error, if about 25 c.c. of  $N/10$  solution of either metal are present, does not exceed 0.5%.—M. Z.

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

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

(Continued from pp. 515-516.)

**Evaporation of Metals in Vacuum.** Hiram W. Edwards (*Rev. Sci. Instruments*, 1933, [N.S.], 4, 449).—The technique of the evaporation of small quantities of metal *in vacuo* is very briefly discussed. A new alloy, called "Pancro," composed of aluminium and magnesium, and having a uniformly high reflection coeff. throughout the visible spectrum, is mentioned.—J. T.

**Improving Automatic Control by Recorder Chart Interpretation.** W. R. Clendinning (*Chem. and Met. Eng.*, 1933, 40, 123-125).—A method of chart reading is described, in an effort to set up certain basic principles of control, to assist in devising new controls and to simplify the improvement and more effective use of the old ones. Most attention is given to the time factor which is the least well known, but the most important, feature of satisfactory control.—F. J.

**A New Temperature Regulator.** Anon. (*Engineer*, 1933, 155, 659).—A short illustrated description of a thermostatic electric regulator for maintaining a constant temperature in type metal and tin furnaces, &c.—W. P. R.

**Ventilating a University Laboratory.** T. R. Davis (*Heating and Ventilating*, 1931, 28, (10), 55-58; *Public Health Eng. Abs.*, 1932, 12, AC, 15).—The problem of proper outside air supply and fume exhaust was of major importance in the building discussed. Practically all fume exhaust is accomplished through sidewall hoods, constructed of an acid-proof asbestos composition. The mechanical exhaust systems are 5 in number, namely, downdraught tables, wall hoods, general rooms, Kjeldahl hoods, and toilet rooms. Air pressures in the laboratories were kept lower than surrounding areas, thus preventing the escape of fumes from laboratories into adjoining rooms.—S. G.



**Cooling of Crystals for X-Ray Scattering Measurements.** P. S. Williams (*Rev. Sci. Instruments*, 1933, [N.S.], 4, 334-336).—Apparatus for maintaining crystals at temperatures down to that of liquid air and suitable also for high-temperature work is described.—J. S. G. T.

**Apparatus for Demonstrating the Liquefaction of Helium.** Franz Simon and J. Elston Ahlberg (*Z. Physik*, 1933, 81, 816-820).—*Cf. J.*, this volume, p. 372. A comparatively simple form of apparatus for liquefying helium, utilizing expansion of the gas, and the Joule-Thomson effect.—J. S. G. T.

**A New Accurately-Focussing Röntgen Spectrometer.** Tryggve Johansson (*Z. Physik*, 1933, 82, 507-528).—Discusses the theory and construction of an X-ray spectrometer, employing a crystal bent into a circular arc.—J. S. G. T.

**A Demountable Metal X-Ray Tube.** E. P. Miller (*Rev. Sci. Instruments*, 1933, [N.S.], 4, 379-380).—A metal X-ray tube comprising a chromium-plated brass cathode and a solid copper target drilled to permit water-cooling is described. The use of a chromium-plated cathode decreases the amount of gas liberated from the surfaces and reduces stray radiation.—J. S. G. T.

**A Calcium Target for X-Ray Tubes.** H. Kersten and Joseph Maas (*Rev. Sci. Instruments*, 1933, [N.S.], 4, 381).—A calcium-silica target which may be used for several hours, and which does not emit gas when bombarded, is described.—J. S. G. T.

## XI.—PHYSICAL AND MECHANICAL TESTING AND RADIOLOGY

(Continued from pp. 516-520.)

**Practical Aids to Inspection.** J. Pettitt-Herriot (*Aircraft Eng., Workshop and Prodn. Section*, 1933, 5, (50), 21).—The iron dust method of detecting cracks in magnetic materials is described. For non-magnetic materials, immersion in hot paraffin oil, wiping, and coating with finely divided chalk is recommended.—H. S.

**A Practical Method of Determining the Thermal Conductivity of Small Metal Rods.** P. Vernotte (*Science et Industrie*, 1933, 17, 17-20, 77-79, 125-127, 186).—The theoretical basis of conductivity determinations is discussed, and the difficulty of the usual experimental methods is indicated. In the method elaborated by V., a small rod of diam. 3-4 mm. and a few cm. in length is inserted, to three standard depths, in a furnace of known radiating power. Variations in the amount of heat radiated must then be due to the inserted rod, and the heat radiated by the rod must depend on the thermal interchanges between (a) furnace and rod, (b) rod and atmosphere, and also on the thermal conductivity of the rod. By taking readings in the three standard positions of the rod, (a) and (b) are eliminated. The thermal exchanges are considered and equations representing them are deduced. Errors due to dissipation of heat by the furnace and its leads are shown to be negligible. Two types of furnace are described, one completely enclosing the specimen, the other, of tubular form, the length of which is traversed by the specimen bar. Experimental details of the measurement of furnace radiation and furnace temperature, calibration of thermo-couples, and construction of furnaces, and actual results are quoted for both types of furnace.—P. M. C. R.

**Behaviour of the Damping Effect in Vibrational Tests.** Max Hempel (*Z. tech. Physik*, 1933, 14, 232-234).—A short account of the measurement and general evaluation of the dependence of the damping effect on the load and the number of alternations.—J. W.

**Fatigue Testing.** J. W. Cuthbertson (*Engineering*, 1933, 136, 55-57, 80-82).—Describes apparatus for determining the fatigue limit by means of the

modification of the alternating bend test known as the load-deflection test. C. points out the advantages of continuous loading, which overcomes the difficulties associated with the overstraining effects of applying the loads in sudden increments.—W. P. R.

**Fatigue Tests of Helical Springs.** Progress Report No. 2 of Sub-Committee on Heavy Helical Springs of the Special Research Committee of Mechanical Springs (*Amer. Soc. Mech. Eng. Preprint*, 1933).—W. P. R.

**The Mechanical Testing of Metals. The Transverse Test.** T. F. Russell (*Met. Ind. (Lond.)*, 1933, 43, 191-193).—In the case of a simple beam subjected to bending by central loading between the supports, both the angle through which the ends of the beam turn and the deflection at the centre are proportional to the load, within the elastic limit and under certain experimental conditions. Transverse testing machines which make use of this principle are briefly described.—J. H. W.

**The Schenck Autographic Extensometer.** Walther Saran (*Engineering*, 1933, 136, 161-162).—An illustrated description of an instrument which automatically records dynamic extension and compression in any member of a built-up structure or machine. By means of a time record taken simultaneously, the amplitude and frequency of the stresses imposed during working conditions can be ascertained. The extensometer contains no lever or other mechanism to magnify the movements, and the record is examined by means of a special microscope. Reproductions of records obtained by mounting the instrument on the front axle of a motor car are included in the text.—W. P. R.

**The Elastic Behaviour of Brittle Polycrystals.** H. Schlechtweg (*Naturwiss.*, 1933, 21, 465-466).—The elastic behaviour of brittle isotropic bodies, such as cast iron, is discussed theoretically.—J. W.

**Use of a New Hardness Ratio.** H. S. Kipling (*Proc. Inst. Automobile Eng.*, 1932-1933, 27, 557-558).—The application of the standard Brinell and diamond impression hardness tests enables the following conditions of steel to be detected and distinguished: cold-worked steel in production, ordinary cold-worked steel, brittleness due to impurities, annealed steel, heat-treated steel, and steel difficult to machine when of standard hardness.—J. S. G. T.

**Light Brinell and Diamond Hardness Testing Machine.** Anon. (*Machinery (Lond.)*, 1933, 42, 316-317).—A brief illustrated description. By the operation of a crank, the specimen is forced against the indenter until the desired load, as indicated on a dial, is reached. The machine is calibrated for loads from 5 to 125 kg.—J. C. C.

**Portable Hardness-Testing Machine.** Anon. (*Mech. World*, 1933, 94, 649).—A small hardness-testing machine, the "Impressor," using a ball of 1 mm. diam. under a load of 30 kg., is illustrated and described. The claims made for the machine are low cost, portability, simplicity of construction, ease of operation, and negligible defacement of material by the impression. The table holding the specimen is brought up into contact with the ball attached to a lever. The lever works on a fulcrum to one side of the ball, and is supported by a pillar at a greater distance on the other side. The lever is loaded on the latter side, and the load is applied by turning a handle, which relieves the lever of the support of the sliding pillar.—F. J.

**Standard Herbert Pendulum Hardness Tester. A Simplified Model.** Anon. (*Met. Ind. (Lond.)*, 1933, 43, 124).—A simplified form of the Herbert pendulum hardness tester has been designed for straightforward shop testing. It is provided with a 1-mm. steel ball, but a spherical diamond can be supplied as an extra. If  $T$  is the time for 10 swings, with the steel ball, the Brinell hardness  $B = 10T$ , when  $T > 28$  and  $B = 0.367T^2$ , when  $T < 28$ . With the diamond,  $B = 13.5D$ , when  $D > 22.5$ , and  $B = 0.54D^2 + 30$ , when  $D < 22.5$ ,  $D$  being the diamond time-hardness number.—J. H. W.



**Simplified Pendulum Hardness Tester.** Anon. (*Engineer*, 1933, 156, 68; and *Mech. World*, 1933, 94, 716).—See preceding abstract.—W. P. R.

**Strain Lines, a New Method for Determining the Distribution of Stress in Machine Parts.** O. Dietrich and E. Lehr (*Technique moderne*, 1933, 25, 149-150).—Abstract from *Z.V.d.I.*, 1932, 78, 973-982. See *J.*, this volume, p. 38.—R. B. D.

**On the Application of Interference Fringes to Stress Analysis.** Max Mark Frocht (*J. Franklin Inst.*, 1933, 216, 73-89).—The photo-elastic method of determining stress distribution in two-dimensional systems is reviewed. A method is suggested for the experimental determination of the sum of the principal stresses, thus eliminating the point by point exploration required by existing methods, and giving photographically a stress-pattern of constant  $P + Q$  curves. This pattern is to be used with the regular  $P - Q$  stress-pattern now obtained photo-elastically, and from the two the principal stresses  $P$  and  $Q$  can be evaluated. The construction and calibration of the apparatus are discussed, and some preliminary experimental verifications and possible future applications are considered.—P. M. C. R.

**A Miniature Testing Machine.** Anon. (*Maschinenkonstrukteur*, 1933, 66, 102).—The apparatus described is claimed to give considerable accuracy in the rapid determination of yield-point, ultimate tensile stress, elongation, reduction of area, and Brinell hardness. Results are slightly below those obtained on full-size machines for similar materials; the chief advantages of the machine are its portability and the small size of the test-pieces, which can therefore be taken from finished products, and which can be easily and quickly prepared. Illustrations are appended.—P. M. C. R.

## RADIOLOGY

**Recent Progress in X-Ray Inspection of Welds.** Herbert R. Isenburger (*Amer. Soc. Mech. Eng. Preprint*, 1933).—The perfection of a cheap sensitive X-ray paper and the introduction of X-ray equipment made specially for industrial use are recent developments. I. gives comparative costs of weld inspection using various class of X-ray equipment and using X-ray film and the new X-ray paper.—W. P. R.

## XII.—PYROMETRY

(Continued from p. 521.)

**An International Comparison of Temperature Scales between 660° and 1063° C.** Wm. F. Roeser, F. H. Schofield, and H. A. Moser (*U.S. Bur. Stand. J. Research*, 1933, 11, 1-6; *Research Paper*, No. 573).—This paper reports an intercomparison of the temperature scales (in the range 660°-1063° C.) in use at the National Physical Laboratory, the Physikalisch-Technische Reichsanstalt, and the Bureau of Standards since 1927. It is shown that the methods used in realizing the International Temperature Scale have yielded results differing by as much as 0.7° C. at 850° C., due primarily to a difference of 0.4° C. at the freezing point of silver, one of the basic fixed points of the International Temperature Scale. After exchanging samples of silver and thermocouples, the various scales have been brought into agreement, within 0.1° C., at all points in the range covered.—S. G.

**Methods for Servicing Noble Metal Thermocouples.** R. S. Bradley (*Amer. Refract. Inst. Tech. Bull.* No. 39, 1933, 1-6).—Platinum-rhodium couples which receive constant use should be overhauled every 6 months. The homogeneity of each wire is tested at points spaced not more than 1 in. apart

by hooking a standard wire of the same composition round it and heating the intersection. No e.m.f. should be developed. Good pieces of wire are then held in a fixture, welded together, and made into couples by use of a carbon arc or an oxy-gas or oxy-acetylene flame. Annealing is carried out by passing a current (14½ amp. for 0.022 in. diam. wire) for about 1 hr. until the darker portions, which have surface contamination, become a bright red. Calibration is carried out by comparison with a standard couple placed in the same protection tube.—J. C. C.

**New Temperature Recorders.** Anon. (*Mech. World*, 1933, 93, 266).—An instrument is illustrated and described which depends on the expansion of ether. The whole of the operating mechanism of the recorder, with the pen, is contained behind a rotating chart. A two-point thread recorder designed for use in cases where it is desired to record only two temperatures on a chart, is also described.—F. J.

**The Pyrograph.** Anon. (*Power Eng.*, 1932, 268).—A description is given of the Pyrograph, a temperature-measuring instrument, in which the resistance averages 18 ohms/m.v. and the current sensitivity is 0.43 micro-amps./mm. deflection.—F. J.

### XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 521-522.)

**Examining the Material of Castings.** Joh. Mehrtens (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 54, 247-248).—Describes the examination of large pieces of castings with a microscope.—J. H. W.

**Pipes in Castings.** Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 54, 307-308, 329-330).—Piping is usually considered to be a shrinkage phenomenon, but the percentage linear shrinkage of different metals and alloys does not show much variation, and castings of 2 alloys with the same linear shrinkage may have very different pipes. If, however, the contractions of volume in the solid state and in the liquid state are tabulated as percentages of the total contraction of volume, it is found that those metals and alloys with large contraction values in the solid state show the greatest tendency to piping. The length of the pipe also depends on the gas content, and thus on the density of the head of the ingot. Thus the heads of bronze ingots gassed in various ways had the following densities and pipe lengths respectively: 8-860, 3 mm.; 8-830, 10 mm.; 8-815, 15 mm.; 8-540, 16-24 mm.; 7-113, entirely porous.—J. H. W.

**Six Competitive Types of Castings.** D. Basch (*Machinist (Eur. Edn.)*, 1933, 77, 427-428E).—The casting properties of a number of non-ferrous metals and alloys, using sand, permanent mould, semi-permanent mould, moderate- and high-pressure die, and centrifugal casting methods are tabulated, and an order of preference for each property considered is indicated. The relation of design and material selection to the requirements of the casting and the finishing operations available are discussed, and the characteristics and defects of sand, permanent-mould, die- and centrifugal castings are outlined.—J. H. W.

**The Use of Silicon in the Foundry.** J. Arnott (*Bull. Assoc. Tech. Fonderie*, 1933, 7, 23-25).—Abstracted from *Found. Trade J.*, 1931, 44, 397-398. Cf. this *J.*, 1931, 47, 431.—W. A. C. N.

**Refining the Grain in Aluminium Alloys.** D. R. Tullis (*Bull. Assoc. Tech. Fonderie*, 1933, 7, 64-66).—Abstracted from *Found. Trade J.*, 1931, 44, 321-326, 328. Cf. this *J.*, 1931, 47, 604-605.—W. A. C. N.

**Refining Molten Aluminium and Aluminium Alloys.** H. Kalpers (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 54, 285-286).—Aluminium and aluminium



alloys tend to take up water either from the atmosphere or from the furnace gases and oil. The absorption of water vapour can be kept low by careful handling and can be further diminished by introducing chlorine gas or, as more recently discovered, chlorides such as boron dichloride, vanadium chloride, or titanium tetrachloride. Zinc chloride is also used where the zinc remaining in the alloy is not objectionable, as it is in Silumin (Alpax) and other corrosion-resisting alloys. Carbon tetrachloride is a good agent for removing the oxide, and is usually used with an alkali fluoride. Manganous chloride and antimony pentafluoride can be used instead of carbon tetrachloride.—J. H. W.

**Manufacture of a Stirring Kettle in Silumin.** Anon. (*Z. ges. Giesserei-Praxis: Der Modellbau*, 1933, 54, 331-332).—The moulding, coring, and casting of a kettle required to resist the action of acetic acid, ammonia, concentrated nitric acid, hydrogen sulphide, sulphur, and carbonic acid in Silumin are described. The kettle was 2100 mm. (82.7 in.) high, 1380 mm. (54.3 in.) diameter, and 30-40 mm. (1.18-1.57 in.) thick, with an outlet pipe from the centre of the bottom 1000 mm. (39.4 in.) long.—J. H. W.

**Compressed Gas Cylinders in Light Alloys.** E. Franchi (*Alluminio*, 1933, 2, 127-138).—The manufacture of cylinders in Avional (Duralumin), Anticorodal, and Lantal, in an Italian works, is fully described together with the equipment used in testing the cylinders. The micrographic structure of the alloys, and their mechanical properties have also been studied. Lantal cylinders cracked at 700 atm., and Avional cylinders at 600 atm.—G. G.

**Bronze Foundry Practice.** — Detournignies (*Rev. Fonderie moderne*, 1933, 27, 189-196; discussion, 196).—Read before the Association Amicale et Mutuelle de Fonderie. Describes in some detail the manufacture of high resistance brass and of a number of bronzes of different compositions. The discussion is briefly reported.—J. H. W.

**The Casting of Bronze Gears.** F. W. Rowe (*Bull. Assoc. Tech. Fonderie*, 1932, 6, 91-93).—From *Found. Trade J.*, 1930, 42, 449-450, 469-470. Cf. this *J.*, 1930, 44, 786.—W. A. C. N.

**The Fusion of Copper Alloys in the Cupola.** T. Mauland (*Bull. Assoc. Tech. Fonderie*, 1933, 7, 67).—Extract from *Foundry*, 1931, 59, (13), 64-65. Cf. this *J.*, 1932, 50, 127, 709.—W. A. C. N.

**Melting of Brass Swarf in a Reverberatory Furnace.** E. T. Richards (*Bull. Assoc. Tech. Fonderie*, 1933, 7, 15-19).—Extracted from *Giesserei*, 1932, 19, 5-9. Cf. this *J.*, 1932, 50, 390.—W. A. C. N.

**Casting Door Plates and Handles in Brass and Nickel Brass.** Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 54, 224-225).—The correct practice for moulding and casting brass and nickel-brass door-plates and handles and for avoiding failures is described. The composition of the alloys used, the amount of permissible impurities, and the use of aluminium, preferably as a copper-aluminium alloy, for improving the fluidity of thin castings are discussed.

—J. H. W.

**Causes of Waste in Valve Taps.** Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 54, 245-246).—The casting of valve taps in 65:35 brass is described and the causes of rejects are explained.—J. H. W.

**The Vertical Centrifugal Casting of Non-Ferrous Alloys.** R. C. Stockton (*Met. Ind. (Lond.)*, 1933, 43, 97-98).—Centrifugal casting is adopted when the casting can be made only with difficulty in sand, as in the case of the nickel-copper-tin-iron alloy used for valve fittings and having a large shrinkage, or to develop certain physical properties, as the small grain-size and regular dispersion of the hard constituent of gear and bearing bronzes and white metal. The methods of overcoming the difficulties that the process entails are explained, and the physical properties which the resulting castings possess, and of which the large decrease in grain-size is the most characteristic, are described.—J. H. W.

**General Remarks on Pressure-Casting.** G. d'Ardigny (*Rev. Fonderie moderne*, 1933, 27, 205-211).—Pressure-casting has many advantages, such as great economy of space and handling and the uniformity of the product. The necessary equipment is expensive, but this is offset by economy in the castings which can often be used in the "as cast" condition. The process is a difficult one, for which good knowledge and experience of the alloys are necessary, and each particular case requires special study, whilst any mistake may be disastrous.—J. H. W.

**Die-Casting of Silumin.** J. Dornauf (*Alluminio*, 1933, 2, 139-153).—The mechanism of solidification of a metal especially during die-casting has been studied. The structure and mechanical properties of Silumin, and of its modifications, Silumin " $\beta$ " (containing manganese and magnesium) and Silumin " $\gamma$ " (heat-treated Silumin " $\beta$ "), and the effects of composition, modification with sodium, and heat-treatment on these alloys are described. Suitable moulds for casting test-pieces are illustrated, and the best melting conditions, types of mould, position of heads, feeders, and spines are discussed.—G. G.

**Die-Casting.** F. A. W. Livermore (*Mech. World*, 1933, 93, 165-167).—The chief advantages claimed for die-castings are enumerated and other general points discussed, among them, from the point of view of economical production, being the minimum permissible wall-thickness. The following data are given, the figures being for minimum hole diam., minimum wall-thickness, and draft, respectively, viz. aluminium alloys  $\frac{3}{32}$ – $\frac{1}{8}$  in.,  $\frac{3}{32}$ – $\frac{1}{8}$  in., 0-005-0-025; zinc alloys  $\frac{1}{16}$  in.,  $\frac{1}{32}$ – $\frac{3}{64}$  in., —; lead-tin alloys  $\frac{1}{32}$  in.,  $\frac{3}{32}$ – $\frac{1}{16}$  in., 0-002-0-015. The casting of internal threads below  $\frac{1}{8}$  in. diam. is not recommended. Whenever possible, engravings or letters should be "raised," i.e. in relief on the castings, and, as shrouding is easily possible in die-casting, it should be done on one side in the case of bevel- or spur-wheels. Brass die-castings can now be successfully produced.—F. J.

**Progress in Die-Casting.** M. Stern (*Bull. Assoc. Tech. Fonderie*, 1932, 6, 120-121).—From *Trans. Amer. Found. Assoc.*, 1930, 1, (12), 723-736. Cf. this J., 1931, 47, 179.—W. A. C. N.

**Die-Cast Pistons.** Anon. (*Automobile Eng.*, 1933, 23, 161-164).—A description of the methods employed in the manufacture of pistons of ordinary pot construction in the heat-treated alloy "Y" and an alloy known as Lo-Ex which has a high silicon content and low expansion qualities, and of the manufacture of the Invar strut piston which has a head of a heat-treated copper-magnesium alloy giving a Brinell hardness of 125-150 and a skirt of Invar, the nickel-iron alloy containing 32-34% nickel. The procedure adopted in alloying and melting is fully described, and the manufacture of dies and the type of mould and core used in the manufacture of the composite piston are considered in full detail with special reference to manipulation and casting. The plant used for heat-treatment of the pistons and the method of treatment are also described.—J. W. D.

**Nicrosilal Castings.** Anon. (*Mech. World*, 1933, 93, 81).—The use of Nicrosilal for ingot-moulds for aluminium is briefly described, the composition and chief properties of this material being mentioned.—F. J.

**Plates, Frames, and Cores of Aluminium.** Hugo Hollweg (*Z. ges. Giesserei-Praxis: Der Modellbau*, 1933, 54, 249-251).—Discusses the application of aluminium to the construction of mould frames and cores.—J. H. W.

**Improvement of Moulding Methods in the Aluminium Foundry.** T. D. Stay, E. M. Gingerich, and H. J. Rowe (*Bull. Assoc. Tech. Fonderie*, 1932, 6, 115-117).—From *Foundry*, 1930, 58, (23), 72-75. Cf. this J., 1930, 44, 703.

—W. A. C. N.

**The Green-Sand Metal Casting Specialist.** A. Heinz (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 54, 305-307).—Green-sand metal casting has not



yet found general application [in Germany]. The reasons for this and the differences between green-sand and dry-sand casting are discussed.—J. H. W.

**Casting a Large Cover in Green Sand.** A. Heinz (*Z. ges. Giesserei-Praxis: Das Metall*, 1933, 54, 266-267).—The moulding, gating, and casting of a large casting in green sand are described.—J. H. W.

**Report on Routine Methods for Testing Green-Sands.** Anon. (*Found. Trade J.*, 1933, 49, 49-52, 56, 68).—Report by the Sands and Refractories Sub-Committee of the Institute of British Foundrymen presented to that Institute.—J. H. W.

**The Testing of Green-Sands. Routine Methods Proposed by the I.B.F.** Anon. (*Met. Ind. (Lond.)*, 1933, 43, 131-133).—Abstract of the discussion of a report presented to the Institute of British Foundrymen by the Sands and Refractories Sub-Committee of the Institute (see preceding abstract).—J. H. W.

**Sand Control in the Modern Foundry.** H. W. Dietert (*Bull. Assoc. Tech. Fonderie*, 1931, 5, 132-133).—From *Trans. Amer. Found. Assoc.*, 1930, 1, (2), 53. Cf. this *J.*, 1930, 44, 709.—W. A. C. N.

**The Classification of Sands.** [A. A. Grubb] (*Bull. Assoc. Tech. Fonderie*, 1932, 6, 735-736).—Extracted from *Trans. Amer. Found. Assoc.*, 1930, 1, (10), 510-515. Cf. this *J.*, 1931, 47, 182.—W. A. C. N.

**Contribution to the Study of the Permeability of Foundry Sand.** H. Viez (*Bull. Assoc. Tech. Fonderie*, 1932, 6, 122-125).—Abstracted from the *Internat. Foundry Congress, Milan, Memoirs*, 1931, 595-403. Cf. this *J.*, 1932, 50, 641.—W. A. C. N.

**Tests on the Permeability and Hardness of Moulds.** [H. W. Dietert] (*Bull. Assoc. Tech. Fonderie*, 1932, 6, 737).—Extracted from *Trans. Amer. Found. Assoc.*, 1930, 1, (10), 509. Cf. this *J.*, 1931, 47, 182.—W. A. C. N.

**Influence of Heat on the Permeability of Natural Moulding Sands.** W. M. Saunders and W. Saunders, Jr. (*Bull. Assoc. Tech. Fonderie*, 1932, 6, 739-741).—From *Trans. Amer. Found. Assoc.*, 1930, 1, (7), 259. See this *J.*, 1932, 47, 53.—W. A. C. N.

**Influence of Humidity on the Properties of Dry-Sand Cores.** H. L. Campbell (*Bull. Assoc. Tech. Fonderie*, 1932, 6, 55-56).—From *Trans. Amer. Found. Assoc.*, 1927, 35, 158. Cf. this *J.*, 1927, 38, 629; 1928, 39, 658.—W. A. C. N.

**New Tests for Sand Cores.** [Edward R. Young] (*Bull. Assoc. Tech. Fonderie*, 1932, 6, 738-739).—Extracted from *Trans. Amer. Found. Assoc.*, 1930, 1, (10), 486. Cf. this *J.*, 1931, 47, 182.—W. A. C. N.

**Shockless Jolt Moulding Machine with Pneumatic Pressing Device and for High Lift Stroke.** —Weil (*Iron and Steel Ind.*, 1933, 6, 388).—A description of a moulding machine which serves for moulding high castings, the moulds of which can be withdrawn without tilting, with or without a stripper plate. The machine likewise allows of the efficient moulding of shallow castings, as the presser plate can be adjusted in height. All operations, as jolting, pressing, vibrating, lifting, are effected by compressed air and regulated in their correct sequence through a common control and only one lever. The maximum pressure of the machine is 6500 kg., and it is capable of producing in continuous operation up to 60 half boxes per hr.—J. W. D.

**The Dust Hazard in Air-Pressure Abrasive Blasting [Sand-Blasting].** L. Greenburg and C. E. A. Winslow (*Arch. Gewerbepath. u. Gewerbehyg.*, 1932, [v], 3, 577-599; *Bull. Hygiene*, 1933, 8, (1), 26-27).—The process of cleaning castings by sand-blasting or by means of steel shot generates much dust, 90% of which is silica when sand is used. A description is given of the dust hazards for the workers, and of means for their protection. The castings may be treated in closed chambers, either in barrels, on tables, or in cabinets, from which the dust is removed by exhaust draughts. The efficiency of these devices for abating the dust risk was carefully tested by dust estimations; it was found that while many were inefficient, the dust content of the air

to be breathed could readily be kept below the danger limit. The use of steel shot instead of sand in itself greatly reduced the hazard by lessening the number of dust particles, of which the quartz content fell to 3% in contrast to 90% in the dust from sand-blasting. Some blasting is done by workers manipulating the blast in special chambers; these workers are protected by helmets into which fresh air is driven at a positive pressure. Here again, if the helmet is in order the dust hazard can be overcome, but dust helmets with no positive pressure device are quite inefficient. Throughout the enquiry dust sampling was done with the Greenburg-Smith Impinger, whereby the dusty air impinges at a high velocity on a submerged wetted surface, and then bubbles through water which collects the dust. Full details are given of the results obtained.—S. G.

**Foundry Ventilation.** John H. Vogt (*Indust. Hygiene Bull.*, 1931, 7, (9), 33-34; (10), 37-39; *Public Health Eng. Abs.*, 1932, 12, IHS, 5).—Describes methods for the control of dust, vapours, and gases disengaged in the processes of foundry operations and gives the regulations of the New York State Industrial Code for protecting the health of foundry workers. It is noted from the rules that suitable ventilation is highly important for safeguarding the health of foundry workers. V. for the purpose of discussion, divides the rules into 3 classes: (1) the provision and maintenance of general ventilation; (2) the control of generated dust, fumes, vapours and gases by the use of devices effectively to catch and remove the deleterious materials at the points of their origin; (3) the maintenance of proper and sufficient heat. A number of operations affecting the health of workers in iron, steel, and brass foundries are described, and the devices that might be used to guard the health of foundry workers are described.—S. G.

**Binding Materials for Cores.** — Ebert (*Maschinenkonstrukteur*, 1933, 66, 104-105).—The various products—organic and inorganic, natural and artificial—commonly used in core-making are enumerated; sulphite lye, molasses, resin, flour, quelling, dextrin, and tar, linseed and other oils are specially considered, and their correct proportions and special uses and limitations are indicated.—P. M. C. R.

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

(Continued from p. 523.)

**Copper Wire Scrap.** R. G. Arend (*Engineer*, 1933, 156, 71).—In a wire works a bench is used solely for the purposes of dealing with short lengths of wire by autogenously welding them together to form one long length of wire. This is a more profitable method of using wire scrap than remelting. In dealing with a poor class of wire scrap, A. points out that crucible melting is not to be advised, as it is uneconomic, since bundled scrap is bulky, and in melting down only a small proportion of the crucible capacity can be utilized. Moreover, crucible melting does not allow any appreciable refining operations.—W. P. R.

**Scrap and the Copper Market.** Samuel Tzach (*Eng. and Min. J.*, 1933, 134, 293-295).—An economic survey of the subject.—R. Gr.

**Electrometallurgical Preliminary Refining of Precious Metal Alloys.** W. Graulich (*V.D.I.-Nachrichten*, 1933, 13, (32), 4).—A brief account is given of two new electrolytic methods due to Carl, and of Siemens and Halske's method for the treatment of double scrap.—J. W.

**Smelting of Tin Waste and Electrolytic Refining of Recovered Tin.** N. N. Muratch (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, 29-41).—[In Russian.]—S. G.



## XV.—FURNACES AND FUELS

(Continued from pp. 523-524.)

## FURNACES

**High Temperature Gas-Fired Furnaces.** Anon. (*Mech. World*, 1933, 93, 359).—A gas-fired furnace stated to be capable of attaining a temperature of 2000° C. is illustrated and described. The furnace is designed to utilize the principle of surface-combustion by allowing the air and gas to impinge on a ring of tubes placed concentrically in the combustion chamber. The burning gases are compelled to pass downwards, thus giving up heat to the external surface of the combustion chamber before passing to a double-walled chimney pipe, which serves to heat the incoming air on the counter-current principle. The obvious difficulties of surface combustion are discussed and are overcome by not mixing the gases prior to their entering the furnace and by reducing resistance to flow within the furnace.—F. J.

**Photoelectric Control of Gas Furnaces.** Anon. (*Mech. World*, 1933, 93, 123).—A brief description of an application of photoelectric cells to the fuel-supply to gas-burners. The equipment shuts off automatically the main gas supply whenever the flame of the gas-burners, for any reason, becomes extinguished.—F. J.

**Waste-Heat Boilers Effect Fuel Saving.** Anon. (*Eng. and Min. J.*, 1933, 134, 352).—Note on the use of recuperators with a producer plant utilizing wood as fuel.—R. Gr.

**The Development in Time and Space of the Combustion in Technical [Furnace] Firing.** Kurt Rummel and Hellmuth Schwiedessen (*Arch. Eisenhüttenwesen*, 1932-1933, 6, 543-549).—The evaluation of a stationary combustion process by determining the distribution of temperature, and the speed and composition of the gas over a definite plane does not give a correct idea of the combustion in an enclosed space. A qualitative evaluation is possible by collecting the carbon dioxide, oxygen, carbon monoxide, and hydrogen fields into a single field of equal rate of combustion (isocaloric field). From this the integral of the rate of delivery of unburnt gas to any desired cross-section of the furnace can be calculated and the combustion correlated with that of a space enclosed by a surface of equal combustion (the reaction space). Finally, it is possible to reach conclusions on the rate at which the combustion proceeds to a definite stage of completion (i.e. to determine the average rate of firing), and on the time and path of combustion of the gases. Some examples of the results obtained in various types of furnace are given.—J. W.

**The Brackelsburg Furnace.** Anon. (*Mech. World*, 1933, 93, 50-52, 54).—A furnace for melting material of high melting-point, e.g. cast iron, is illustrated and described. The furnace consists of a cylindrical shell lined with high-grade refractory. A pulverized-fuel burner is inserted at one end and flue gases escape at the other. When working, the furnace is rotated continuously, therefore there is no slag line and no excessive attack of the lining at one particular level. The motion also mixes the metal and liberates non-metallic inclusions.—F. J.

**[Contribution] to the Knowledge of the High-Frequency Induction Furnace.**—VIII. Werner Bottenberg (*Mitt. K.W.-Inst. Eisenforschung*, 1933, 15, 55-58).—A laboratory vacuum high-frequency induction furnace is described, the coil of which lies inside a water-cooled hollow steel cylinder. The furnace can be used for casting *in vacuo*. The processes of melting and degassing metals are described, and some examples of the use of the furnace are given.—J. W.

**Low-Temperature Heat-Treatment Furnace.** Anon. (*Mech. World*, 1933, 93, 431-432).—Heat-treatment up to a temperature of 700° C. for steels, aluminium, and other non-ferrous materials may be carried out in an electrical resistance furnace, which is illustrated and described. A method of forced air circulation is employed, using a centrifugal fan to force air at a sufficient pressure to overcome the resistance to flow through the packed work in the basket.—F. J.

**Birlec Forced Air Circulation Furnaces.** Anon. (*Machinery (Lond.)*, 1933, 42, 416-417).—Cf. J., this volume, p. 458, and preceding abstract. A brief description of a forced air circulation electric heat-treatment furnace suitable for temperatures up to 700° C.—J. C. C.

**Nomographic Chart for Determining Heating Unit Design.** Temple C. Patton (*Chem. and Met. Eng.*, 1933, 40, 150-151).—In designing a heating element, the engineer is usually influenced by 2 factors, viz. the heat which must be evolved and the line voltage available. A chart, the solution of which is briefly explained, is given for the purpose of providing an easy, quick, and accurate graphical method of determining the length and gauge of wire required in a small heating element.—F. J.

### FUELS

**Flame Temperatures of Combustible Gas-Oxygen Mixtures.** H. H. Lurie and G. W. Sherman (*Indust. and Eng. Chem.*, 1933, 25, 404-409).—Experiments for determining the flame temperatures of combustible gas-oxygen mixtures are described. The theory, experimental results, combustion mechanics, and flame temperature calculations of oxy-acetylene and oxy-hydrogen are discussed. For mixtures of 550, 800, and 1005 B.th.u. (138.7, 201.6, and 253.5 cal., respectively) city gases with oxygen, the flame temperatures lie between 3410° K. (the temperature of the oxy-acetylene flame) and 2933° K. (the temperature of the oxy-hydrogen flame). The practical application of these oxygen-gas mixtures lies essentially in the field of welding, since the cost of oxygen is still too great for the large quantities thereof demanded in furnace work. Moreover, cheap refractories to withstand these temperatures are not available.—F. J.

**Limits of Inflammability of Natural Gases Containing High Percentages of Carbon Dioxide and Nitrogen.** G. W. Jones and R. E. Kennedy (*Amer. Gas J.*, 1933, 139, (1), 13-15).—Limits of composition relating to the inflammability of mixtures of methane, and ethane with carbon dioxide and nitrogen and mixtures of propane with nitrogen are given.—J. S. G. T.

**The Heats of Combustion of Carbon Monoxide in Oxygen and of Nitrous Oxide in Carbon Monoxide at Constant Pressure.** J. H. Awbery and Ezer Griffiths (*Proc. Roy. Soc.*, 1933, [A], 141, 1-16).—The following values of the heats of combustion (expressed in international joules per mole) of the respective substances have been determined: carbon monoxide in oxygen, 282,730; nitrous oxide in carbon monoxide, 364,340; heat of formation of nitrous oxide, 81,610. The accuracy is of the order 2 or 3 parts per 1000. The value of the heat of combustion of carbon monoxide in oxygen is equivalent to 67.5, k.-cal.<sub>15</sub> per mole.—J. S. G. T.

**A Bomb Calorimeter Determination of the Heats of Formation of Nitrous Oxide and Carbon Dioxide.** R. W. Fenning and F. T. Cotton (*Proc. Roy. Soc.*, 1933, [A], 141, 17-28).—The heats of formation of nitrous oxide and carbon dioxide at a constant pressure of 1 atm. and at 20° C. are: N<sub>2</sub>O,  $-19.74 \pm 0.07$  k.-cal.<sub>15</sub>, or  $-82,600 \pm 290$  international joules per mole; CO<sub>2</sub>,  $67.65 \pm 0.03$  k.-cal.<sub>15</sub>, or  $283,090 \pm 150$  international joules per mole. A form of adiabatic bomb calorimeter is described.—J. S. G. T.

**The Analysis of the Dry Combustion Gases as a Basis for Technical Firing Calculations [for Furnaces].** Hellmuth Schwiedessen (*Arch. Eisenhüttenwesen*, 1933, 6, 321-326).—A review of the basic principles.—J. W.



**Chlorine Determination in Coal.** W. A. Selvig and F. H. Gibson (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1933, 5, 189-191).—The coal is burnt in oxygen in a bomb calorimeter and the chloride determined in the washings by addition of standard silver nitrate and titration of the excess with ammonium thiocyanate. Water extraction of the coal does not always remove all the chloride present.—A. R. P.

**A Rapid Volumetric Method for Determination of Sulphur in Coal and Coke.** Comparison of a Modified Benzidine Method with the Standard Methods. Evald L. Skau and I. Laird Newell (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1933, 5, 180).—The coal or coke (1 grm.) is burnt in a silica tray in a gold-lined bomb calorimeter containing a few c.c. of water and filled with oxygen at 20-30 atm. After cooling for 5 minutes, the oxygen is slowly released and the interior of the calorimeter flushed out with 150 c.c. of a saturated solution of benzidine sulphate. The solution is treated with 60 c.c. of saturated benzidine hydrochloride solution, the precipitate is collected and washed free from acid with cold saturated benzidine sulphate solution, and the filter and precipitate are returned to the beaker, macerated with 100 c.c. of water, and titrated with 0.0624*N*-sodium hydroxide solution (phenolphthalein indicator) raising the solution to boiling near the end-point (c.c. NaOH  $\times 10 = \%$  sulphur).—A. R. P.

## XVI.—REFRACTORIES AND FURNACE MATERIALS

(Continued from pp. 521-526.)

**Refractories.** Anon. (*Refractories Bull. (John G. Stein & Co., Ltd.)*, 1933, (13-18)).—In this series of 2-pages monthly Bulletins features and properties of refractories are dealt with, which include the slagging of a firebrick; silica, slags, and slagging; thermal spalling; temperature gradients, the handling of refractories, and specifications for refractories. In the Bulletin dealing with specifications, the properties of refractories are viewed under three heads, depending on whether the constructional, the high-temperature, or the chemical characteristics of the materials are considered.—J. W. D.

**Refractory Brick.** G. Milani (*Corriere ceram.*, 1932, 13, 183-187, 202-207, 243-249, 275-281; *Ceram. Abs.*, 1932, 12, 157).—M. gives the raw materials, chemical composition, manufacture, behaviour and properties, tests and uses of (1) refractory clay brick (neutral); (2) silica brick (acid); (3) magnesia brick (basic); (4) chromium brick (neutral); (5) bauxite brick (neutral); and (6) special bricks for different industries.—S. G.

**Cement for Furnace Settings.** Anon. (*Mech. World*, 1933, 93, 224).—The properties of Sairset, a high-temperature air-setting cement of high alumina content, are described. Diaspore, a mono-hydrate of alumina, is used as the base, and the cement is suitable for steam-boiler plant and many other types of furnace setting, including the laying of firebricks, the protection of the working face of firebrick walls, and the pointing-up of cracks and worn surfaces.—F. J.

**Refractories for Industrial Furnaces.—IV.** F. H. Norton (*Fuels and Furnaces*, 1932, 10, 575-584; *Ceram. Abs.*, 1933, 12, 67).—*Cf. J.*, this volume, p. 385. The thermal characteristics of heat flow and heat capacity of common types of refractories and insulators are discussed. Values of thermal conductivity, measurement of thermal conductivity, efficient use of furnace insulation, computation of the heat flow through insulated walls, the economy of insulation, construction of insulated walls, heat content of walls, recuperators, and some typical calculations are taken up.—S. G.

**Elastic Distortion and Plastic Deformation of Refractory Brick at 20° C. and at Higher Temperatures.** K. Endell and W. Müllenseifen (*Ber. deut. keram. Ges.*, 1933, 14, 16-28; *Ceram. Abs.*, 1933, 12, 301).—A new device for

the determination of elastic and plastic distortion of refractory brick at room temperature is described. The results obtained on 10 different refractory bricks with this apparatus make it possible to detect a new relation between torsion stresses and the specific distortion in the elastic and plastic range. A relation between the modulus of elasticity and resistance to compression is set up for ceramic materials, slags or clinker, and glasses. The sphere of refractory brick is divided into three groups with increasing modulus of elasticity and resistance to compression. The following causes, which may be active separately or in combination, for high distortion of certain refractory bricks have been detected: (1) grain-size combination, grain bond, type of bonding medium; (2) smooth crystallographic rearrangement ( $\text{SiO}_2$ ); (3) cleavage planes in crystals, *e.g.*, periclase. Reference is made to the significance of these characteristics on the elastic and plastic deformability and resistance to temperature changes of refractory brick. Curves for softening under tension of different refractory bricks up to  $1500^\circ\text{C}$ . were determined in a torsion apparatus in which heat could be applied to the specimen under test.

—S. G.

**The Thermal Expansion of Refractories to  $1800^\circ\text{C}$ .** R. A. Heindl (*U.S. Bur. Stand. J. Research*, 1933, 10, 715-735; *Research Paper No. 562*).—The linear thermal expansions of the following 36 materials were measured: African chrome sand; Cuban, Grecian, Friable African, Rhodesian Imperial, Indian, and Turkish chrome ores; Austrian, Californian, and electrically-fused magnesites; a periclase brick; a spinel brick; 2 types of fire-clay brick and 2 types of fireclay; Kentucky, Tennessee, and English ball clays; Georgia kaolin and an English china clay; an 80% alumina brick; artificial corundum; diaspore; bauxite; 5 mullites, each of which was prepared from different raw materials; 2 zircon bricks and a furnaced zirconium silicate; silicon carbide, a silica brick, and an insulating brick. Data are also given for artificial graphite which had been preheated several times to  $1800^\circ\text{C}$ . Measurements were made below  $1000^\circ\text{C}$ . in both an oxidizing and a reducing atmosphere. Above  $1000^\circ\text{C}$ . the materials were tested in a reducing atmosphere only. When the refractoriness of the materials permitted, they were tested up to  $1800^\circ\text{C}$ . Petrographic analyses of the materials were carried out before and after the several heat-treatments.—S. G.

**Characteristics of Some Special Refractories.**—I. —II. —III. Marcel Lépingle (*Rev. mat. constr. trav. publ.*, No. 279, 1932, 225-228; No. 280, 6-8B; No. 281, 29-31B; *Ceram. Abs.*, 1932, 12, 157, 193, 227).—(I.—) Refractories may be classified into 3 groups: (1) ordinary silico-aluminous refractories; (2) extra-aluminous refractories, and (3) special refractories. The second group contains refractories the main constituent of which is natural silicate of aluminium with ball clay as bonding agent. These refractories are characterized by their high refractoriness and mechanical resistance and their great resistance to erosion and fluxes. Refractories containing bauxite or corundum, the main constituent of which is fused alumina, have a softening temperature under load reaching  $1700^\circ\text{C}$ ., their fusing temperature is  $1900^\circ$ - $1950^\circ\text{C}$ ., and they have a high resistance to pressure and a slight variation in linear dimensions but are sensitive to sudden changes of temperature. They are used in gas and liquid fuel burning furnaces. Silicon carbide refractories can be used only in a reducing atmosphere, and their softening temperature depends on the amount of clay used as bonding agent. Such products are highly resistant to changes in temperature and are used in oil-fired furnaces. They are resistant to erosion and abrasion and are characterized by the constancy of their linear dimensions. Zirconium refractories have a remarkable chemical passivity and are therefore mostly used in the chemical and metallurgical industries. Different English, French, Belgian, and German refractories are compared briefly and the qualities of 5 Belgian refractory products are discussed. (II.—) L. briefly reviews the manufacture of English and



German special refractory products, together with their chemical analyses and characteristics. (III.—) Data are given on refractory products of Czechoslovakia, U.S.A., Sweden, and Spain.—S. G.

**Highly Refractory Special Materials for High Temperatures.** — Gallus (*Wärme*, 1932, 55, 644-646; *Ceram. Abs.*, 1933, 12, 157).—G. discusses the reasons for utilizing refractory special materials such as corundum, silicon carbide, magnesite, zirconium silicate, chromium ore, sillimanite, carbon, alumina, zirconia, thoria, beryllia, and boron nitride.—S. G.

**Materials with the Highest Melting Point and Their Utilization.** Curt Agte (*Feuerfest*, 1933, 9, 1-4; *Ceram. Abs.*, 1933, 12, 192).—Binary compounds of the highest melting metals of groups IV, V, and VI of the periodic system when combined with carbon, nitrogen, and boron possess melting points which in some cases exceed the melting point of metals having the highest melting temperature. They are produced by (1) heating the metal or oxide with carbon until the formation of carbide; (2) heating the metal in a nitrogen current until the nitride is obtained, and (3) calcining the metal with boron in required mixing proportion. An especially high melting point is shown by tantalum carbide and hafnium carbide, and even higher melting points are obtained with mixtures consisting of tantalum carbide and zirconium carbide or hafnium carbide (the highest melting point ever ascertained for solid bodies). The compounds show an electrical conductivity similar to that of metals, sometimes a "super-conductivity." Their hardness lies between 8 and 10 of Mohs' scale. Chemically they are indifferent. These materials may be utilized as radiators, furnace material, abrasives, and as hard components for hard metals.—S. G.

**The Influence of the Quality and Quantity of the Binding Clay on the Physical Properties and Especially on the Mechanical Properties of Fireclay Bricks.** S. Sachs (*Sprechsaal*, 1933, 66, 435-438, 453-456, 469-471, 487-489).—The mechanical strength of the unburnt brick is determined by the loss in weight under the action of a stream of falling shot, and that of the burnt brick by compression tests and by loss in weight under the combined action of blows and friction in a rotating drum. In all cases the individual properties determined are greatly dependent on the variables, and show little relation to one another. Bricks with non-uniform grain size have especially good properties.—J. W.

**Introducing Binary Kaolins into the Fireclay Mix in Order to Increase its Alumina Content and Refractoriness.** P. P. Budnikov and B. I. Endovitzkii (*Domez*, 1932, (1/2), 11-13).—[In Russian.] See *J.*, this volume, p. 387.—S. G.

**Gas Permeability of Fire-Brick and Iron Ores at High Temperatures. I.—Fire-Brick.** Yoshiaki Tadokoro (*J. Japanese Ceram. Soc.*, 1932, 40, 619-637; *Ceram. Abs.*, 1932, 12, 158).—[In Japanese.] T. improved his arrangement for measuring the gas permeability of refractories and other materials by continued heating, and experiments have been made of 5 kinds of fire-brick. The permeability  $u$  was calculated by the following formula:  $u = Q/T \cdot (Pt + h)/P \cdot 273/(273 + t) \cdot 1/(Ah)$ ; where  $Q$  = volume of gas in cubic centimetres,  $T$  = time in seconds,  $Pt$  = atmospheric pressure in  $\text{grm./cm.}^2$ ,  $h$  = pressure of gas in water head in  $\text{cm.}$ ,  $P$  = normal pressure or 1033  $\text{grm./cm.}^2$ .

TABLE I. CHEMICAL COMPOSITION.

Brick.	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe	FeO	Fe <sub>2</sub> O <sub>3</sub>	CaO	MgO	TiO <sub>2</sub>	Cr <sub>2</sub> O <sub>3</sub>	Na <sub>2</sub> O	K <sub>2</sub> O
(a) Silica	92.5	1.2	0.2	0.5	2.3	2.8	0.5	...	...	0.1	0.2
(b) Agalmatolite	62.3	31.1	...	...	3.2	0.6	0.4	0.7	...	0.3	1.1
(c) Magnesite	7.1	2.4	...	...	6.4	1.3	82.7	...	...	0.1	0.2
(d) Chrome	12.0	17.2	...	...	18.1	0.4	30.0	...	22.1	0.4	0.1
(e) Grog	62.3	31.6	...	...	3.4	0.5	0.5	1.1	...	0.2	0.4

$\text{cm.}^2$ ,  $t$  = room temperature in  $^{\circ}\text{C}$ , and  $A$  = area of test-piece in  $\text{cm.}^2$ . Chemical composition, permeability, and other physical properties are shown in Tables I and II.

TABLE II. AIR PERMEABILITY AND OTHER PHYSICAL PROPERTIES.

Brick.	Firing Temperatures (cone).	P.O.E.	Sp. Gr.	Porosity.	Permeability at			
					50° C.	200° C.	500° C.	800° C.
(a)	17	32	2.36	24.70	0.3016	0.1272	0.0839	0.0641
(b)	10	32	2.62	30.08	0.0256	0.0160	0.0082	0.0048
(c)	26	37	3.75	28.38	0.2125	0.1247	0.0654	0.0359
(d)	14	36	3.54	24.42	0.0694	0.0375	0.0196	0.0108
(e)	10	34	2.64	28.43	0.0603	0.0379	0.0196	0.0112

It is concluded that the gas permeability decreases with rise of temperature in logarithmic power though the bricks expand directly as the temperature rises. The fact is contrary to the common idea that the pores open as the bricks expand.—S. G.

**Magnesite Refractories.** P. P. Budnikov and Z. Ya. Tabakov (*Domez*, 1932, (9), 24-31).—[In Russian.] A review.—S. G.

**Thorium Oxide, a High-Temperature Refractory.** Oscar H. Fritsche, H. B. Wahlin, and Joseph F. Oesterle (*Electrochem. Soc. Preprint*, 1933, Sept. 281-291).—An account is given of the methods used in making a thorium crucible of special design for a study of the positive ion emission of metals at high temperatures *in vacuo*. The thorium is prepared by repeated precipitation of the hydroxide from commercial thorium nitrate, followed by precipitation and ignition of the oxalate. The resulting oxide is fused in a simple smothered carbon arc furnace to produce a hard, glassy mass which is free from carbide provided that the arc is kept well covered with thorium; this mass is ground to pass 100 mesh and, after moistening with thorium chloride solution, tamped into moulds of suitable shape made of electrode graphite. The shapes are burnt in the mould at 1600° C. in an induction furnace, heated at 1000° C. in air to oxidize carbide formed on the outer surface, again burnt at 1600° C., and again heated at 1000° C. in air. Magnesia crucibles can be made in a similar way.—A. R. P.

**New Super Refractory. Discussion of Tests and Operating Results [Siemensit].** Anon. (*Found. Trade J.*, 1933, 49, 17-18, 38).—See *J.*, this volume, pp. 210, 328. The results of tests of Siemensit, a new refractory, consisting of  $\text{Cr}_2\text{O}_3$  20-40,  $\text{Al}_2\text{O}_3$  25-45,  $\text{MgO}$  18-30, other constituents 8-14% are described. The 3 main constituents are present as spinels, the others as silicates. The principal characteristics are: (a) refractoriness, above Seger cone 42, (b) softening under a load of 28.9 lb./in.<sup>2</sup>, above 1800° C., (c) bulk density (including pipe) 3.2-3.4, (d) heat conductivity, not yet determined, but more than that of magnesite, (e) expansion between 0°-1200° C., 1.2-1.4%, at higher temperatures about 2%. Operating tests have been made on a large scale under works conditions.—J. H. W.

**"Siemensit" in the Construction of Furnaces.** Arthur Sprenger (*Tonind. Zeit.*, 1933, 57, 14-15, 39-40).—The results obtained over several years on a large scale with the Siemensit refractory are described; it has proved particularly satisfactory for lining combustion chambers in which coal-dust firing is practised.—B. Bl.

**Sintered Corundum.** Otto Bär (*Feuerungstechnik*, 1932, 20, 174-175; *Ceram. Abs.*, 1932, 12, 226).—Sintered corundum is obtained from chemically pure alumina. During fine grinding some acid must be added because alumina powder forms a positive suspensoid in a watery suspension in contrast to clays and kaolins which form a negative. It is shaped either in gypsum moulds or by



pressing. The firing takes place in electric furnaces or in gas furnaces fired to 1800° C. Owing to a crystallization process of alumina particles in a solid state, the particles grow together in the  $\alpha$ -modification and form a dense structure similar to granite. Chemically, sintered corundum consists of 99.3–99.8%  $\text{Al}_2\text{O}_3$ . It is resistant to a 6-hr. boiling with 10 or 30% solution of caustic soda and to superheated water vapour. It is stable to fusions of  $\text{Na}_2\text{O}$ ,  $\text{NaOH}$ ,  $\text{Na}_2\text{CO}_3$ , metallic aluminium, manganese iron, and other metallic alloys, to evaporation to dryness, and to glass and slag melts. It resists blast-furnace slag, lead carbonate, lead, and other metal silicates, lead boron glasses, glaze frits, and all silicate glasses. Its specific gravity is 3.9, hardness 9 (Mohs'), and porosity 0. Pyrometer tubes are gas tight when heated up to 1720° C. and under an inner pressure of 776 mm. The thermal expansion between 20° and 800° C. is  $80 \cdot 10^{-10}$ . Sintered corundum is also highly resistant to sudden changes of temperature. It contains a resistance to pressure of 5140 kg./cm.<sup>2</sup> and a tensile strength of 350 kg./cm.<sup>2</sup>. The softening point lies near 1730° C. The deformation point could not be determined. Sintered corundum may be used for chemical vessels, pyrometer tubes, and as highly refractory material for small furnaces and laboratory vessels, &c.—S. G.

**Sintered Corundum.** René Leonhardt (*Ind. Silicati*, 1933, 11, 10–11; *Ceram. Abs.*, 1933, 12, 227).—The manufacture, properties, and uses of sintered corundum products are detailed.—S. G.

**Manufacture of Silicon Carbide and Artificial Corundum.** A. C. (*Rev. mat. trav. publ.*, No. 277, 1932, 425–426; *Ceram. Abs.*, 1933, 12, 110).—Silicon carbide is produced from coal (coke) and siliceous sand treated in an electric furnace. At 1400° C. an amorphous material is obtained which has no refractory qualities, being too sensitive to oxidation. To secure a refractory product, the mixture is heated up to 1800° and 2200° C. to obtain crystallization; over this temperature silicon carbide is no longer stable and decomposes into its elements. The reaction is facilitated by adding sea salt and sawdust. Corundum exists in nature and has 95–98% pure alumina, although the emery from Naxos contains only 55–60% alumina. Some bauxites are easily transformed into crystallized alumina in an electric furnace at about 2000° C. and an artificial corundum is thus obtained. Because of crystallization, corundum easily separates from impurities. There is a great difference between crystallized corundum obtained in such a way and bauxite which has simply been fused, because the latter has none of the qualities of stability produced by crystallization.—S. G.

**Manufacture of Electrocorundum and Silicon Carbide.** R. Schneider (*Feuerfest*, 1932, 8, 129–132; *Ceram. Abs.*, 1933, 12, 62).—Aluminium oxide or alumina exists in 3 different crystallographic modifications: (1) the  $\alpha$ -alumina (corundum) stable at high temperatures; (2) the metastable  $\gamma$ -alumina with a stability range up to 930° C., and (3) the  $\beta$ -form. The alumina of the  $\alpha$ -form and  $\gamma$ -form differ in that the  $\gamma$ -alumina is mostly amorphous, whilst corundum ( $\alpha$ -alumina) forms aggregates with crystals besides having different physical properties. Electrocorundum is a crystallized  $\alpha$ -aluminium oxide free from water and is produced in an electric arc furnace. It differs from artificial corundum (cupola furnace method, Thermit method) and natural corundum of purest form (ruby and sapphire). The manufacture of artificial corundum consists morphologically in a conversion of the amorphous  $\alpha$ -alumina into the crystalline  $\alpha$ -form at over 930° C. The raw materials used for it are white and red bauxites, emery, and kaolin. Amorphous alumina of great purity is used for corundum of the highest alumina content. Silicon carbide is a pure artificial product and is formed from its components, silica, and coal, in an electric resistance furnace. Patent literature dealing with the manufacture of corundum and silicon carbide refractories is discussed.—S. G.

## XVII.—HEAT-TREATMENT

(Continued from p. 526.)

**Remarks on the Heat-Treatment of Duralumin.** Jean Matter (*Aciers spéciaux*, 1933, 8, 109-112).—M. discusses the influence of the time of heating, rate of cooling in annealing, and the temperature of ageing on the characteristics of normal Duralumin. It is recommended that annealing should consist of heating for some minutes at 400° C., except in the case of large pieces which require a longer time. The rate of cooling depends largely on the thickness of the pieces, which should be cooled separately. Ageing is considerably accelerated (a few hours as opposed to weeks) by increasing the temperature from 0° to 100° C.—J. H. W.

**The Heat-Treatment of Hiduminium Alloys.** Anon. (*Metallurgia*, 1933, 8, 113).—Heat-treatment technique of the Hiduminium alloys varies according to the particular alloy to be treated, and it is of vital importance to use the most suitable treatment in order to obtain the most desired properties. The recommended heat-treatments for sand- and die-castings in "R.R.50" and "R.R.53" alloys are given, and it is stated that in the treatment of castings with widely different variations of sections, additional care must be taken to prevent cracking or distortion due to differential contraction. The treatment of forgings and stampings in "R.R.56" and "R.R.59" alloys are also discussed and certain alternative treatments are mentioned. Consideration is also given to the treatment of castings in Hiduminium "Y" alloy, particularly to castings of intricate design and change of section.—J. W. D.

**Application of Tungsten Wire in the Electrical Industry and Principles of its Heat-Treatment.** N. M. Zarubin and A. N. Koptzik (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, 189-204; *C. Abs.*, 1933, 27, 3689).—[In Russian.] Recent progress in the manufacture and heat-treatment of tungsten wire is reviewed. An apparatus and the method for measuring the sag in tungsten wire are described. Heat-treating experiments are described for controlling the grain-size of wires with the addition of  $K_2O$ ,  $SiO_2$ , and  $ThO_2$ . Photomicrographs and a bibliography are given.—S. G.

**Some Heat-Treatment Problems in the Automobile Factory.** A. MacLachlan (*Proc. Inst. Automobile Eng.*, 1932-1933, 27, 478-501; discussion, 502-505).—The heat-treatment of steel in automobile works is reviewed, the possibility of effecting economies being kept in view throughout. The treatment is essentially practical, the work embracing a discussion of the utilization of existing plant and personnel, and shop lay-out.—J. S. G. T.

## XVIII.—WORKING

(Continued from pp. 526-527.)

**The Manufacture of Aluminium Foil.** Anon. (*Synthetic and Applied Finishes*, 1933, May; also (reprints) *Light Metals Research*, 1933, 2, (28), 8-11; and *Aluminium Broadcast*, 1933, 4, (7), 16-18).—Aluminium foil is rolled from ingots 500 × 500 × 150 mm., which are cooled slowly in electrically-heated moulds and then machined all over to a depth of 1 cm. These are rolled to sheet 2 cm. thick in a reversible mill, cut to lengths of 5 m., and annealed. Further reductions to 0.02 mm. thick are carried out in a foiling mill, after which two sheets are fed together through the rolls until the final thickness, which may be as small as 0.005 mm., is reached. A final anneal removes oil and produces the necessary softness.—J. C. C.

**Lubrication for Deep-Drawing.** E. E. Halls (*Machinery (Lond.)*, 1933, 42, 453-457).—The requirements of a lubricant for deep-drawing operations are discussed under the headings of ease of application, adherence, film strength, lubricity, corrosiveness, ease of removal, and cost. The characteristics of various oils, workshop mixtures, and proprietary compounds are considered.—J. C. C.



**72:28 Cartridge Brass.** H. Dureault (*Mém. artill. franç.*, 1932, 11, 385-408; *Chim. et Ind.*, 1932, 29, 1088; *C. Abs.*, 1933, 27, 3693).—Like 67:33 brass, 72:28 brass easily becomes work-hardened and loses its malleability, which can be restored only by annealing. Tests with thick brasses showed that at the temperature corresponding with complete annealing 72:28 brass has a greater elongation than 67:33 brass. It would appear advantageous, therefore, with 72:28 brass to endeavour to reduce the number of operations in the manufacture of cartridges and to increase the amount of work effected at each operation. Tests on thin brasses showed practically no difference between 72:28 and 67:33 brasses. It would seem, therefore, that the increase in the copper content cannot be depended on to guarantee the keeping qualities of the cartridges, and in order to prevent fissuring a complete annealing is essential.—S. G.

**Methods of Working and Fabricating Magnesium Alloys.** Anon. (*Machinery (N. Y.)*, 1933, 39, 721-723).—The operations of casting, forging, pressing, rolling, drawing, and welding magnesium alloys are described in a general way.—J. C. C.

**Spontaneous Combustion of Metals.** —Freitag (*Oberflächentechnik*, 1933, 10, 107-108).—In working magnesium alloys, especially that containing 86.2% magnesium, 0.3% silicon, and 13.5% copper, on the lathe the turnings frequently take fire. Water and sand are useless for quenching such fires, but powdered carnallite rapidly smothers them by making a film of fused salt over the hot metal.—A. R. P.

**Factors that Affect Machinability.** F. R. Palmer (*Metal Progress*, 1933, 23, (4), 17-19).—Hardness, toughness, microstructure, frictional properties, and tendency to work-hardening are shown to affect the machinability, primarily of steels, but inferentially of other materials. Corrections both in machining practice and in selection of material are suggested.—P. M. C. R.

**Advances in the Construction of Machinery for the Working of Sheet.** —Weil (*Maschinenkonstrukteur*, 1933, 66, (9/10), 59-67).—Recent examples of bending and pressing machinery, punching and cutting plant are described and illustrated; diagrams of certain unusual sections are given.—P. M. C. R.

**Tapping Monel Metal.** Anon. (*Machinery (Lond.)*, 1933, 42, 347).—In tapping Monel metal, the tough chips are apt to stick in the flutes of the tap. Methods of minimizing this trouble are briefly discussed.—J. C. C.

**Materials for Cold-Heading.** H. B. Pulsifer (*Metal Progress*, 1933, 23, (3), 13-17).—The bolt industry is estimated to be capable of producing annually 5000 million pieces by the cold-heading process. This would require about 300,000 tons of material in wire form, the average sizes ranging from 0.16 in. to  $\frac{3}{4}$  in. in diameter. The process demands stock of high quality; properties of typical steels, brass, Everdur, Duronze, and Monel metal are tabulated. Materials must combine high strength with low cost, and in practice this limits the choice to the  $\alpha$ -solid solutions of iron, copper, and nickel. Certain details of the process are modified according to the alloy selected. Possible sources of defects in the wire are considered, and the importance of surface finish and of proper lubrication is emphasized.—P. M. C. R.

**A Molybdenum-Titanium Carbide Cutting Material.** Anon. (*Metallurgia*, 1933, 8, 62).—A description of Cutanit, a new cutting material the components of which are molybdenum and titanium carbides of high purity, carburized in powder form. Its sp. gr. is much lower than that of other carbide materials of a similar character, yet when cutting it generates less heat. Its Rockwell hardness is 83-85 on the 100 kg. scale, and it resists oxidation up to 900° C. It has given good results after extensive and exhaustive tests for a considerable time on a wide range of materials.—J. W. D.

**The Tool-Metal "Widia."** Anon. (*Maschinenkonstrukteur*, 1933, 66, (11/12), 86-87).—The preparation of Widia tools is briefly described; necessary precautions are enumerated, and 6 varieties of Widia are tabulated with their

respective trade markings and colours and with the types of work for which they are especially suited.—P. M. C. R.

**Cemented Tungsten Carbide for Cutting Tools.** L. J. St. Clair (*Trans. Amer. Soc. Mech. Eng.*, 1931, 53, M.S.P.-15, 139-146; *Ceram. Abn.*, 1933, 12, 119).—S. describes the origin of cemented tungsten carbide and the most satisfactory method for making it. Because of its hardness, it is valuable for wear-resisting tools and particularly for cutting tools. The physical properties of cemented tungsten carbide and its economic value as a cutting medium are discussed. Design and care of the tools are essential factors in successful application. Proper support of the cemented tungsten carbide tip and allowance for proper clearance angles are essentials of design. The tool set up should be as rigid as possible, as chatter or vibration is detrimental to successful life. The critical speed at which the tool should run for a particular job should be determined and the machine should be operated below this. Grinding of the tool is important and proper grinding methods are given. Use of cemented tungsten carbide for cutting tools has resulted in increased machine speed, longer life per grind, reduced tool maintenance, less waste of material in setting up, and greater accuracy throughout a long run.—S. G.

**New Metal-Cutting Alloy (548).** W. P. Sykes (*Metal Progress*, 1933, 23, (2), 32).—A paper read before the Cleveland meeting of the American Society for Steel Treating. The iron-tungsten and iron-cobalt alloy systems are considered; tungsten and cobalt exert opposite effects on the  $\gamma$ -region, the former restricting, and the latter extending, it. The hardening properties of both series are discussed. The introduction of cobalt into the iron-tungsten system greatly increases the hardness of both quenched and aged alloys. The alloy of composition 20% tungsten, 30% cobalt, and 50% iron is found to be capable of great refinement of structure on suitable treatment, with a hardness ranging between Rockwell C-40 and C-64. A full description with photomicrographs illustrating the structures associated with varying degrees of hardness is appended.—P. M. C. R.

**Non-Ferrous Super High-Speed Cutting Alloys.** Anon. (*Machinery (Lond.)*, 1933, 41, 715-724).—A comprehensive review of the characteristics and applications of 4 British-made cutting alloys—the Wimet metals (originally introduced as Widia metals), the Ardaloy metals, Cutanit, and Sellite. The design, maintenance, and grinding of cutting tools, milling cutters, and drills tipped with these materials are described, and reference is made to chip-breaking methods which have been developed.—J. C. C.

**Campbell "Hunderkat."** Anon. (*Automotive Ind.*, 1933, 68, 357).—The "Hunderkat" machine eliminates dust and produces a clean, smooth cut by means of a thin wheel or disc which rotates at high speed, and operates on pieces immersed in a bath. The cutting stroke is automatic, the completion of the process being indicated by a light. It is claimed that time is saved both in cutting and by removing the necessity of further machining of the cut face, since the finish is of high quality. The process is applicable to a wide range of metallic and other materials.—P. M. C. R.

## XIX.—CLEANING AND FINISHING

(Continued from p. 583.)

**Metal Cleaning. Methods and Materials.** Joseph Gesehelin (*Automotive Ind.*, 1933, 68, 486-470, 527-526, 702-703).—(I.) Factors influencing the choice of cleaning methods are classified. The available methods are: alkaline cleaning, pickling, degreasing by organic solvents, electrolytic methods, bright-dipping, the Sulfard-Dunn process, cleaning and rinsing tanks, and metal washing machines. The advantages and special applications of each are considered. (II, III.) Some proprietary cleaning processes are described.—P. M. C. R.



**The Heating of Wooden Pickling-Vats by Gas.** Anon. (*Maschinenkonstrukteur*, 1933, 66, 98-99).—An enclosed submersible gas-heating apparatus is described for use in vats where steam-heating is not convenient. A combustion chamber of cast brass, into which are led supplies of gas and of compressed air, is almost entirely submerged in the pickling fluid; the products of combustion are led out through a copper heating coil. Directions for use and certain possible modifications are given.—P. M. C. R.

**Amalgamating Copper Plates.** Anon. (*Eng. and Min. J.*, 1933, 134, 321).—Describes a method of amalgamating copper plates with a soft mush of ammonium chloride 80%, moistened with 20% of water, with sufficient mercury dispersed through it.—B. Gr.

**Electronic Interferences on Emiered and Polished Surfaces.** H. Raether (*Naturwiss.*, 1933, 21, 547).—The changes undergone by the surfaces of metals (copper, silver, and nickel) and the cleavage planes of certain salts during polishing and burnishing have been studied by the electronic interference method. Metal surfaces polished on emery give relatively slight broadening of the interference lines, but, after finer polishing, broad interference lines appear which are almost the same for all metals, and do not correspond with the atomic distances in the lattice; this is possibly due to a transition from the crystalline to the amorphous state.—J. W.

**Grinding, Polishing, and Buffing of Monel Metal and Pure Nickel.** Anon. (*Machinist (Eur. Edn.)*, 1933, 77, 341-342).—The applications, methods, and effects of the various operations of grinding, polishing, and buffing Monel metal and pure nickel are described and summarized in tabular form.

—J. H. W.

## XX.—JOINING

(Continued from p. 525-529.)

**New Counterbore Riveting Process for Sheet Metal.** A. Eyles (*Met. Ind. (Lond.)*, 1933, 42, 99).—Describes a method of riveting very thin sheets of aluminium and other alloys used in the aeronautical industry. A specially shaped tool forces the flat rivet head into the two sheets which sink together into a cup shape without distorting the sheets, which remain dead flat, and at the same time form a new cup head on the rivet shank.—J. H. W.

**Soldered Porcelain and Glass in the Electrical Industry.** E. H. Fritz (*Ceram. Ind.*, 1932, 19, 279-283; *Ceram. Ab.*, 1933, 12, 85).—The process consists of producing a metallized area on glass or glazed porcelain surfaces which can be tinned and soldered to metal parts with a commercial solder. The metallized area is produced by coating the glass or glazed porcelain surface with a special metallic glaze of comparatively high metallic content of which the essential constituents are platinum and gold in the form of chlorides. This glaze is fired in an oxidizing atmosphere. The commercial solder consists of approximately half tin and half lead. A satisfactory union takes place between the solder and metallic glaze at 225° C. and this temperature must be closely controlled. To overcome strains due to different coefficients of expansion of metal and non-metal parts the former are made as light as possible and the latter with the maximum ductility. Examples of joints made by this process are illustrated photographically and explained.—S. G.

**New Low Temperature Brazing Alloy (50-F°).** Anon. (*Canad. Mach.*, 1933, 44, (5), 22).—See this J., 1931, 47, 306; 1932, 50, 53.—P. M. C. R.

**Fabricating Products by Electric Furnace Brazing.** H. M. Webster (*Machinery (N.Y.)*, 1933, 22, 520-524; and *Machinery (Lond.)*, 1933, 42, 461-464).—*Ch. J.*, this volume, p. 217. Electric furnace brazing is carried out by passing assembled steel parts through an electric furnace in which a reducing atmosphere is maintained. Copper is applied to the joints as wire, chips, or a paste of copper dust mixed with pyroxylin and a thinner. Details of the construction of some typical brazed products are given.—J. C. C.

**New Developments Lower Cost of Continuous-Furnace Brazing.** C. L. West (*Iron Age*, 1933, 132, 15-16, 66).—Data are given on different brazing materials and on the fitting and the preparation of the parts to be joined, as well as on the operation and scope of continuous-furnace brazing.—J. H. W.

**Copper Brazing.** C. L. West (*Metal Progress*, 1933, 24, (1), 44-47).—Brazing in a controlled atmosphere increases both economy and efficiency by making it possible to join rigidly and strongly many simple units in one operation. The brazing material is placed in convenient form on or near the joint to be made and on melting enters and fills the joint. A list of typical assemblies is given. Brazing materials include silver solders, certain brass alloys, and copper. The preparation of joints is described, and suitable types of furnace are considered. Braze joints are stated to be stronger than those made by the rather cheaper projection welding process. Examples of brazed assemblies are described.—P. M. C. R.

**Soldering, Brazing, and Welding of Stainless Steels.** A. Eyles (*Mech. World*, 1933, 93, 306-308).—The technique essential to good results in soldering, brazing, and welding stainless steels, is discussed. The necessity for brazing solders to be free from impurities, particularly tin and lead, is pointed out. For use with silver solders the flux recommended consists of equal parts of calcined borax, and boracic acid made into a paste with concentrated zinc chloride solution.—F. J.

**Cadmium Solders.** Anon. (*Machinery (Lond.)*, 1933, 42, 162-163; *correspondence*, 369).—Details are given of the composition and uses of a number of alloys containing cadmium. These are grouped as fusible alloys, soft solders, silver solders, brazing solders, and aluminium solders.—J. C. C.

**Some Economic Aspects of Welding Aluminium.** D. E. Roberts (*Met. Ind. (N.Y.)*, 1933, 31, 61-62; and (short abstract) *Met. Ind. (Lond.)*, 1933, 42, 380).—Paper read before the International Acetylene Association at Philadelphia, Nov. 16-13, 1932. Comparison of the costs of oxy-acetylene and oxy-hydrogen flames for large-scale welding of aluminium shows an advantage of 47% in favour of the former.—A. R. P.

**On the Welding of Aluminium and of Its Alloys.** H. Bohner (*Alluminio*, 1933, 7, 100-102).—Cf. *J.*, this volume, p. 331. Buchholz's paper (see this *J.*, 1932, 50, 257) is discussed. The structure and mechanical properties of welded joints of light alloys, and particularly those of heat-treated alloys, are materially affected by the welding operation, but may be restored by further heat-treatment. In cold-worked alloys, the mechanical properties are permanently affected. Contrary to the statement of Buchholz, the welding method has no influence on the properties of the joint: if the welding is correctly done, oxy-hydrogen and oxy-acetylene welds will have the same mechanical properties. Cold-ripping of aluminium alloys is always possible, and gives good results, provided that certain elementary precautions are observed.—G. G.

**A Canoe of Welded Aluminium.** Anon. (*Fiamma Ossiacetilenica*, 1933, 8, (2), 60-62; and *Soudeur-Coupeur*, 1933, 12, (4), 10-12).—A detailed description of the construction from sheet aluminium, welded by oxy-acetylene, is given. The canoe will carry two persons, is about 17 ft. long, weighs 60 lb., and has 2 air tanks for safety.—H. W. G. H.

**Fluxing is Indispensable [for Welding Aluminium].** Anon. (*Fiamma Ossiacetilenica*, 1933, 8, (4), 51-54).—The formation of vitreous alumina in the welding of aluminium is shown in photomicrographs, and Odani's attempts to find a suitable flux for the autogenous welding of aluminium are mentioned.—G. G.

**Welded Aluminium Articles.** Anon. (*Fiamma Ossiacetilenica*, 1933, 8, (4), 55-57).—The use of welded aluminium in the manufacture of reservoirs, mixers, radiators, cars, moving pent-houses, &c., is illustrated.—G. G.

**Welding of Light Alloy Castings.** Anon. (*Fiamma Ossiacetilenica*, 1933, 8, (4), 58-59).—Deals with the repair of gear boxes, &c.—G. G.



**Welding Aluminium with the Metallic Arc.** John J. Bowman (*Machinery* (N.Y.), 1933, 39, 403-406).—Arc welding of aluminium is possible provided a flux is used. Electrodes made from a 5% silicon alloy, coated with a rather heavy layer of flux, are recommended. Arc welds are always slightly porous. Complete removal of flux by washing in 10% acid solution is essential.—J. C. C.

**Resistance Welding of Aluminium and Its Alloys.** D. I. Bohn and G. O. Hoglund (*Amer. Soc. Mech. Eng. Preprint*, 1933).—Spot and seam welding of aluminium and its alloys require a high thermal gradient from the weld point to the sheet surface, and the weld is made with metal in the molten state. Pressure between electrodes is important. Existing methods used for steel welding are not applicable without modification.—W. P. R.

**Repair Methods on Damaged All-Metal Coaches.** A. J. T. Eyles (*Locomotive*, 1933, 39, 184-185).—Discusses the advantages of fusion welding of aluminium over soldering and describes appropriate technique.—P. M. C. R.

**The Welding of Brass and Bronze Sheets.** Herbert Herrmann (*Met. Ind. (Lond.)*, 1933, 43, 145-148).—Owing to the oxidation and vaporization of the alloying constituents, brass and bronze require a somewhat different technique from that of copper, (1) in the introduction of small quantities of some metal or metalloid, such as aluminium or phosphorus, exhibiting a larger deoxidizing effect than the zinc or tin, so protecting these metals from the oxidizing effect of the cuprous oxide, and (2) in the use of a flux having a protective effect and a solvent action on the zinc and tin oxides produced. The use of the deoxidizers, the composition of fluxes and welding rods, failures in brass welding, the technique of welding sheet, and the avoidance of buckling, flame control, and the differences between brass and bronze welding are discussed.—J. H. W.

**Repairing Foundry Castings by Autogenous Welding.** H. Gerbeaux (*Bull. Assoc. Tech. Fonderie*, 1933, 7, 1-15).—A discussion of this essential part of present-day foundry practice. The methods employed are illustrated by typical examples, and full details are given of the technique which is necessary in order to produce a good weld. Thermit, ordinary acetylene, and arc welding are the principal processes described. Photomicrographs of good welds are included to show that true penetration and union have occurred in the examples cited. A short section is devoted to brazing.—W. A. C. N.

**The Welding of High Nickel Alloys.** J. G. Schoener and F. G. Flocke (*J. Amer. Weld. Soc.*, 1932, 11, (11), 18-22).—Metallic arc welding of Monel metal, nickel, Inco chrome nickel, and nickel-clad steel is discussed. Covered electrodes are used with reversed polarity and the nature of the flux coating is extremely important. A heavy coating containing ferro-titanium is recommended.—H. W. G. H.

**Welding of Nickel and Nickel Alloys.** Herbert Herrmann (*Metallurgist (Suppl. to Engineer)*, 1933, 9, 30-32).—The welding of nickel is unfavourably affected by the "hot-short" range which exists at 800°-1050° C., and the capacity of the metal for absorbing gases, which leads to embrittlement. Oxygen is less injurious than sulphur, which separates at the crystal boundaries. Oxy-hydrogen is not practicable and oxy-acetylene is the only suitable autogenous process, the acetylene being necessarily pure. Adjustment of the character of the flame is important. Welding rods may be of nickel or alloy containing a deoxidizer. The effects of various deoxidizers and fluxes are discussed. The special fluxes for the purpose are based on borax-boric acid deoxidant mixtures and are applied as an alcohol paste. Methods of jiggling are discussed as well as various points of manipulation. Hammer welding of nickel is possible, although requiring much skill and attention to temperature and type of support for the welding. Careful cleaning before welding is essential. Nickel alloys behave similarly to nickel in welding, except nickel silvers, which more nearly resemble brass.—R. G.

**The Principles of Bronze-Welding.** A. R. Lytle (*J. Amer. Weld. Soc.*, 1932, 11, (12), 14-17).—The characteristics of bronze-welding rods and correct methods of use are described. Joints in ferrous metals are mainly considered. —H. W. G. H.

**Fundamental Research Problems in Welding.** Anon. (*J. Amer. Weld. Soc.*, 1932, 11, (12), 18-26).—A review, compiled by the Fundamental Research Committee of the American Bureau of Welding, of the more important problems requiring investigation and a list of researches already in progress. The Bureau is a joint research Board affiliated to the American Welding Society and the National Research Council. —H. W. G. H.

**Advances in Welding Technique.** Wolf von Bleichert (*Anz. Berg-, Hütten- u. Masch.*, 1933, 55, (34), 4-5).—A description of recent improvements in welding technique.—B. Bl.

**Welding Ferrous and Non-Ferrous Metals.** W. C. Freeman (*Found. Trade J.*, 1933, 48, 342).—Abstract of a paper (and discussion) read before the Midland Section of the Institute of Welding Engineers. Briefly describes the manufacture of acetylene for oxy-acetylene welding and the use of this process for the welding of copper, aluminium, and cast iron and for cutting metals.—J. H. W.

**Copper-Hydrogen Welding a Quantity-Production Process.** W. W. Anderson (*Iron Age*, 1933, 131, 538-539).—Copper-hydrogen welding is said to produce a joint stronger than the steel. The nature and applications of the process are outlined.—J. H. W.

**Welding Difficulties.** Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1933, 9, (11/12), 118-120).—A consideration of the oxy-acetylene welding of iron sheet, galvanized sheet, and special steels is followed by a review of the special difficulties presented by copper, lead, zinc, nickel, and Monel metal. Suitable fluxes, and adjustments of flame, are suggested, and the injurious nature of certain impurities is indicated. Some safety precautions are given. —P. M. C. R.

**Welding as a Maintenance Tool.** E. L. Quinn (*Blast Fur. and Steel Plant*, 1933, 21, (3), 161-164).—A general review of the application of the process, reference being made to non-ferrous metal technique. Stress is laid on the need for care in selecting the proper rod for the different materials. —R. Gr.

**Notes on Autogenous Welding.** Anon. (*Locomotive*, 1933, 39, 57-58).—A description of economical welding practice as carried out in the workshops of the New Zealand Government Railways.—P. M. C. R.

**Simple Tests for Identifying Metals.** Anon. (*Iron Age*, 1933, 132, facing p. 26).—A table showing methods of identifying ferrous alloys, copper, brass and bronze, aluminium and its alloys, Monel metal, nickel and lead by appearance and chip, spark and blowpipe tests. This table has been drawn up by the Linde Air Products Co., New York, to facilitate the identification of metals that are to be oxy-acetylene welded, particularly in maintenance work.—J. H. W.

**Recent Advances and Future Expectations of the Oxyacetylene Process.** James H. Critchett (*J. Amer. Weld. Soc.*, 1932, 11, (12), 8-9).—A review of modern developments and some prophecies for the future—blowpipes of greater thermal efficiency, applications to new alloys and to non-metallic materials, uses other than welding, such as localized heat-treatment. —H. W. G. H.

**Electric Welding or Autogenous Gas Welding?** Karl Tewes (*Anz. Berg-, Hütten- u. Masch.*, 1933, 55, (17), 20-22).—The advantages and disadvantages of these methods of welding are compared.—B. Bl.



**Acetylene from Cylinders or from Gas-Generators?** Anon. (*Anz. Berg-, Hütten- u. Masch.*, 1933, 55, (25), 4-5).—A comparison of the advantages and disadvantages of taking acetylene supplies from these sources with comparative cost data.—B. Bl.

**Determination of the Capacity of Acetylene Generators.** Michel Rochette de Lempdes (*Bull. Soc. Ing. Soudeurs*, 1932, 3, 739-750).—An exhaustive report presented by de L. on behalf of a Committee appointed by the Société des Ingénieurs Soudeurs. The particulars usually given by the makers—viz. maximum thickness of metal which can be welded and/or cut, number of blow-pipes which can be operated for a given time, and charge of carbide, are not sufficient to define the size and capacity of a generator. The Committee has accordingly examined the important factors and recommends a standard specification for generators; a standard name-plate giving the essential characteristics and bearing the official stamp of an authority independent of the manufacturers, and revision of the regulations for testing generators.

—H. W. G. H.

**Electric Welding—Arc and Resistance Welding.** International Congress of Electricity. Anon. (*Science et Industrie*, 1933, 17, 146).—An abstract of Report No. 10 (Section 12). Recent developments include the protected-arc method and the atomic hydrogen process. Automatic arc-welding machines are described and their extended applications in industry are reviewed.—P. M. C. R.

**Electric Double Spot Welding.** Anon. (*Maschinenkonstrukteur*, 1933, 66, 6-8).—The "double spot" welding machine described and illustrated is said to obviate certain disadvantages and limitations of the ordinary spot, arc, and autogenous welding processes. The side-by-side setting of the electrodes renders the machine especially suitable for the attachment of thin sheet to heavier structural members, as in aero work and some types of building construction. Overheating is avoided, and the adaptability of the installation enables it to be applied to large pieces and to the making of joints in parts which are difficult of access.—P. M. C. R.

**A New Welding Process.** John C. Arrowsmith (*Aircraft Eng., Workshop Prod. Section*, 1933, 5, (48), 9-10).—The Budd "Shot-weld" process is described, and advantages are claimed in uniformity of properties of the individual welds, automatic indication of the use of incorrect conditions of welding, and a permanent record of the electrical conditions employed in every weld. Results of shear tests on welds in a corrosion-resisting steel are given.—H. S.

**New Electrode for Welding Aluminium.** Anon. (*Power*, 1932, 75, 673).—See *J.*, this volume, p. 100.—F. J.

**Electric Welding.** R. Brennecke and A. Franke (*Anz. Berg-, Hütten- u. Masch.*, 1933, 55, (52), 3-4).—A short description of modern welding machines and apparatus as shown at the Electric Heat Exhibition in Essen.—B. Bl.

**Electrical Plant Auxiliaries: Electric Welding.** Anon. (*Fuel Economist*, 1933, 8, 613-615).—Types of welding sets are described and illustrated and economies that can be effected by electric welding as against replacement are briefly discussed. The selection of electrodes for special work is referred to.

—J. S. G. T.

**Sources of Supply for Electric Welding, Particularly D.C. Generators.** J. Berger (*Bull. Soc. Franç. Elect.*, 1931, 1, 856-878; *Sci. Abs.*, 1932, [B], 35, 23).—Graphical methods are used to determine the best characteristics for such machines, and the machines dealt with include the compound generator and the separately-excited machine, with lesser reference to the shunt-wound machine with and without separate excitation. Special generators are then considered in which the polar faces are split and a local short-circuited flux-path results, which modifies the normal armature reaction to produce a

constant current independently of the load circuit. Other machines with modified poles and short-circuiting brushes, including the Alsthom, are described, and oscillograms show some of the characteristics. Finally, a brief reference is made to the generation of 1-phase current for welding.—S. G.

## XXI.—INDUSTRIAL USES AND APPLICATIONS

(Continued from pp. 529-533.)

**Aluminium at the XIVth Exhibition, Milan.** Anon. (*Alluminio*, 1933, 2, 159-165).—An illustrated description of the exhibit.—G. G.

**Aluminium in the Cotton and Wool Industries.** John R. Whitelegg (*Textile Manufacturer*, 1933, 59, 241-241A, 282-283).—An illustrated article describing the uses and advantages of the aluminium alloys "2L5," "3L11," "Y," and Silumin in the manufactures of various pulleys, rollers, reels, and other parts of textile machinery where lightness combined with strength is required.

—A. R. P.

**Aluminium in the Equipment of Varnish Manufacturers.** C. Bianchi (*Alluminio*, 1933, 2, 90-97).—An illustrated article, in which all the possible uses of aluminium in the manufacture of varnishes and paints, boiling, cold solution, mixing, distillation, filtration, and transportation are discussed and demonstrated.—G. G.

**Demountable Walls for Power Plant Construction.** R. B. Horner (*Power Plant Eng.*, 1933, 37, 172).—The use of aluminium-clad sections in building construction is claimed to be economical in erection and replacement, and to give simple, durable, and weather-tight structures. A section illustrated consists of two 18-gauge aluminium sheets, between which is fixed rock-wool insulating material. Supports and attachments are made of aluminium.

—P. M. C. R.

**Use of Aluminium in Collieries.** T. R. Barnard (*Colliery Eng.*, 1933, 10, 233).—B. considers that aluminium and Duralumin should find more extended application in colliery work. He suggests the lightening of cages, conveyor pans, props, and bank-bars by the substitution of Duralumin for steel. Aluminium paint combines with high protective quality considerable reflecting power, involving a useful gain in underground illumination. Other uses are suggested.—P. M. C. R.

**A Tower 500 Metres High [in Aluminium Alloy].** M. Dornig (*Alluminio*, 1933, 2, 154-158).—An illustrated description.—G. G.

**The Use of Aluminium in Conductors of High-Voltage Electrical Lines.** Anon. (*Alluminio*, 1933, 2, 35-39).—Statistical. Germany has 27,034 km. of high-voltage lines, 10,185.1 km. of which are aluminium. Aldrey, or aluminium-steel and 130 km. bronze. In France there are 32,624 km. of conductors carrying more than 30 kv.; 22,723 km. of these are copper, 7388 km. pure aluminium, 2306 km. aluminium-steel, and 188 km. of Almelec-Aldrey. In Switzerland, of 7309.1 km. of electrical lines carrying over 30 kv. 4651.8 are copper, 32.5 bronze, and 2624.8 in aluminium, aluminium-steel, and Aldrey. In England (not including the Grid System), 7727 km. of the 9114 km. of old lines are aluminium-steel. In the United States (1929) there are 877 lines with 66,000 v. or more (38,000 km.), of which 350 are in aluminium-steel (22,500 km.). The use of aluminium conductors in the rural electrification of various districts (1931-1932) is very considerable. In Italy, of the 83,960 km. of high-voltage lines (31,266 with over 30 kv.) only 1091 km. are aluminium. Aldrey, or aluminium-steel, the remainder being copper.

—G. G.

**A Metal Tender for "Britannia."** Anon. (*Motor Boat*, 1933, 59, 17).—A description of a launch built for the Royal yacht "Britannia" which has been constructed almost entirely of MG7 alloy. The main structure is of angles



and plates of this material, and castings of the same alloy are used for the rudder, deck fittings, stern tube, and propeller. As a result of using this light alloy, the weight of the complete craft with its 10-20 h.p. engine has been kept down to 9 cwt.—J. W. D.

**Light Alloys Cut Weight.** Anon. (*Automotive Ind.*, 1933, 69, (3), 69-70).—A recent type of Diesel engine intended for commercial vehicles weighs 15.4 lb. per h.p., largely through the extensive use of light alloys. Magnesium alloy castings are used for sump and crank-case; the crank and piston pins bear directly on aluminium alloy rods. Pistons are of "Y" alloy.—P. M. C. R.

**More Aluminium Utilized to Increase Car Efficiency.** Anon. (*Daily Metal Reporter*, 1933, 33, (40), 5-6).—The use of aluminium cylinder heads in automobile work is steadily increasing. Reference is made to an address delivered by F. F. Kishline before the Society of Automotive Engineers in which the superiority of the aluminium over the cast-iron head is emphasized. —P. M. C. R.

**Light Alloy Body Construction.** Anon. (*Tram. and Rail. World*, 1933, 73, 143).—An account is given of the Burlingham system of body construction. Its principle is the adoption of unit sections, all parts being standardized and easily removable for repair or replacement. A standard aluminium-silicon alloy (Admiralty specification) is employed for cast parts; fillets, plating and edgings are of aluminium sheet, and for girders and other heavily strained members a strong forged light alloy is used. At no point do 2 metal surfaces touch, and no riveted structures are used: welded parts and welding instructions are greatly simplified.—P. M. C. R.

**Silumin Castings in the Motor Industry.** Anon. (*Automobiltech. Z.*, 1933, 36, 67-68).—The properties of Silumin are reviewed. Recently developed alloys of this class, Silumin- $\beta$  and Silumin- $\gamma$ , are described, and the properties of ordinary Silumin, copper-Silumin, Silumin- $\beta$ , and Silumin- $\gamma$ , the latter with and without special heat-treatment, are tabulated for both sand- and chill-castings.—P. M. C. R.

**An Aluminium Alloy Piston of Controlled Expansion.** Anon. (*Nickel Bulletin*, 1933, 6, 51-52).—To overcome the large thermal expansion of aluminium alloys for use as piston heads, the alloy is poured into a die in which has been inserted a bridge of low-expansion alloy containing nickel. The bridge is thus securely keyed into position, and serves as a gudgeon pin bearing and prevents undue radial expansion of the piston-head when the metal becomes hot.—J. H. W.

**First Power-Driven Railway Coach with All-Aluminium Body.** Anon. (*Machinery (N.Y.)*, 1933, 39, 673-674).—A brief illustrated account is given of the construction of the "Autotram" railway coach.—J. C. C.

**Light Alloys Help Make Possible the Autotram, Latest Development in Railway Cars.** Anon. (*Met. Ind. (N.Y.)*, 1933, 31, 135).—A petrol-driven railway car with seats for 42 persons and capable of 70 m.p.h. has just been built in America; all the superstructure and the wheels are made of aluminium alloys, and the whole is mounted on steel bogies. The car is stated to be 18,000 lb. lighter than a similar steel car would be.—A. R. P.

**On Duralumin in Means of Communication (Automobiles, Aeroplanes, and Airships).** — Arnzen (*Aluminium*, 1933, 15, (3), 1-4).—A review of the uses of aluminium alloys in vehicles driven by internal-combustion engines. —A. R. P.

**Calculations for Duralumin Constructions.** M. Pubellier (*Arts et Métiers*, 1933, 86, 213-230).—A large number of data and formulæ commonly used in structural work have been collected and adapted for the use of Duralumin constructions.—J. H. W.

**Aluminium-Magnesium Mirrors.** Hiram W. Edwards (*Phys. Rev.*, 1933, [ii], 43, 205).—A note. Mirrors were prepared by evaporating a mixture

of aluminium and magnesium in a vacuum, and were deposited on glass. They reflected from 93 to 94% of red, green, and blue light incident at  $10^\circ$ , whilst a silver mirror gave values of 95% and 85% for red and blue light, respectively, so that the aluminium-magnesium mirror has a great advantage when used with short wave-lengths.—W. H. R.

**Evaporation Technique for Aluminium [Preparation of Aluminium Mirrors].** John Strong (*Phys. Rev.*, 1933, [ii], 43, 498).—A note. Mirrors made by evaporating aluminium are superior to those of silver as regards permanency, inertness to corrosive agents, adherence to glass, and reflectivity in the ultra-violet. Methods are described for volatilizing aluminium by means of a tungsten helix.—W. H. R.

**Tests for Aluminium Foil from the Viewpoint of its Suitability as a Wrapping Material for Cut Bread.** K. Seidel (*Z. Unters. Lebensm.*, 1933, 65, 104-106; *Brit. Chem. Abs.*, 1933, [B], 310).—Solubilities in 100 c.c. of 0.25*N*- and 0.5*N*-acetic acid, 0.25*N*- and 0.5*N*-lactic acid, 0.25*N*-phosphoric acid, and an aqueous extract of pumpnickel are recorded after 3 days at  $20^\circ\text{C}$ . A satisfactory specimen (100 mg.) lost 0, 10, 2.8, 4.5, 135.3, and 0 mg./100 cm.<sup>2</sup>, respectively.—S. G.

**Thermal Insulation with Aluminium Foil.** Ralph B. Mason (*Indust. and Eng. Chem.*, 1933, 25, 245-255).—One method of using aluminium foil for insulation is to provide a framework which supports the foil and forms a series of air-cells between the foil surfaces; the other is first to crumple the foil and then partly stretch it so that the resulting wrinkles separate the sheets when laid against each other and provide the necessary air cells. The results of an extensive investigation of the efficiency of different types of insulation are described. Distances of  $\frac{1}{4}$  in. between foils of the plain air-cell type gave the highest resistance to heat-flow. Insulations with corrugated separators were slightly inferior to the plain air-cell type. Crumpled foil insulations were slightly inferior to the corrugated structures. By using the minimum amount of separator material of high thermal resistance the foil insulation of the air-cell type can be made to approximate the thermal resistance of quiet air, i.e. to eliminate practically all the heat ordinarily transmitted by radiation. The secret lies in the low thermal emissivity of the bright aluminium surface.—F. J.

**Paints Wet Surfaces.** Anon. (*Eng. and Min. J.*, 1933, 134, 125).—A note on the aluminium paint known as Triple-A No. 44 Aluminium Vehicle, consisting of aluminium powder in a black vehicle made from coal tar. The naphtha vehicle displaces any water on the metal surface and penetrates rust, giving a good protective coating.—R. Gr.

**Heat-Resisting Coatings on Metallic Surfaces.** Anon. (*Maschinenkonstrukteur*, 1933, 66, (9/10), 72).—Aluminium powder affords efficient protection to metallic surfaces when applied in suspension in a suitable vehicle; the choice of the latter is limited by service conditions, shellac, copal, and nitro-cellulose proving unsatisfactory. Certain synthetic products, e.g. the condensation product of glycerin and phthalic acid, afford a sufficiently resistant medium. On heating, the organic portion is eliminated without blackening or gumming, leaving an evenly-distributed coating of metallic powder. Although aluminium powder finds the widest application, other metals can be used in the same way.—P. M. C. R.

**Aluminium Primer.** [I.—] Durability of Paint on Longleaf and Shortleaf Pine. F. L. Browne; [II.—] Why Mill Prime? R. I. Wray; [III.—] Mill Priming and Trade Promotion. J. F. Carter (*Southern Lumberman*, 1933, Feb. 1, and (abstract) *Aluminium Broadcast*, 1933, 4, (7), 25-28).—References are made to the use and advantages of aluminium paint as a priming coat.

—J. C. C.



**1932 Aluminium Output Off from 1931 Level.** Anon. (*Daily Metal Reporter*, 1933, 33, (47), 1, 6).—The 1932 production of new aluminium in the U.S.A. amounted to 104,885,000 lb., as against 177,544,000 lb. in 1931. Certain branches of the industry, however, show an increase, notably in constructional work and in aircraft.—P. M. C. R.

**Welded Alloy Bucket Lips Cut Trenching Costs [Stellite].** George Sykes (*Eng. News Record*, 1933, 110, 215).—In a ladder-type trench excavator, digging teeth hard-surfaced with a cobalt-chromium-tungsten alloy (Stellite) were capable of further work after digging 28,000 ft. of trench. Steel teeth needed replacing after digging 2000 ft.—J. C. C.

**Report of Committee B-5 [of A.S.T.M.] on Copper and Copper Alloys, Cast and Wrought.** C. H. Mathewson and D. K. Crampton (*Amer. Soc. Test. Mat. Preprint*, 1933, 1-6).—Numerous modifications in certain existing standards—especially for composition brass or ounce metal sand-castings, and for yellow brass sand-castings—are given. In general, they indicate a tightening up of the specification limits. Certain other alterations in tentative standards for copper tubing, condenser tubes in general, copper bars and plates for locomotive fireboxes, and brass piping are recommended.—W. N.

**What to Look For in Selecting [Telephone] Cords.** J. D. Williams (*Telephone Eng.*, 1933, 37, (2), 13, 22).—Solid copper wires were the first type used for telephone cords, but they rapidly became brittle. The fine tinsel type followed, but the resistance increased rapidly with wear and the life was short. Thin copper ribbon was next tried, but crystallization caused brittleness and increased resistance. Steel-cored cords were found to be somewhat too inflexible. Finally, a bronze alloy of which the resistance remained constant despite repeated flexure was developed. Two layers of 0.001 in. thick ribbon are spiralled over a cotton thread, and six of the resulting strands are formed into a rope; the outer insulation is then added.—H. F. G.

**The Manufacture of Cocks and Taps—The Use of Cupriferous Metals in this Industry.** A. Chaplet (*Cuivre et Laiton*, 1933, 6, 57-68, 111-118).—An exceedingly clear and fully illustrated description of the main types of taps and valves used for domestic and industrial purposes. The article is divided into 3 sections dealing respectively with: (1) barrel taps and those of the ordinary domestic variety; (2) plug valves, and (3) sluice valves. Single and multiple way taps are included in the three classes. Details of construction are given in the majority of the examples quoted.—W. A. C. N.

**El Paso Replaces Rustable Service Pipes with Copper.** Anon. (*Daily Metal Reporter*, 1933, 33, (29), 3).—The low price of copper has enabled the Waterworks Department of El Paso, Texas, U.S.A., to replace worn iron service pipes by copper piping. So far about one third have been thus replaced. It is stated that the iron pipes last from 2 to 15 years, according to the type of soil, but that in the Department's opinion the copper piping should need no replacements for about 100 years.—P. M. C. R.

**Merimet Copper-Fabric Material Developed for Automobile Roofs.** Anon. (*Automotive Ind.*, 1933, 38, 192).—Merimet, a new material for automobile roofing, consists of thin copper sheet, a special adhesive of great flexibility being used to attach it to strong waterproofed cotton fabric. Decorative finishes are easily applied, and the material is said to have high wearing qualities and to be free from warping with variations of temperature.—P. R.

**Use of Lead and Copper Service Pipes.** Anon. (*Public Works*, 1931, 62, (10), 20; *Public Health Eng. Abs.*, 1932, 12, W, 1).—Gives a summary of the replies received to questions: "How many lead services have you in use?" "How many copper?", which were included in a questionnaire sent to water works engineers. Of the 663 cities which replied, 310 use lead and 251 use copper service pipes. Of those using copper, all but 64 have lead service pipes in use also.—S. G.

**Absorption of Lead by Tooth-Pastes from Tinned-Lead Tubes.** V. Frobose (*Z. Unters. Lebensm.*, 1933, **65**, 176-181; *Brit. Chem. Abs.*, 1933, [B], 334).—The quantities found in the paste ranged from 0.5 to 37 mg. of tin per 100 grm. and 0.1-8 of lead at the time of purchase, and increased to 139 and 3.1, respectively, after up to 12 weeks' storage. Storage for periods up to 4 years produced increases (up to 357 and 2.8, respectively), decreases, and no change in the tin and lead contents, and the amounts found appear to bear no definite relation to the reaction or  $\Lambda$  of the paste. A suitable lead content for the tubes is  $\approx 1\%$ , and the tin coating usually corresponds to 0.12 grm. per 100 cm.<sup>2</sup>.—S. G.

**General Electric Receives Large Mercury Shipment for Generating Power.** Anon. (*Blast Fur. and Steel Plant*, 1933, **21**, 27).—A note. 540,000 lb. of mercury will be used in the new 20,000-kw. mercury turbine at the Kearney power station, New Jersey. The total order represented 89% of the mercury consumed in the U.S.A. in an average year.—R. Gr.

**Nickel-Chromium Alloy [Cronite] Furnace Bars.** Anon. (*Nickel Bull.*, 1933, **6**, 1).—Furnace bars made of modified Cronite, after being subjected to a year's more or less continuous exposure to washed producer gas containing sulphur at a working temperature of 1000° C., were almost indistinguishable from new.—J. H. W.

**Heat-Resisting Metals in the Pottery Industry.** J. Ferdinand Kayser (*Pottery Gaz.*, 1932, **57**, 1493-1494; *Ceram. Abs.*, 1933, **12**, 69).—To meet the variable needs in the pottery industry a number of different heat-resisting alloys have been developed, each having its own special characteristics. The most essential characteristic was surface stability at high temperatures, which was comparatively easy to attain. Various uses of heat-resisting alloys in the vitreous enamelling industry, the pottery industry, the glass industry, and in metal recuperators are listed.—S. G.

**The New "Zinkan" Sheet in Automobile, Motor, and Aero Construction.** J. F. Kesper (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1933, **9**, 129-131).—Zinc sheet containing a small admixture of aluminium is rolled together with aluminium sheet, and subsequently aluminium-plated. The product is said to resist corrosion by water, dry and moist air, carbon dioxide, hydrogen sulphide, smoke, soot, and many organic acids. It is further claimed that Zinkan retains its bright appearance for a long time. Mechanical properties are given for 3 qualities of the material; an elongation of 40-65% is claimed for the "normal" or softest quality. The material can therefore be easily drawn and shaped. Heat-treatment at 150°-300° C. causes migration of aluminium into the zinc, with marked hardening and strengthening effects. Zinkan is very light, and may be expected to replace copper, aluminium, nickel, and brass sheet for many purposes. Many possible applications are suggested.—P. M. C. R.

**Zinc-Base Alloy Die-Castings Find Steadily Widening Field of Automotive Application.** Joseph Geschelin (*Automotive Ind.*, 1933, **69**, 72-75).—The adoption of die-castings in automobile construction has led to economy, due to lessening or elimination of finishing and machining, the replacement of expensive fabrication by inexpensive dies, the possibility of producing intricate forms, and to the possibility of obtaining simple design, uniform structure, and thin sections. Some uses of zinc-base die-castings are tabulated, as are the effects of normal ageing on certain important physical properties of Zamak alloys. The impact strength, tensile strength, and elongation of these alloys are compared in a table with those of sand-cast malleable iron, sand-cast brass, and die-cast aluminium alloys (type not stated). Lines of further investigation are indicated.—P. M. C. R.

**Zinc-Nickel Accumulator.** Anon. (*Automobiltech. Z.*, 1933, **35**, 519).—The accumulator described has an e.m.f. of 1.9 v., as against the 1.3 v.



developed by the nickel-iron cell. The negative plates consist of a specially-treated grid of nickel or Monel metal, while the positive plates have nickel oxide and silver oxide as active materials.—P. M. C. R.

**Zinc in Dry Batteries.** R. Gould (*Met. Ind. (Lond.)*, 1933, 43, 104).—A short letter commenting on an abstract (*ibid.*, 1933, 42, 659) of an article in *Z. Metallkunde*, 1931, 23, 301. See this *J.*, 1932, 50, 435.—J. H. W.

**Non-Ferrous Metals in the Limelight.** Anon. (*Iron Age*, 1933, 131, 45-46).—The properties and applications of new alloys and new methods of heat-treating non-ferrous metals adopted during the past year are briefly described. —J. H. W.

**Sintering.** Anon. (*Metallurgist (Suppt. to Engineer)*, 1933, 9, 2-3).—The characteristic features of sintered metals are discussed. Although the process has disadvantages, its development may in the future enable the metallurgist to meet demands difficult to satisfy by melted products.—R. G.

**Contact Metals and Contact Care.** P. Mabb (*Met. Ind. (Lond.)*, 1933, 43, 3-5).—For the high qualities required of contact metals, only rare metal alloys and tungsten alloys have been successfully used. Platinum is hardened and its corrosion-resistance is increased by the addition of iridium or, where economy is required, palladium. The composition, specific properties and applications of the principal contact alloys of platinum, iridium, palladium, copper, silver, gold, tungsten, and nickel and cobalt are given.—J. H. W.

**Metallic Contamination of Beverages.** Anon. (*Bottler and Packer*, 1933, 7, (3), 30-32).—Where cost permits, it is thought that stainless steel should be used for syrup and carbonating equipment. Tinned copper and gun-metal are the most popular materials in use, and give satisfactory service until the tin is worn or corroded away. Electrolytic tinning is unsatisfactory. Nickel is useful for making filter gauzes which may be subject to the action of hot tartaric acid. Good quality glass enamel is considered satisfactory, but requires care in use. Earthenware often contains pits which are difficult to clean. Care must be exercised in the use of cleansers for metal equipment; chlorine solutions, for example, being very corrosive to most metals. Bisulphite of soda cannot be used to clean and sterilize metal vessels, "as, being a fairly strong acid, it attacks practically all metal, particularly copper and its alloys."—H. W. G. H.

**Effect of Metal in Mixing Bread Doughs.** E. N. Frank (*Cereal Chem.*, 1932, 9, 636-637; *Brit. Chem. Abs.*, 1933, [B], 168).—Doughs prepared in a bronze mechanical mixer gave loaf volumes up to 40 c.c. lower than those obtained by hand-mixing, the actual decrease increasing with the period of contact between metal and dough.—S. G.

**Suitability of Metals, Alloys, &c., for Varnish-Kettle Manufacture.** J. Sommer (*Farben-Zeit.*, 1933, 38, 420-427; *Brit. Chem. Abs.*, 1933, [B], 198).—The properties of a range of materials are tabulated under the headings: price, durability, influence on colour of varnish, ease of cleaning, heat-transference. Separate data relating to suitability for kettle bottoms and bodies are collectively evaluated; it is shown that a Monel metal body and tin-plated steel bottom is the best combination, whilst a copper body and aluminium bottom is the worst.—S. G.

**What the School of Experience Has Taught a Dye Plant Operator About Construction Materials.** Anon. (*Chem. and Met. Eng.*, 1933, 40, 62).—Numerous corrosion problems are encountered in dye plants and the equipment is subject to a range of conditions so wide that almost every known material of construction finds application. The more outstanding applications are reviewed. "Aluminium-bronzes" and manganese-brasses are next to cast iron in general utility value. The former give excellent service in both sulphuric and hydrochloric acid processes. An instance is given of experimentation leading to the adoption of an alloy consisting of copper 88,

aluminium 10, iron 2%, which saved \$3800 per annum in the department in which cast iron had formerly been used. Copper-nickel, nickel-chromium, and nickel-molybdenum alloys have special merits but their high cost precludes their general application.—F. J.

**Service Pipes of Various Materials.** R. W. Reynolds (*J. Amer. Water Works Assoc.*, 1931, 23, 658-663; discussion, 663-672).—Measurements were made at four or more velocities, of the friction losses in pipes of cement-lined and unlined galvanized pipes, copper tubing, and unlined iron pipes for bores varying from  $\frac{3}{4}$  to 2 in. Test lengths of 19 ft. were used. Taking into account that the copper tubing was usually under nominal bore and the iron pipe oversize, copper tubing is considered to show lowest friction losses. Losses increase considerably in iron pipes after service. In the discussion, it is emphasized that character of water and soil must influence the choice of pipe material for any given locality.—J. C. C.

**Service Pipe Material and Practice in the United States and Canada.** James E. Gibson (*J. Amer. Water Works Assoc.*, 1931, 23, 1435-1454; discussion, 1454-1460).—A questionnaire concerning service pipe material and practice, drafted by Subcommittee 7-F of the Water Works Practice Committee was answered by 255 out of 463 water departments in the United States and Canada. For service pipe material, 49% reported good experience with copper tubing, 40% with lead, 25% with galvanized wrought iron, and 15% with galvanized steel. In the case of copper tubing no users reported unsatisfactory results, lead pipe was found fair by 5% and poor by 3%, and galvanized steel was found fair by 11% and poor by 7%. Troubles from tuberculation and incrustation were overcome by substituting lead or copper pipe (presumably for iron) in 44% of the cases. Only one reply reported known lead poisoning and 93% answered positively that no lead poisoning was encountered. As the ideal material for service pipes, 49% favoured copper, 23% lead, and 13% galvanized iron.—J. C. C.

**Use of Non-Ferrous Service Pipes at Present Prices.** George W. Pracy. J. E. Gibson. S. B. Morris. H. F. Blomquist. T. H. Wiggin. — Hibbs (*J. Amer. Water Works Assoc.*, 1932, 24, 1819-1828; corrigenda, 1933, 25, 444).—A report of a Superintendents' Round Table Discussion at the Memphis Convention, 1932. In San Francisco, copper service tubes are used in heavy soils, which are most corrosive. Galvanized steel is used in lighter soils which permit the pipe to be driven through. It is emphasized that no one material can be universally adopted. Electrolytic action between iron and copper tubing, imperfect annealing of copper tubes, and corrosion embrittlement of brass, are briefly discussed.—J. C. C.

**Dissertation on Non-Ferrous Metals Used for Power Plant Piping.** Henry C. Moffett (*Power Plant Eng.*, 1933, 37, 208-210).—The properties and special applications of tubing made of copper, lead, tin, zinc, aluminium, nickel, various brasses and bronzes, copper-nickel alloys and "packing" alloys are enumerated.—P. M. C. R.

**Sludge Pumps.** G. Sire (*Science et Industrie*, 1933, 17, 227-230).—The materials, construction, and maintenance of centrifugal pumps intended for the handling of sludges and pastes are reviewed. Appropriate modifications are described for special service conditions, e.g. the pumping of highly acid or markedly abrasive materials.—P. M. C. R.

**The Present Position of Airship-Construction, Especially of Framework Construction.** Hans Ebner (*Z. Flug. u. Motor.*, 1933, 24, 331-341).—A fully illustrated survey of the framework of recently constructed airships is followed by a discussion of constructional elements. Materials are reviewed, and the mechanical properties of some Duralumins used in recent assemblies are tabulated, and compared with those of "DM31," a new alloy of the Duralumin class with exceptional resistance to corrosion. The questions of



loading and of the relative weights of various portions are considered in the concluding sections.—P. M. C. R.

**All-Metal Planes.** R. E. Johnson (*Metal Progress*, 1933, 24, (1), 41-43).—Aluminium sheet, bronze, Duralumin, and cadmium-plated alloy steel are used in the production of a standard all-metal plane. All main parts are interchangeable with the corresponding portions of another plane; bolted joints are adopted where interchangeable units are used. Sheet-metal work becomes of the first importance. Increased cheapness and extreme rapidity of output and in repair are claimed.—P. M. C. R.

**The Metallurgists' Contribution to Automotive Development.** P. M. Heldt (*Automotive Ind.*, 1933, 69, 64-68).—A review of developments in ferrous materials is followed by sections which review the manufacture and properties of zinc die-casting alloys, light alloy pistons, and aluminium and magnesium body-work and casings.—P. M. C. R.

**Process Industries as Purveyors to the Motor Car.** T. A. Boyd (*Chem. and Met. Eng.*, 1933, 40, 15-17).—The U.S. motor-car industry has been the largest consumer of nickel, and of lead. It has also been a very large user of aluminium, copper, tin, and zinc. The basic chemical and metallurgical products used in the industry are tabulated, but the list, although large, is not complete. The quantities of metals and other materials used in making, repairing, and operating motor-cars during the years 1927 to 1931 inclusive and the percentages of the total production of each, which the motor-car industry has absorbed, are also tabulated. The demand for cheaper light metals and better rustproofing methods is stressed.—F. J.

**Recent Developments in the Design of Tank Wagons.** Roderick Hedley (*Locomotive*, 1933, 39, 45-46).—Recent types of container are described, with details as to dimensions, capacity, tare weight, and paying load. For such liquids as formaldehyde, aluminium containers must be used: the sheet, of chemical purity not less than 99.5%, being rolled to  $\frac{1}{16}$  in. thick, pickled and subsequently welded. Corrosion due to contact with iron parts is eliminated by protective paint and by the insertion of webbing.—P. M. C. R.

## XXII.—MISCELLANEOUS

(Continued from pp. 533-533.)

**British N.F. Metals Research Association. Researches in Hand.** ——— (*Met. Ind. (Lond.)*, 1933, 43, 9-11).—Details of individual researches in progress, taken from the Annual Report of the British Non-Ferrous Metals Research Association.—J. H. W.

**Engineering Research at Michigan.** A. E. Whitto (*Metal Progress*, 1933, 23, (3), 33-36).—The development and present activities of the Department of Engineering Research of the University of Michigan are described and illustrated.—P. M. C. R.

**Recent Progress in the Technique of Copper Production.** M. Altmayer (*Cuivre et Laiton*, 1933, 5, 227-230, 255-258).—A summary of modern practice exemplified by references to plants in different countries of the world. The introduction of flotation methods has caused the development of more efficient and more economical reverberatory smelting. The fine material is charged into the reverberatory while still containing up to 15% of moisture. Full details of the process employed at Anaconda are given. Finely-pulverized coal is now used for firing purposes, and the results obtained are compared with those previously recorded for coal, gas, and oil. A description is next given of the basic converter practice at Messina.—W. A. C. N.

**Field for Non-Ferrous Metals is Broadened by Research.** Anon. (*Machinery (N.Y.)*, 1933, 39, 388-390).—A review of some recently developed alloys.—J. C.

New Inventions [in the Non-Ferrous Metal Industry]. E. S. Gurevich and S. S. Gurevich (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, 99-100; *C. Abs.*, 1933, 27, 3688).—[In Russian.] Lists some abstracts of pending patents of Russian inventions.—S. G.

Electric Power Consumption in the [U.S.S.R.] Metal Industry. N. P. Aseev (*Zvetnye Metally (The Non-Ferrous Metals)*, 1932, 377-386; *C. Abs.*, 1933, 27, 3902).—[In Russian.] In connection with the second 5-year plan a study was made of the requirements in electrical energy for the production of non-ferrous metals. Interesting figures are given for the consumption of electrical energy for several common metals, in terms of kw.-hrs. per ton of metal produced, and also total energy consumption for the entire world output of the common metals in 1929.—S. G.

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[This volume of the Encyclopædia Series contains the standards and specifications for metals and metal products prepared by more than 80 nationally-recognized organizations. It reproduces all available nationally-recognized specifications for such commodities as are embraced within the numerical classification designations 600-699. In the National Directory of Commodity Specifications. This volume includes: (1) Either in full or by suitable abstract, tabulation, or cross reference, more than 1600 nationally-recognized standards and specifications, covering both ferrous and non-ferrous metals and their manufacture, except machinery, vehicles, and electrical supplies. (2) Methods of testing, chemical analyses, metallic coatings, and heat-treatment of metals in considerable detail. (3) Some 2000 cross-references to demonstrate the close relationship existing among the specifications assigned to the metals. (4) An extended index of approximately 3500 items containing all references to any metallic commodity referred to in these 1000 specifications, so that comparisons may readily be made between the specification require-

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#### THESES

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## XXIV.—BOOK REVIEWS

(Continued from pp. 540-544.)

**An Engineer's Outlook.** By Sir Alfred Ewing. Cr. 8vo. Pp. xxiv + 333, with portrait and 5 illustrations. 1933. London: Methuen & Co., Ltd. (8s. 6d.)

This is a book that positively cannot be reviewed at a glance: it is too fascinating. It has held my interest from its first to its last page; it is one of the few books of general interest that have come my way which have been well worth writing and well worth reading.

Sir Alfred Ewing in an autobiographical preface states that his friend E. V. Lucas, when undertaking to publish the volume, remarked: "It will be your monument." One can desire no better. The contents of the book consist principally of addresses delivered by Sir Alfred on a variety of occasions. What a privilege and pleasure it must have been to have been present on the occasions of their delivery! The next best thing is to have the addresses easily available, and here they are. I recommend them whole-heartedly to the attention of metallurgists, engineers, physicists, and the intelligent public generally, not excluding politicians, who, too frequently, appear to be completely ignorant of the contribution of scientific workers to the advance of civilization. Here they will find set out a short review of the long pageant of discovery and invention, an account of the work of Lord Kelvin in telegraphy and navigation, the work of Parsons in the invention and development of the steam turbine. Here, too, will be found reminiscences of Lord Balfour, of Fleming Jenkin, and, last but not least, of Robert Louis Stevenson. The whole is written in a beautiful style which is not generally anticipated from a scientific author. Our author, however, has "something the others haven't got"—he was a friend of the Stevensons, and that, I think, will explain the fascination which I have found in the book. It is crammed with epigrams. Let this one suffice by way of example: "All the visual signals that have been used from the day when Eve first smiled to Adam are examples of magnetic wave telegraphy, though I cannot claim them as fruits of magnetic research." There is an amusing reminiscence of the author and Sir Frederick Bramwell travelling in a "growler," the bottom of which fell out, depositing the two distinguished engineers in the road! I have said enough, I hope, to whet your appetites for more.

I would like, in conclusion, to refer to Sir Alfred's opinion, which runs as a *leit-motif* through the book, that the gifts of the engineer to mankind are good gifts only if they are used with wisdom. How often is this forgotten? The work is certain to have a wide circulation; it deserves to be a best-seller.—J. S. G. THOMAS.

**Der Einfluss der Korrosion auf die Drehschwingungsfestigkeit von Stählen und Nichtisenmetallen.** Von Theodor Dusold (Mitteilungen des Wöhler-Instituts, Braunschweig, Heft 14). Demy 8vo. Pp. iv + 89, with 36 illustrations. 1933. Berlin: N.E.M. Verlag G.m.b.H.

Dr. Dusold's little book contains an instructive account of experiments recently carried out at the Wöhler-Institut at Braunschweig on the resistance towards alternating torsion of ten materials, including nickel, aluminium, Pantol, and various steels. The alternating-stress strength was tested both in air and in Braunschweig water. With one exception ("Nitrierstahl") the strength was lower under the wet conditions, but a process of surface pressure is described which was found to increase the strength shown under wet conditions to a figure similar to that obtained from air-tested specimens not subjected to the surface treatment; the beneficial effect of the pressure is attributed to the removal of surface defects which constitute the starting places of corrosion. The strength of the materials when tested in air was, with one exception, considerably increased by the same type of treatment. The detrimental effect of corrosion could also be overcome to some extent by electrochemical protection, using a zinc anode and current from an external source; the protection (which the author seems to regard as due to a film of metallic zinc) takes time to develop. Sulphur derived from rubber connections used in the water-jacketing was found to accelerate the attack. The latter part of the book is devoted to mechanical matters, such as the damping of oscillations.

The experiments are described in an interesting manner, and the tables of results deserve careful study from all engaged in research on corrosion-fatigue. The description is illustrated by numerous photographs showing the various types of fracture, the nature of typical corroded surfaces, and the curious four-rayed rust-stars noted by McAdam in one of his earlier papers; this paper by McAdam is the only representative of non-German work in the list of 13 references given at the end of the book.—U. R. EVANS.

**Gmelins Handbuch der anorganischen Chemie.** Herausgegeben von der Deutschen Chemischen Gesellschaft. Achte völlig neu bearbeitete Auflage. System-Nummer 35. Aluminium. Teil B.—Lieferung 1. Sup. Roy. 8vo. Pp. 308, with 10 illustrations. 1933. Berlin: Verlag Chemie G.m.b.H. (R.M. 48; subscription price R.M. 42.)

The present section of Gmelins' *Handbuch* deals with the preparation, properties, and general relationships of the compounds of aluminium. The treatment follows the lines adopted, with such happy results, in the volumes which have already appeared. Among the features which call for special notice we may direct attention to the following. The various commercial methods for the production of pure alumina from natural material are fully described and discussed. Under the heading of aluminium chloride, a large number of compounds of this substance with organic compounds is included. The commercial preparation of aluminium sulphate is fully described. An unusual, but none the less welcome, fact is the inclusion of a number of aluminium salts of organic acids.

The section is in every respect an excellent one, the work of compilation has been carried out with care and discretion, the book is not over-weighted in any particular part, and it contains much valuable and useful material of the kind which ought to be included in works like this, but which is not generally included. The book is thoroughly up to date and accurate. It is a volume which must find a place in every chemical library.—JAMES F. SPENCER.

**Iron and Steel (A Pocket Encyclopædia), Including Allied Industries and Sciences.** By Hugh P. Tiemann. With an Introduction by Henry Marion Howe. Third edition. Pp. xviii + 590, with 67 illustrations. 1933. New York: McGraw-Hill Book Co., Inc. (\$4.00); London: McGraw-Hill Publishing Co., Ltd. (24s. net).

This pocket encyclopædia of iron and steel, which includes allied industries and sciences, is now issued in its third edition. In the thirteen years which have elapsed since the appearance of the second edition there have been many improvements in processes, largely due to better equipment and technique and marked advances in metallurgical science. Advances which might be instanced are the developments in the manufacture and uses of stainless and heat-resisting steels, nitriding, advances in metallography, the application of the X-rays to metallurgy, and the protection of metals against corrosion. To keep in touch with these advances and with the various investigations and researches, which are increasing yearly, is a task which is becoming more difficult to all metallurgists and users of both ferrous and non-ferrous materials.

The present edition should, therefore, be of considerable value, for not only is it a metallurgical encyclopædia as formerly, but it has also been brought up to date by the addition of special articles dealing with the advances referred to.

The non-ferrous metallurgist will find particular interest in the articles on corrosion, where the various theories are discussed at considerable length; on crystallography, in which are discussed the various crystal systems, the space lattice theory, cleavage, twinning, and crystalline structure; on electric melting, to which 12 pages are given and which deals with various types of electric furnaces; on heat-treatment; on metallography; on the protection of metals, where reference is made to protection by metal coatings, spraying, and electroplating; on refractories (5 pages); on the various methods of testing (20 pages); on welding; and on the use of the X-rays in studying the crystal structure of metals.

The volume also contains interesting articles on heat, including pyrometry, and on the physical properties of metals, as well as various definitions and phrases which are of considerable interest to the non-ferrous as well as to the ferrous metallurgist.

The book is well cross-indexed, which is important in an encyclopædia which is to be of value, and it can be recommended as being extremely useful and up to date.

—J. W. DONALDSON.

**The Metals, Their Alloys, Amalgams and Compounds.** By A. Frederick Collins. Cr. 8vo. Pp. ix + 310, with 54 figures in the text. 1932. New York and London: D. Appleton and Co. (7s. 6d. net.)

This is intended to be a "popular handbook on the metals for the layman and student," according to the publisher's claim on the dust-cover: it is "written simply and lucidly, . . . gives the complete story of the World's metals, . . . is a great reference book in itself, . . . is of truly encyclopædic character, . . . entertaining to read, instructive to study and of great value to anyone engaged in metal work." A careful perusal of the book leads one to conclude that the only claim which is really substantiated is that relating to its entertainment value. It is certainly written in simple language, but many of the statements made are the reverse of lucid; as a work of reference for students and those engaged in metal work its value is practically nil, since the large number of erroneous and misleading statements it contains serve



simply to confuse the reader. In many places the author seems to have allowed his imagination to run away with his discretion; this is especially true of the historical and ore metallurgy sections, which contain many absurd statements. The articles on the extraction of copper, lead, nickel, antimony, gold, silver, arsenic, and most of the rarer metals from their ores display an abysmal ignorance of the reactions involved and of modern methods of metallurgy. In the chapters on alloys and amalgams brief notes of the composition and uses of some of the more important alloys are given, but even these are not always correct, despite the numerous text-books on the subject which the author could have consulted to check his information. Thus aluminium bronze is said to have a beautiful golden colour, and "when powdered and mixed with oil makes a very fine silvery-white paint;" tungsten bronze is said to consist of 90 per cent. copper and 10 per cent. tungsten; gold amalgam is stated to be made by melting powdered gold and stirring in mercury with an iron rod; steel is defined as "iron that has various higher percentages of carbon in it than cast iron," and aluminium-silver alloy is stated to consist of 84.20 per cent. of aluminium, 10.20 per cent. of tin, 5.50 per cent. of copper, and 0.01 per cent. of phosphorus, the copper and tin being added "to give it enough weight so that it approximates that of silver." There is a chapter on the hypothetical metals; these are divided into three classes, viz. true hypothetical metals, pseudo-hypothetical metals, and mythical hypothetical metals.

There are numerous errors in the formulæ given throughout the book and many names of minerals, &c., are incorrectly spelt. Some of the numerical data are entirely wrong, especially in the section on cobalt; thus skutterudite is formulated as  $\text{CoAs}_3$ , and its cobalt content is given as 68.2 per cent.; the density of cobalt is given as 85.89 and its atomic weight as 58.94. The illustrations are on the whole very crude, and in some cases ludicrous; thus, that representing the discovery of copper shows two Ancient Britons apparently sharing their lunch (!), and that of a pyrophoric gas lighter shows sparks arising from friction between hard steel and pyrophoric acid (sic).

To sum up, this book is of little technical value, but its perusal has afforded us several hours of quiet amusement.—A. R. POWELL.

**Enquiry into the Manufacture of Gold-Filled Spectacles.** 4to. Pp. 31, with 26 illustrations. 1932. London: The Joint Council of Qualified Opticians, Clifford's Inn Hall, Fleet St., E.C.4.

This report is the result of attempts made by the J.C.Q.O. to standardize qualities of rolled gold spectacle frames for the purposes of supplying contributors under the Insurance Acts with uniform grades of spectacles at minimum cost. The enquiry on which the report is based led to the disclosure that the quality, grade and description of rolled-gold frames differed markedly according to the manufacturer, and the J.C.Q.O. therefore has put forward a series of suggestions for standard qualities and for testing the quality of the finished frames. The report contains a brief account of the manufacture of rolled gold wire and of the methods used in making this up into the various parts of spectacle frames; hints on soldering are also given. Much emphasis is laid on the necessity for assuring an adequate gold covering on all parts of the frames especially at joints and cut edges; numerous excellent photomicrographs illustrate the many points that arise in this connection.

The J.C.Q.O. are to be congratulated on producing a report which is excellent in all respects and should, if its recommendations are put into practice, result in the production of standardized frames and thus safeguard the public from being supplied with an article which sooner or later is bound to develop serious faults.—A. R. POWELL.

**Kristallchemie der anorganischen Verbindungen.** Von M. C. Neuburger. (Sammlung chemischer und chemisch-technischer Vorträge. Herausgegeben von H. Grossmann. Neue Folge, Heft 17.) Roy 8vo. Pp. 115, with 21 figure and 15 tables. 1933. Stuttgart: Ferdinand Enke. (R.M. 9.70.)

The application of X-ray methods to the study of matter in the solid state has resulted in a large extension of our knowledge of the fine structure of matter, and the numerical data obtained have provided material for the foundations of a new branch of physical chemistry concerned with matter in the crystalline state. Recent researches have shown that the crystalline state is more widespread than was commonly supposed, and, in fact, is the rule rather than the exception, among solids. Even vegetable and animal fibres, such as cotton and wool, display crystalline properties. Professor Neuburger's book is confined to a description of the advances which have been made in the crystal chemistry of inorganic compounds, and readers of this *Journal* will no doubt share his regret that the space at his disposal has made it impossible for him to discuss the large body of material now available concerning metals and alloys.

Although the structure of intermetallic phases is not dealt with in the book, the subject-matter is of such importance that it will, in spite of this omission, be of interest to all physical metallurgists. The "valency laws" formulated by chemists, which have long been known to have no validity in the study of intermetallic phases, find no place in crystal chemistry.

The new science is founded on the work of V. M. Goldschmidt and his collaborators on the relationships between atomic (or ionic) diameters and crystal structure. The first half of the book consists of sections dealing with this aspect of the subject, together with the effect of the ratio of the diameters and electrical charges of the atoms of which crystals are built. A discussion of the influence of the number and type of neighbouring atoms on the atomic radii includes a brief reference to solid solutions of metals. The remainder of the book includes sections on isomorphy, polymorphy, and morphotropy, hardness of crystals, and finally brief reference to the structure of silicates.

The book concludes with a bibliography divided into two parts; the first being a list of original papers for further study of the subject; the second a list of literature referred to in the text.—G. D. PRESTON.

**Atlas Metallographicus.** Von [H.] Hanemann und [A.] Schrader. Lieferung 10: Tafel 73-80; Lieferung 11: Tafel 81-88. 1932. Berlin: Gebrüder Borntraeger, Schöneberger Ufer 12a. (Lieferung 10: R.M. 15; subscription price R.M. 7.50; Lieferung 11: R.M. 13.50; subscription price, R.M. 6.75.)

Continuing the "Atlas" (cf. this *J.*, 1927, 38, 712; 1929, 42, 730, and 1930, 44, 762), the subject matter of Part 10 deals with the separation of fine constituents in unworked  $\alpha$ -iron, the structure of rolled iron and steel, the effect of the rate of cooling on the formation of pearlite, pearlite in hypereutectic, eutectic, and hypoeutectic steel, and veining in ferrite. In the introduction to Part II are discussed the formation of iron nitride ( $\text{Fe}_3\text{N}$ ), slip phenomena in ferrite, the structural appearance of ferrite after striking, cold-rolled ingot iron, and the alteration in structure caused therein by tests to destruction. As before, the subject-matter is profusely illustrated by the excellent photomicrographs which comprise the actual "Atlas."  
—J. H. WATSON.

**Applied X-Rays.** By George L. Clark. Second Edition. Med. 8vo. Pp. xiv + 470, with 239 illustrations. 1932. New York: McGraw-Hill Book Co., Inc. (\$5.00); London: McGraw-Hill Publishing Co., Ltd. (30s. net).

The first edition of this work appeared in 1927, and was reviewed in this *J.*, 1927, 37, 770. Our statement in that review, that "we know of no better work than the present to recommend to metallurgists anxious to know something of the development and technique of X-ray analysis," is abundantly justified by the early appearance of this second edition, and applies with added force thereto. Developments which have occurred in the technical application of X-rays since 1926 have converted the task of revision of the original edition into one of a completely new creation. The growth of the subject during the intervening years is well illustrated by a comparison of the two editions, the first with its 255 pages and 99 illustrations, published at 20s., and the second with almost twice as many pages and more than twice as many illustrations, published at 30s. Let it be said, right away, that the increase of price is justified. It is interesting to contrast the author's enthusiasm for the application of X-rays to industrial problems, contained in the first edition—"before long an X-ray apparatus will be an essential part of the research and testing equipment of progressive manufacturers"—with the achievement suggested by, "and yet all would agree that only the barest beginning has been made" of this edition. It can very definitely be asserted that X-rays have not hitherto been applied in technology to anything like the extent they might be. Part I of the present edition is devoted to the discussion of the general physics and applications of X-radiation; Part II, devoted to the X-ray analysis of the ultimate structures of materials, contains much of interest to metallurgists. Here are discussed, amongst other subjects, such matters as the structures of alloys, the interpretation of diffraction patterns in terms of grain size, orientation, internal strain, and mechanical deformation, and applications in metallurgical practice. Here surely is much to interest the practical metallurgist. The book as a whole should make a very ready appeal to metallurgists, physicists, chemists, and medical practitioners. It is well printed on good paper and is well illustrated; an adequate index is provided, and the book is sturdily bound.—J. S. G. THOMAS.

**Der Verchromungsbetrieb. Bewährte Badzusammensetzungen und Arbeitsweisen bei der Verchromung.** Von K. Altmannberger. 5 $\frac{1}{2}$   $\times$  8 $\frac{1}{2}$  in. Pp. 39. 1932. Coburg: Muller und Schmidt. (Geh., R.M. 1.50.)

The principal contents of this volume consist of detailed methods of analysis for the estimation of the more important constituents of chromium, nickel, and copper (acid and cyanide) plating solutions. The methods are well selected, with due attention to the order of accuracy required in each case, and should be easily carried out with a minimum of equipment and training. The application of the analytical results to the rectification of the plating solutions is then described. The composition and operating conditions of eight different nickel depositing solutions are given, special attention being devoted to plating on aluminium and zinc. Sodium citrate is a constituent of each solution to increase the throwing power and to decrease the hydrogen absorbed by the deposit. Although it must be admitted that



the addition of this salt has many advantages, it should be pointed out that the presence of organic salts is undesirable, since the anodic oxidation or cathodic reduction of such substances, facilitated by the presence of freshly precipitated nickel, may lead to the formation of deleterious organic compounds in the bath and consequent pitting or embrittlement of the deposit.

Recommended compositions and operating conditions for acid and cyanide copper plating solutions and for a brass depositing solution are given, also for a combined degreasing and coppering bath. A short section describes methods for the removal of defective nickel or chromium deposits.

The book is well produced and can be recommended; selected references to the original literature would be an improvement.—S. WERNICK.

**Traité de Galvanoplastie.** Par Alfred Soulier. 8e. édition, revue et augmentée d'une annexe sur le Chromage. Cr. 8vo. Pp. viii + 203, with 32 illustrations. [1932.] Paris: Garnier frères, 6 rue des Saints-Pères. (9 francs.)

The expressed object of this volume (which is a revised edition of a previous work) is to provide amateurs and artisans with precise instructions in the electrodeposition of metals. The scope of the book is wider than the title might suggest, since practical information on both electrotyping and decorative electroplating of metals is included. Considerable space is devoted to a description of sources of current, chiefly primary cells, and there is a short section on electro-refining of copper.

No attempt is made to explain the mechanism of the processes described, and many processes are made to appear more simple than, unfortunately, they are in reality. Almost all the information is much out of date, and even the section on chromium plating, newly added in this edition, is not in accordance with modern practice. The chapter on nickel plating fails to mention three of the essentials of modern nickel deposition, *viz.* warm solutions, accurate control of acidity by determination and adjustment of the *pH* value of the solution, and the presence of chloride in the electrolyte to facilitate anode corrosion. The recommended preparatory methods prior to electroplating would scarcely be adequate for the thickness of deposit now normally required.

The printing and illustrations are clear, but the paper and binding are poor: this, however, is excusable in view of the low price of the book.—S. WERNICK.

**Handbuch der technischen Elektrochemie.** Herausgegeben von Victor Engelhardt. Zweiter Band. 1 Teil. Die technische Elektrolyse wässriger Lösungen. B. Anwendungen in der Chemischen Industrie. 1. Anorganischer Teil: Elektrolyse des Wassers getrennte Darstellung von Chlor und Alkali. Bearbeitet von J. Billiter, F. Fuchs, u. G. Pfeleiderer. Med. 8vo. Pp. ix + 451, with 147 illustrations. 1933. Leipzig: Akademische Verlagsgesellschaft m.b.H. (Brosch., M. 42; geb., M. 44.)

Notices of the two volumes forming Part I of this "Handbuch" appeared in this *Journal*, 1931, 47, 506, and this volume, p. 176. The present volume deals only with the electrolysis of water, and of aqueous solutions of alkali chlorides. Both sections have been prepared with the thoroughness which characterized the earlier volumes of this series, and deal in detail not only with the theoretical aspects of the problems, but also with the various types of cell and other plant involved in their technical application. This particular section of the work is entirely confined to problems in the chemical industry, the only section likely to be of interest to metallurgists being that dealing with the use of alkali amalgams in the electrolytic processes.

C. J. SMITHELLS.

**Practical Cable Jointing.** Second impression. Cr. 8vo. Pp. 215, with 332 illustrations. 1932. London: W. T. Henley's Telegraph Works Co., Ltd., Engineering Department, Holborn Viaduct, E.C.1. (5s. net.)

With the exception of a short introduction which lists the kit of tools considered necessary for a cable jointer and briefly but authoritatively lays down the precautions to be observed in handling lead-covered cables, this book consists of a collection of excellent photographs illustrating clearly every step in jointing impregnated paper-insulated power cables in a variety of circumstances. The operations which are illustrated include wiping a joint by the "stick" and "pot" methods, jointing copper conductors in different ways, trimming, fitting, and plumbing lead sleeves, and installing proprietary types of jointing, distribution, and terminal boxes. Within the limits of a detailed instruction manual, it achieves its purpose to perfection, and should prove invaluable to jointers, their apprentices, and cable engineers generally. Such competence, indeed, is shown in describing every detail of jointing practice that it is all the more disappointing that no attempt is made to discuss at all fully that most interesting metallurgical operation, the "wiping" of lead joints, to examine the causes of "porous wipes," to describe that mysterious "grittiness" that all plumbers seem able to find in some samples of solder, or to discuss the effects of impurities. The conventional attitude is taken that practice alone will teach the art; and its full analysis still remains unrecorded.—J. C. CHASTON.

**Anleitung zum Gas-Schmelzschweissung.** Unter Mitarbeit zahlreicher Fachleute, massgebender Körperschaften. Bearbeitet und herausgegeben vom Deutschen Ausschuss für Technisches Schulwesen E.V. Demy 8vo. Zweite, verbesserte Auflage. Pp. 44, with numerous illustrations. 1932. Berlin: Deutscher Ausschuss für Technisches Schulwesen, Potsdamerstr. 119b, W.35. (R.M. 1.)

This little booklet consists of a series of instruction charts illustrating the apparatus and technique of oxy-acetylene welding. Exercises for practice are clearly demonstrated by excellent sketches. These are so self-explanatory that, with no knowledge of German at all, one could understand quite three-quarters of the book. Correct flame adjustment is explained and the technique of right-hand and left-hand welding, horizontally, vertically and overhead, is described. As a manual for the instruction of technical classes, this provides a very sound, well-arranged course. It may possibly be thought, however, that its methods tend to "spoon-feeding."—H. W. G. HIGNETT.

**Annual Reports on the Progress of Applied Chemistry.** Volume XVII, 1932. Demy 8vo. Pp. 721. 1932. London: Society of Chemical Industry (Members 7s. 6d.; non-members, 12s. 6d.).

The new volume of the annual reports of the Society of Chemical Industry deals, as in previous years, with the progress in a number of important branches of industrial chemistry during the year 1932. One or two minor changes in the titles of the sectional reports may be noted. The sectional report which has previously been entitled "Colouring Matters and Dyes" has become "Intermediates and Colouring Matters," in the present volume. The consideration of the progress in paper manufacture has been omitted from the report which previously dealt with "Fibres, Textiles, Cellulose, and Paper," and a new report has been added on "Paper and Pulp." Otherwise the sectional reports are as in previous years, except that the report on "Rubber" has now become one on "India-Rubber." The report on "Explosives" deals with the progress during 1931-1932. The volume contains, amongst others, very good reports on "Refractories, Ceramics, and Cements" (p. 15) by A. H. B. Cross and W. J. Rees; "Non-Ferrous Metals" (p. 23) by A. R. Powell, and "Electrochemical and Electrometallurgical Industries" (p. 12) by J. H. West.

The high standard of the reports is maintained, and a volume has been presented to the chemical world which will be exceedingly useful to all chemists, whether they are engaged in the industries or in purely academic chemistry.—JAMES F. SPENCER.

**Jahresbericht 1932 der Stoff-Abteilung der D.V.L.** Von Paul Brenner. (Sonderdruck aus dem Jahrbuch 1932 der Deutschen Versuchsanstalt für Luftfahrt, E.V.) Demy 4to. Pp. 22 + 72, illustrated. 1932. München und Berlin: R. Oldenbourg. (Geh., R.M. 5.50.)

Summaries of reports on completed investigations dealing with light metals, steel, non-metallic materials, surface protection against corrosion, failures, fuels, &c., are given in the first part of the volume. Several of these summaries deal with experiments on the influence of heat-treatment on corrosion properties of Duralumin, experiments on blistered Duralumin, stress-cracking in wrought light alloys, and spot-welds in Duralumin. Each of these items is of importance in relation to the use of light alloys in aircraft construction and of interest to users of light metals and alloys generally. Items placed under the heading "Surface-Protection" include tests of paints and varnishes, oxide films, and oxide films supplemented by organic protectives on light aluminium alloy sheets, and tests of paints on pickled Elektron sheets. The investigations of failure include work on broken crank-shafts, crank-cases, pistons, &c. The second and larger portion of the volume consists of reprints of papers on materials of construction, protection against corrosion, stress-corrosion cracks in light metals, &c.

—H. SURTON.

**The Advancement of Science: 1932. Addresses Delivered at the Annual Meeting of the British Association for the Advancement of Science (102nd Year), York, August 31-September 7, 1932.** Demy 8vo. Pp. 256, illustrated. 1932. London: British Association, Burlington House, W.1. (3s. 6d.)

Whilst these 13 addresses are of outstanding interest from the point of view of the sciences with which they deal, there is little in any of them to appeal directly to the worker in metals, except possibly in Professor M. Walker's "Call to the Engineer and Scientist," in which the lecturer discusses in a very able manner the causes of the present world depression, and puts forward a series of suggestions for removing these causes and setting the world once more on the way to prosperity.—A. R. POWELL.