

METALLURGICAL ABSTRACTS

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I.—PROPERTIES OF METALS

(Continued from pp. 593-599.)

Researches on the Mechanical Properties of Free Transmission Wires of Electrolytic Copper, Bronze, Aluminium, and Aldrey. E. Honegger (*Schweiz. Bauzeit.*, 1931, 97, 137-138).—A short summary of a paper by Schwinning and Dorgerloh. See this *J.*, 1931, 47, 257.—J. W.

Researches into the Fatigue Strength of Transmission Line Conductors. W. Schwinning (*Aluminium Applications*, 1930, 2, (5)).—Abstracted from *Hauszeit. V.A.W.u.d. Erftwerk A.G. Aluminium*, 1929, 1, 52-59. See this *J.*, 1931, 47, 257; and this volume, p. 289.—J. C. C.

The Appearance of Small Amounts of Gases and Oxides in Aluminium and Aluminium Alloys, their Detection and Removal. R. Sterner-Rainer (*Z. ges. Giesserei-Praxis: Das Metall*, 1931, 52, 79-80).—Abstract of a paper read before the Deutsche Gesellschaft für Metallkunde. See *J.*, this volume, p. 209.—J. H. W.

A Search for Evidence of the Radioactive Decomposition of Barium. T. R. Hogness and R. Ruth Comroe (*Proc. Nat. Acad. Sci.*, 1932, 18, 528-531).—No evidence of the radioactivity of barium was obtained.—E. S. H.

The Cathode Sputtering of Beryllium and Aluminium in Helium. P. D. Kueck and A. K. Brewer (*Rev. Sci. Instruments*, 1932, 3, 427-429).—The respective numbers of aluminium and beryllium atoms sputtered cathodically under identically similar conditions are found experimentally to be in the ratio 1.5 : 1; the corresponding thicknesses of the sputtered films and their light-absorbing powers are found to be in the respective ratios 2.5 : 1 and 10 : 1.—J. S. G. T.

Beryllium—a Metal of the Future. C. B. Sawyer (*Machinery (N.Y.)*, 1930, 36, 529).—Note of a paper read before the Cleveland meeting of the Society of Automotive Engineers. See this *J.*, 1931, 47, 169.—H. F. G.

Thermoelectric Power of Single-Crystal Bismuth Near the Melting Point. Adolf Soroos (*Phys. Rev.*, 1932, [ii], 41, 516-522).—The thermoelectric power of single crystals of bismuth against copper has been investigated in the region 260°-290° C. by a method in which the e.m.f. of the bismuth-copper couple was measured with a temperature difference of about 1° C. between the ends of the bismuth crystal at successive mean temperatures. The behaviour is abnormal, and instead of showing the usual abrupt change of thermoelectric power at the melting point which is confirmed by a similar experiment with lead, the bismuth crystals show a transition zone of about 8° C. in which the thermo-electric power changes gradually before reaching a constant value of 4.5 microvolts per degree above about 280° C. (the melting point is 271° C.). In some cases the curve shows a knee or irregularity in the transition zone, and it is concluded that some kind of crystal structure or seed crystals persists into the liquid state.—W. H.-R.

The Dependence of the Susceptibility of Bismuth Single-Crystals upon the Field. W. J. de Haas and P. M. van Alphen (*Proc. K. Akad. Wet. Amsterdam*, 1932, 35, 454-458).—[In English.] At room temperature the magnetization increases linearly with the intensity of the field. The susceptibility is given as -1.17×10^{-6} , which is regarded as probably too small a value.—E. S. H.

On a Sumerian Copper Bar in the British Museum. N. T. Belaiew (*Seminarium Kondakovianum*, 1932, 5, 165-177 [in Russian], 178-180 [in English]).—The bar weighing 1.7 kg. is apparently a lever or beam and dates from about

2500–2530 B.C. Allowing for the corrosion which has taken place, its original composition was copper 98.30, tin 0.23, lead 0.37, iron 0.41, and nickel 0.64%; the bar is thus crude copper and not a bronze; apparently it was made from the nickeliferous copper ores of Jebel Akhdar in Oman.—A. R. P.

The Electrical Conductivity of Copper. G. Elsner and P. Siebe (*Metallurgia*, 1932, 6, 129–132).—Translated from *Z. Metallkunde*, 1930, 22, 397–401. See this *J.*, 1931, 47, 60.—J. W. D.

The Adsorption of Gases by Copper. A. F. Benton and T. A. White (*Met. Ind. (Lond.)*, 1932, 41, 105).—Abstract from *J. Amer. Chem. Soc.*, 1932, 54, 1373; see *J.*, this volume, p. 417.—J. H. W.

The Magnetic Susceptibilities of Alpha- and Beta-Manganese. Mary A. Wheeler (*Phys. Rev.*, 1932, [ii], 41, 331–336).—Pure α -manganese was prepared by distillation, and its mass susceptibility, as determined by a null-reading astatic magnetometer, was 9.60×10^{-6} . β -Manganese was prepared by quenching the α modification from about 1000°C ., and removing the impure surface; its mass susceptibility was 8.80×10^{-6} . The ferromagnetic manganese reported by some investigators is not the pure α or β form, and probably contains impurity.—W. H.-R.

Remanence and Hysteresis Associated with Magnetostriction in the Case of Nickel. F. Lichtenberger (*Z. Physik*, 1932, 77, 395–397).—The phenomena of remanence are shown to characterize the occurrence of magnetostriction in hard nickel and a reversal of sign of the remanent magnetization is shown to occur where there is a steep drop in the magnetization hysteresis loop.—J. T.

An Experiment Relating to the Recombination of Hydrogen Atoms on Metallic and Oxidized Nickel. L. S. Ornstein and A. A. Kruithof (*Z. Physik*, 1932, 77, 287–289).—Oxidation of a nickel surface is shown to reduce the rate of recombination of hydrogen atoms at the surface.—J. S. G. T.

The Burning-Out of [Tungsten] Filaments Heated in Vacuo.—III. Leopold Pránsnik (*Z. Physik*, 1932, 77, 127–132).—The effect of heat-conduction on the burning out of thin wires is discussed mathematically and the theory applied to the case of tungsten wires previously discussed (see *J.*, 1931, 47, 471; and this volume, pp. 3, 342).—J. S. G. T.

Creep Characteristics of Metals at Elevated Temperatures. A. L. White and C. L. Clark (*Amer. Soc. Steel Treat. Preprint*, 1932, Oct., 1–16).—A brief historical summary is first given of the development of testing methods and particularly of their application at elevated temperatures, where creep is an important factor. The equipment installed at Michigan University is described and illustrated, and the significance and application of the data which have been plotted are discussed. The differences arising from single-step, up-step, and down-step methods of loading are shown. The lowest rate of creep is obtained by the down-step scheme of loading. If plotted logarithmically, the curves indicating the relationships between stress and rate of creep are parallel to one another if the recrystallization temperature has not been reached. Similarly, the lines above the recrystallization temperature are parallel in themselves, but at a distinct angle to the lines first mentioned. The discussions embrace the influence of grain-size, chemical composition, heat-treatment, rate of creep, and methods of manufacture.—W. A. C. N.

Fatigue of Metal. A Backward Glance. H. F. Moore (*Metals and Alloys*, 1932, 3, 195, 207).—Historical retrospect.—A. R. P.

Thermal Effects in Elastic and Plastic Deformation. M. F. Sayre (*Met. Ind. (Lond.)*, 1932, 41, 153–156).—Read before the American Society for Testing Materials. See *J.*, this volume, p. 468.—J. H. W.

The Elastic Limit of Metals Exposed to Tri-Axial Stress. Gilbert Cook (*Proc. Roy. Soc.*, 1932, [A], 137, 559–574).—Particulars are given of an investigation carried out to determine the relation between the principal stresses in ductile materials, subjected to stresses in 3 dimensions, and to examine the applicability of the hypotheses of constant maximum shear stress (Guest), constant

total strain energy (Haigh), and constant energy of shear strain (von Mises-Hencky). An observation by Bridgman, suggesting an effect on the elastic limit under distorting stresses by the superposition of high hydrostatic pressure, was examined by exposing an annealed iron wire to torsional stress (*a*) at atmospheric pressure and (*b*) under hydrostatic pressure of 21.5 tons/in.². No lowering of the elastic limit was observed; this result suggests that the Haigh hypothesis does not hold. Further investigations showed that variations in axial stress, provided this remains the intermediate principal stress, have a negligible influence on the internal pressure required to cause initial failure at the internal surface. It is concluded that for the same kind of stress distribution, the values of the principal stresses at the elastic limit give a constant value of the maximum shear stress.—J. S. G. T.

On the Change in Hardness of a Plate Caused by Bending. Sadajirō Kokubo (*Sci. Rep. Tōhoku Imp. Univ.*, 1932, 21, 256-267).—[In English.] The change in hardness brought about by bending plates of Armco iron, carbon steels, copper, brass, aluminium, Duralumin, and magnesium has been measured with a Vickers hardness tester. In cold-rolled specimens the hardness on the convex side decreases, at first rapidly and afterwards slowly as the degree of bending increases, whilst on the concave side it increases slowly. In annealed specimens the hardness on the convex side decreases at first rapidly, passes through a minimum, and then increases slightly, whilst on the concave side the hardness increases throughout. The change caused by elastic deformation is attributed to the effect of the applied stress, and that produced by plastic deformation is explained as the combined effect of the stress and the work-hardening.—E. S. H.

The Flow of Solid Metal Aggregates. C. H. M. Jenkins (*J. Rheology*, 1932, 3, 289-297).—The extent and nature of the internal changes occurring in a metal subjected at a suitable temperature to a steady stress sufficiently high to produce flow and rupture are discussed. Flow occurs in metal aggregates by three methods, not necessarily independent, viz., by slip within the crystals, by grain boundary movement, and by continuous recrystallization under stress. The method of ascertaining the rate of creep and the significance of tests are briefly discussed in relation to the probable mode of flow occurring. The connection between the flow and the previous condition of the metal, i.e., whether cast or worked, &c., is correlated with the microstructure and grain-size of the metal. The effects of grain boundaries, temperature, and crystalline material within the grains on inter-crystalline rupture and slip are discussed. The importance of these factors is illustrated by reference to a complex nickel-chromium alloy which age-hardens on exposure to service temperatures. A short bibliography is appended.—J. S. G. T.

The B.A. Standards of [Electrical] Resistance, 1865-1932. Sir R. T. Glazebrook and L. Hartshorn (*Phil. Mag.*, 1932, [vii], 14, 666-681).—Details are given of the degree of constancy achieved in the construction of the British Association primary standards of electrical resistance of various alloys and metals, including platinum-iridium alloys, gold-silver alloys, platinum, mercury. The records show that the values of the resistance of most of the coils have changed during their long lives, but that the two original platinum coils have remained unchanged.—J. S. G. T.

On the Effect of Torsion on the Density, the Dimensions, and the Electrical Resistance of Metals. [Armco Iron, Swedish Steel, Brass, Nickel, and Copper.] Tarō Ueda (*Sci. Rep. Tōhoku Imp. Univ.*, 1932, 21, 193-230).—[In English.] The changes in density, dimensions, and electrical resistance of Armco iron, Swedish steel, brass, nickel, and copper, when twisted by a torsion machine, have been measured. In general, the density decreases with twisting at a considerable rate up to the yield-point; the length of the specimens increases slightly with the twisting angle, but beyond the yield-point the elongation becomes greater; the electrical resistance increases with increasing angle of

twist. The rate of change is very great in the case of brass, and very small in the case of copper. With nickel, the change is considerable at the beginning of torsion, but the further increase is only slight.—E. S. H.

On the Influence of the Elastic State of Stress on the Magnitude of the Initial Permeability. M. Kersten (*Z. tech. Physik*, 1931, 12, 665-669).—Abstracted from *Z. Physik*, 1931, 71, 553-592; this *J.*, 1931, 47, 642.—J. W.

The Effect of Plastic Deformation on the Susceptibility of Dia- and Paramagnetic Metals. A. Kussmann and H. J. Seemann (*Z. Physik*, 1932, 77, 567-580).—Very considerable changes are produced in the values of the magnetic susceptibilities of the metals copper, silver, bismuth, and lead, and of the copper-zinc alloys by cold-rolling. In each case the change is in the direction of increasing magnetizability. The effect is particularly marked in the case of copper and brass, in which a transition from diamagnetic to paramagnetic properties is produced by cold-working. Cold-rolling is without appreciable effect on the susceptibility of a second group of metals, including aluminium, gold, zinc, tungsten, molybdenum, and copper-zinc-nickel alloys (Neusilber). The observed effects in the case of the first group are attributable to the presence of minute proportions of ferromagnetic impurities, more especially iron. The necessary conditions for the susceptibility to influence by cold-working include an extremely small solubility of the ferromagnetic phase at room temperature, a rapid increase of solubility with increase of temperature, and the production of a supersaturated solid solution on cooling.—J. S. G. T.

Diffraction of Electrons in Single Crystals. J. J. Trillat and Th. v. Hirsch (*J. Phys. Radium*, 1932, [vii], 3, 185-203).—See abstract from another source, *J.*, this volume, p. 440.—E. S. H.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 600-608.)

The Compressive Strength of Duralumin Columns of Equal Angle Section. Eugene E. Lundquist (*Nat. Advis. Cttee. Aeronautics, Tech. Notes*, No. 413, 1932, 1-12).—The compression strengths of Duralumin columns of equal angle section have been calculated and the results are embodied in charts. The data used have been obtained from the literature and correlated with theory in the range where secondary failure occurs. Two appendices contain excerpts from U.S. Army and Navy specifications for Duralumin and approximate formulæ for the properties of the equal angle section.—A. R. P.

Aluminium Alloys at Low Temperatures Proved to be Stronger. Anon. (*Daily Metal Reporter*, 1930, 30, (229), 8).—Comparative tests are described on alloys of the Duralumin type ("17ST"), on a propeller alloy ("25ST"), and on "2S" and "3S," two simpler alloys, at 24° C. and -80° C. in order to determine their suitability for aero construction. The low-temperature tests were carried out in a container cooled by a mixture of solid carbon dioxide and ether; they covered toughness, load-carrying capacity, and tensile strength, and were applied by specially designed machines. Both wrought and sand-cast alloys showed a definite increase in strength.—P. M. C. R.

On the Effect of Magnetic Treatment on the Age-Hardening of Quenched Steels and Alloys [Duralumin]. Yosiharu Matuyama (*Sci. Rep. Tôhoku Imp. Univ.*, 1932, 21, 242-255).—[In English.] Experiments on the age-hardening of Duralumin and of certain steels have failed to confirm the report of Herbert (this *J.*, 1931, 47, 432) that rotation in a magnetic field after quenching causes the hardness to vary periodically. It is concluded that the age-hardening of Duralumin is not affected by a.c. or by the magnetic treatment.—E. S. H.

High-Tensile Light Alloys. Anon. (*Met. Ind. (Lond.)*, 1932, 41, 270).—Short note. A new series of light alloys, developed in America, contains nickel and chromium with a minimum of copper. Sections have been extruded

having a tensile strength of 31 tons/in.², a yield-point of nearly 27 tons/in.², and an elongation of 15%.—J. H. W.

The Influence of Antimony on Aluminium Alloys. A. W. Bonaretti (*Light Metals Research*, 1932, 2, (2), 1-24).—Translated in full from *Metalli Leggeri*, 1931, 1, 29-52. See this *J.*, 1931, 47, 516.—J. C. C.

[Aluminium-Silicon Alloy.] Anon. (*Machinery* (N.Y.), 1930, 36, 857).—An aluminium alloy, containing about 13% of silicon, to which 1-2% of sodium is added immediately before casting, is said to possess high resistance to corrosion by sea-water. Its density is rather lower than that of aluminium, and its tensile strength 30,000-35,000 lb./in.², with an elongation of 7-15%.—H. F. G.

Physico-Chemical Investigation of the Ternary Alloys of Aluminium, Silicon, and Copper. G. G. Urazov, S. A. Pogodin, and G. M. Zomoruev (*Izvestia Instituta Fiziko-Khimicheskogo Analisa* (Ann. Inst. anal. phys.-chim.), 1931, 5, 157-200).—[In Russian.] Cf. this *J.*, 1930, 43, 447.—S. G.

A New Light Alloy. "Chlumin." I. Itaka (*Z. Instrument.*, 1932, 52, 377).—Abstract from *J. Soc. Mech. Eng. Japan*, 1930, 33, 203-208. See *J.*, this volume, p. 221; also pp. 11, 425.—E. S. H.

Hyduminium "R.R. 66" [Aluminium Alloy]. Anon. (*Light Metals Research*, 1932, 2, (3), 5-6).—An account of the physical characteristics of this alloy.—J. C. C.

The New [Aluminium] Alloys "R.R. 66" and "M.G. 7." Anon. (*Alluminio*, 1932, 1, (1), 45-56).—Describes the properties and characteristics of these alloys.—G. G.

"M.G. 7" [Aluminium Alloy]. Anon. (*Machinery* (Lond.), 1932, 39, 600; *Light Metals Research*, 1932, 2, (3), 2-4; and *Aluminium Broadcast*, 1931, 3, (22), 2-5).—Accounts of the properties of the aluminium-magnesium-manganese alloy "M.G. 7." See *J.*, this volume, pp. 76, 223, 294.—J. C. C.

Birmabright Aluminium Alloy. Anon. (*Aluminium Broadcast*, 1931, 3, (13), 8-15).—A comprehensive review of the physical properties and uses of Birmabright, with details of recommended workshop practice for its machining, joining, and finishing.—J. C. C.

Duralite, a New Light Alloy for Casting and Forging. Anon. (*Alluminio*, 1932, 1, (4), 251).—A brief note.—G. G.

The Thermochemistry of Sulphides of Antimony, Arsenic, Bismuth, Cadmium, Tin, and Iron. E. V. Britzke and A. F. Kapustinsky (*Zvetnye Metally* (The Non-Ferrous Metals), 1931, 6, (9), 1147-1156).—[In Russian.] See this *J.*, 1931, 47, 80.—S. G.

Batterium Metal. Anon. (*Daily Metal Reporter*, 1932, 32, (23), 4; and *Mech. World*, 1931, 90, 410).—A brief account of this alloy. See also this *J.*, 1931, 47, 532, and this volume, p. 14.—P. M. C. R.

The Influence of Silicon on Copper-Nickel Alloys of Low Tin Content. Léon Guillet, Marcel Ballay, and A. le Thomas (*Compt. rend.*, 1932, 195, 89-92).—The effect already observed (see *J.*, this volume, p. 541), of adding silicon to copper-nickel, copper-tin, and nickel-tin alloys is now shown to be of general application, and the effect on the properties of the alloys, particularly the hot-hardness, is presented. The effect of replacing copper by silicon in a 93.5 : 6.5 bronze is to increase the hardness and the amount of the δ constituent. This result can be explained by the theory of "apparent percentage" (*titre fictif*), the equivalent of silicon in relation to tin being 3. The amount of silicon that can be present in copper-nickel alloys without the formation of a nickel-silicon compound or the so-called *D*-constituent is very small, being about 1% for low-nickel and 3% for high-nickel alloys. Similar considerations apply to the copper-tin alloys. The hardness of these 3 types of alloy has been taken at 350° and 450° C., and the results show that the substitution of silicon for tin causes an increase in hardness at these temperatures.—J. H. W.

Directional Properties in Cold-Rolled and Annealed Commercial Bronze. Arthur Phillips and Carl H. Samans (*Amer. Inst. Min. Met. Eng. Tech. Publ.*

No. 491, 1932, 1-12).—A study of tensile and cupping tests on samples of brass having the composition: copper 90.08, zinc 9.88, lead 0.012, and iron 0.030%, with the object of determining (1) anisotropic relationships in annealed metals, and (2) whether the tensile test is a criterion of the tendency of a material to produce ears on cupping and drawing. Five different schemes of rolling were followed and from each hard-rolled specimen tensile test-pieces were taken in 5 directions. Further specimens cut from similar directions were afterwards annealed and compared by cupping tests. In general, it has been shown that in a 90:10 brass pronounced directional properties are observed after the greatest reductions and high temperatures of anneal. The tensile test appears to indicate any tendency of annealed brass to form ears on drawing. In slightly or moderately worked brass the lower the temperature of the intermediate and penultimate anneals the more marked are the directional differences as shown by both tensile and cupping tests. Copper usually forms ears at right angles to the rolling direction. The 90:10 brass shows a similar formation at 45° to the direction of rolling and, generally, quite different directional properties from those of copper.—W. A. C. N.

The Constitution of the Copper-Tin-Antimony System. B. Blumenthal (*Metals and Alloys*, 1932, 3, 181-182, 188).—A correlated abstract and bibliography of recent work, with ternary diagrams of the system.—A. R. P.

Influence of Temperature on the Diffusion Velocity of Solid Metals. (The Zinc-Copper System.) Chujiro Matano (*Mem. Coll. Sci. Kyoto Imp. Univ.*, 1932, [A], 15, 167-180).—[In English.] In the zinc-copper system over the temperature range 87°-302° C., the relation between the velocity of diffusion V and the absolute temperature T is given more accurately by the expression $V = Be^{-\alpha/T}$ than by Weiss's formula $V = Ke^{\beta/T}$, where B , K , α , and β are constants and $\alpha = 9.52 \times 10^3$ degrees.—E. S. H.

14-Carat Standard Legalized for Gold Wares. Ernest A. Smith (*Met. Ind. (Lond.)*, 1932, 41, 267-270).—14-Carat gold must legally contain 58.5% of gold. The history of this standard is reviewed and the composition, Brinell hardness, tensile strength, elastic limit, elongation, Erichsen number, and colour of the alloy with various ratios of silver and copper are tabulated and its properties are compared with those of 15- and 12-carat alloys.—J. H. W.

Some Observations on Cast and Swaged Dental Plates. A. C. W. Hutchinson and F. C. Thompson (*Dental Board of the United Kingdom, "Practical Points Connected with Dental Mechanics,"* 1932, 63-87).—The ordinary silver-copper 18-carat gold alloy is regarded as the best alloy for swaged plates; the use of platinum alloys is unnecessary and expensive. For cast plates the ordinary 16-18-carat alloy is satisfactory if the casting technique is good, but an alloy of gold 70, silver 12, copper 15, and either platinum or palladium 2-3% is recommended as being less likely to give trouble during casting and working. A strong alloy for clasps consists of gold 68, copper 12, silver 10, and platinum (or palladium) 10%. Higher platinum content effects no improvement in the alloys and more than 15% copper appears to be deleterious, whereas a small proportion of nickel increases the hardness. These complex alloys are softest when quenched from the annealing temperature and hardest when slowly cooled from 450° to 250° C. In melting any of the alloys rapid heating is desirable, the metal should not be overheated, and should be cast immediately it is at the correct temperature, and melting should be made under a reducing flux comprising a mixture of potassium bitartrate 25, animal charcoal 5, borax glass 42, boric acid 14, and silica 4%. The best solder is an alloy of gold 65, silver 15, copper 14, zinc 3.5, and tin 2.5%, which is used with a flux comprising a mixture of borax glass 55, boric acid 35, and silica 10%. The solder has a melting range of 750°-800° C. and in the hard condition has an elastic limit of 12 tons/in.², a tensile strength of 19 tons/in.², an elongation of 11%, and a Brinell hardness of 108; the corresponding values for the soft state are 30,

35, 1, and 192, respectively. Casting of dental alloys should be done in an investment compound which *really* expands at 300° C. or preferably at 750° C.; cristobalite mixtures have proved the most satisfactory for this purpose.

—A. R. P.

The Light Metals and their Alloys. E. Girard (*Rev. chim. ind.*, 1932, 41, 134-138).—A review of the preparation, fabrication, properties, and uses of magnesium alloys.—E. S. H

Contribution to the Study of the Ternary System Magnesium-Aluminium-Copper. A. Portevin and P. Bastien (*Compt. rend.*, 1932, 195, 441-443).—Continuing the work of Vogel (*Z. anorg. Chem.*, 1919, 107, 265), that part of the ternary system corresponding with the triangle Mg-Mg₂Al₃-Mg₂Cu is now investigated by means of cooling curves, micrographic examination, and the determination of the physical properties. The constitution is shown diagrammatically. A definite compound, Mg₂Al₃Cu₂, was found and the liquidus has 4 levels corresponding with the 4 phases Mg, Mg₂Al₃, Mg₂Cu, and Mg₂Al₃Cu₂. The physical properties confirm the equilibrium diagram. Roughly, for magnesium-rich alloys, the density increases linearly and the coeff. of expansion decreases linearly as a function of the copper and aluminium contents. Beyond the region of the α -solid solution, the resistivity decreases rapidly with the addition of aluminium and clearly marks the limits of the α -solid solution near the aluminium, whilst the addition of copper causes a much more rapid increase in the resistivity. The addition of copper to the 10% aluminium alloy also results in a lower resistivity, indicating the existence of the above compound. The mechanical properties in general improve in the α -region. Outside this region, the increase in hardness is accompanied by a great increase in fragility.—J. H. W.

A Process for the Production of Copper Amalgam from Ingredients in Aqueous Solution. F. C. Husband (*J. Dental Research*, 1932, 12, 321-326).—When copper sulphate solution is mixed with hypophosphorous acid a precipitate of copper hydride slowly forms; if this precipitate is introduced into mercuric chloride solution it is converted into copper amalgam. The application of this reaction to the precipitation of copper amalgam inside teeth is described. Copper amalgam has a very high germicidal action.—A. R. P.

The Solubility of Gold in Mercury.—V. Joseph T. Anderson (*J. Physical Chem.*, 1932, 36, 2145-2165).—Forty-two determinations of the solubility of gold in mercury have been made between 280° C. and 400° C., using a method which enables the disappearance of the solid phase to be detected when the solution is not transparent. A tube has been designed in which the liquid phase is separated from the solid by filtering through a porous glass disc. The tube is whirled and filtering effected by centrifuging. The solubility results agree with those of Sunier and Weiner (*J. Amer. Chem. Soc.*, 1931, 53, 1714; this *J.*, 1931, 47, 430), Sunier and Mees (unpublished), and Parravano (*Gazz. chim. ital.*, 1918, 48, II, 123), but do not agree well with those obtained by Britton and McBain (*J. Amer. Chem. Soc.*, 1926, 48, 593; this *J.*, 1927, 37, 469) and by Plaksin (*J. Soc. phys.-chim. russe*, 1929, 61, 521; this *J.*, 1930, 44, 506). The solubility curve exhibits a break at about 310° C., at which temperature Plaksin also finds a thermal effect. Results found for the composition of the solid phase indicate that the gold-rich compound is probably Au₃Hg, and not Au₂Hg as given by Plaksin. A suggested phase diagram agrees better with the results of Parravano, Biltz and Meyer, Pabst, and the present results than does that suggested by Plaksin.—J. S. G. T.

The Problem of Liquid Sodium-Amalgams (a Case for the Colloid View). G. R. Paranjpe and R. M. Joshi (*J. Physical Chem.*, 1932, 36, 2474-2482).—An examination of metallographic and physical data relating to liquid sodium-amalgams leads to the conclusion that these amalgams are hydrargyrophilic colloidal solutions of sodium in mercury with (Na₂)₂Hg, as the colloid micellæ,

and that a mere statement of the concentration of an amalgam is not sufficient to define the amalgam; its method of preparation, age, and previous history must be given.—J. S. G. T.

The Variation with Temperature of the Thermoelectric Power of Nickel and Some Copper-Nickel Alloys. K. E. Grew (*Phys. Rev.*, 1932, [ii], 41, 356-363).—The thermoelectric powers of nickel and of copper-nickel alloys containing 94 and 79% nickel, respectively, have been measured against platinum at temperatures between 0° and 500° C. With pure nickel the slope of the thermoelectric power curve changes abruptly at 360° C., above which it decreases continually, finally assuming a constant negative value above 430° C. The copper-nickel alloys show similar changes at lower temperatures. The results are discussed from the point of view of the theory of Stoner (*Proc. Leeds Phil. Soc.*, 1931, 2, 149, see this *J.*, 1921, 47, 647; and *Phil. Mag.*, 1931, 12, 737, see *J.*, this volume, p. 10), but whilst a general agreement is found, the simple theory is incomplete even at low temperatures where the assumption that the magnetization is due to spin moments only is approximately valid.—W. H.-R.

International Nickel Puts Out New Non-Ferrous Alloy [Inco]. Anon. (*Daily Metal Reporter*, 1931, 31, (228), 5).—Inco, a nickel-base alloy low in iron and containing chromium, is said to be highly resistant to corrosion by dairy products, brine, and cleansing agents. It can be produced as castings or as sheet, tubing, or rod.—P. M. C. R.

Invar, Elinvar, and Related Iron-Nickel Alloys. J. W. Sands (*Metals and Alloys*, 1932, 3, 131-135, 150, 159-165).—A lengthy review of recent work on the constitution and mechanical, thermal, and electrical properties of iron-nickel and iron-nickel-cobalt alloys.—A. R. P.

Strain and Magnetic Orientation. Lewi Tonks and K. J. Sixtus (*Phys. Rev.*, 1932, [ii], 41, 539-540).—A note. Wires of nickel-iron alloy (15% nickel) were submitted to combined longitudinal and transverse magnetic fields whilst under torsion or combined torsion and tension. It is concluded that under torsion the component of the applied field in the direction of maximum elongation is solely effective in causing the large Barkhausen jump. With sufficient strain applied the magnetic intensity lies in the direction of maximum elongation, and transverse fields are ineffective in aiding the reversal of magnetization under these conditions. The transverse fields were obtained by simply passing a current through the wire.—W. H.-R.

The Silver-Copper-Zinc System. M. Keinert (*Z. physikal. Chem.*, 1932, [A], 160, 15-33).—The binary silver-zinc and copper-zinc systems resemble one another closely, so that a considerable range of mutual solid solubility of the individual phases in the two systems is to be expected. This has been confirmed for the ϵ -, γ -, and β -phases; no tests have been made with the δ -phase. The α - and β' -phases in the two systems form no solid solutions with one another. On cooling homogeneous β from high temperatures both β' -phases separate, but at room temperature a small amount of ternary β remains in the middle of the original ternary field. The α -silver-zinc solid solution dissolves only a few % of copper, but the binary α -phase can be age-hardened.—B. Bl.

Copper-Tin Compound in Babbitt. George A. Nelson (*Metals and Alloys*, 1932, 3, 168-170).—The compound CuSn crystallizes in Babbitt metals in the form of hexagonal needles of considerable length which collect into star-shaped aggregates. CuSn appears to be the initial crystallization centre for SnSb, the cubes of which grow larger in contact with the CuSn needles than in the eutectiferous areas. Increasing the copper content of the alloy above 6% causes a decrease in the number of SbSn crystals and an increase in their size due to the greater prevalence of CuSn. When the alloy contains less than 2.5% copper, no star-shaped aggregates of CuSn are formed, but only long spines. CuSn is more ductile and softer than SnSb.—A. R. P.

Illinois Zinc Perfects New Alloy for Radio Use [Erayde]. Anon. (*Daily Metal Reporter*, 1931, 31, (186), 5).—Erayde, a zinc-copper-silver alloy, is described as non-magnetic, and is suitable for use in chassis, bases, shields for coils and valves, and other radio parts. The tensile strength is said to equal that of mild steel.—P. M. C. R.

Influence of Recrystallization Temperature and Grain-Size on the Creep Characteristics of Non-Ferrous Alloys. C. L. Clark and A. E. White (*Met. Ind. (Lond.)*, 1932, 41, 225-228, 249-250).—Abstract of a paper read before the American Society for Testing Materials. See *J.*, this volume, p. 432.—J. H. W.

On the Electrolysis of Molten and Solid Alloys. R. Kremann (*Berg- u. Hüttenmannisches Jahrb.*, 1930, 78, (1), 1-11; *C. Abs.*, 1931, 25, 3247).—Experimental investigations on the electrolysis of molten alloys are described. The effect of electrolysis increases with time until it reaches a maximum, thereafter remaining constant. The effect of electrolysis reaches a maximum at 50% concentration of a metal in binary alloys, whence it falls again to zero at 100% of the metal. A general review is given of K.'s work since 1924 on the electrolysis of the binary and ternary alloys. The electrolysis of solid zinc-antimony and lead-bismuth alloys is studied at room temperature, at 300° C., and at 100° C. The possibility of the technical application of the electrolysis of alloys appears evident.—S. G.

On Dia- and Para-Magnetism in Metallic Solid Solutions. E. Vogt (*Ann. Physik*, 1932, [v], 14, 1-39).—The magnetic properties depend on the structure of the atom, so that the results of magnetic measurements allow conclusions to be reached in future as to the behaviour of the metal atoms in alloys. In gold-silver alloys the susceptibility shows deviations from the linear law of mixtures; the same applies to gold-copper alloys. CuAu has a smaller, and Cu₃Au a higher, susceptibility than the solid solution. During the transformation of CuAu the susceptibility curve is similar to that of the electrical conductivity. Measurements on gold-palladium alloys at temperatures down to -180° C. show irregularities, from which it is concluded that a transformation takes place at low temperatures. This system and the gold-platinum and palladium-platinum alloys show marked deviations from the linear law. The magnetism of palladium-gold alloys saturated with hydrogen has also been examined. The susceptibility of worked gold-silver alloys decreases during annealing, whilst that of gold-palladium alloys increases.—v. G.

A Method of Discussing the Magnetic Moments of Alloys and the Common Measure of Atomic Moments. R. Forrer (*Compt. rend.*, 1930, 190, 1284-1287; *C. Abs.*, 1930, 24, 4673).—In the ferro-magnetic alloys the mean atomic moment is a linear function of the atomic concentration of one of the constituents over a more or less extended range. This is explained by the "principle of substitution" which is generalized to include the possibility of changes in the moments of neighbouring atoms produced by the addition of one of the constituents. On these assumptions it is shown that the slope of the line giving mean atomic moment as a function of atomic concentration represents the change, ΔM , in the total number of magnetons per substituted atom. When this theory is applied to the nickel-copper, nickel-cobalt, iron-nickel, and iron-cobalt alloys, the results, in general, agree excellently with the experimental values. Except in two cases, the values of ΔM are approximately integral numbers, and in these two cases there is some experimental justification for the fractional numbers. Unlike the results calculated from the Curie constant, these values do not require choosing between the classical and the quantum formulæ.—S. G.

Ternary Diagrams. H. Thyssen and J. Dessent (*Rev. Univ. Mines*, 1930, [viii], 3, 97-105; *Eng. Index*, 1930).—Notes are given on the application of the three-dimensional diagram (graphical models) to the study of ternary alloys.—S. G.

III.—CORROSION AND PROTECTION

(Continued from pp. 608-614.)

CORROSION

Aluminium Corrosion in Breweries. M. Bosshard and — Zurbrügg (*Aluminium Broadcast*, 1931, 3, (15), 5-9).—Corrosion of aluminium brewery vats is a rare occurrence, but possible causes are examined in detail. Segregations, non-metallic inclusions, and small iron or copper particles picked up in rolling are all possible causes of corrosion. Surface impurities should be removed by scraping. In assembly and service, the accumulation of dirt, the improper use of soda, or the accumulation of particles of copper, may cause corrosion. Electrolytic corrosion is especially to be feared if copper cooling coils are used; in this connection Anticorodal floats are recommended.—J. C. C.

Electric Currents in Aluminium Vessels. Anon. (*Brewer's J.*, 1932, 68, 421-422).—Describes the detection and measurement of electric currents which cause corrosion in aluminium brewery vessels. A galvanometer, sensitive to 0.04 m.amp. and resistances to increase the range for 0-25, 0-50, 0-100, and 0-200 m.amp., are used. Distinction must be made between wandering and galvanic currents, the former being harmless.—H. W. G. H.

Milk Products and Metals. —. Osterburg and T. Liepus (*Aluminium Broadcast*, 1931, 3, (6), 2-18).—A translation of extracts referring to aluminium, with a bibliography of 111 references, from a literature review published in *Milchwirtschaftlicher Literaturbericht*, 1930, (36), June 6. The matters dealt with include the effect of impurities in aluminium on its corrosion resistance, its corrosion resistance in various liquids, and its special advantages in the construction of dairy plant. The original article is divided into 3 sections dealing with (a) the characteristics of metals used in dairy work; (b) the effect of metals on the taste of dairy produce and the colour of cheese; (c) the relative advantages of tin and aluminium foil for wrapping cheese.—J. C. C.

Aluminium-Chromium Alloys. G. Gallo and G. Frangipane (*Aerotecnica*, 1931, 11, 1539-1554).—Aluminium-chromium alloys with up to 6% chromium were prepared, and various determinations and tests were made with regard to their corrosion by sea-water, using the "Tödt" apparatus. A similar research was conducted on chromium-Duralumin. Chromium is said to increase hardness and corrosion-resistance to a considerable extent, but this applies only in the case of pure aluminium. Added to Duralumin, it diminishes to a great extent the mechanical properties of the alloy. A tentative explanation is given of the results, based on the series of electrolytic potentials.—G. G.

The Rapid Development of Patina on Copper. John R. Freeman, Jr., and P. H. Kirby (*Metals and Alloys*, 1932, 3, 190-194; and (abstract) *Compressed Air Mag.*, 1932, 37, 3947).—A method of producing an adherent green patina on copper tiles and sheets used in architectural work is described. The solution used comprises 10% ammonium sulphate which has been blown with air in the presence of copper turnings until the p_H is reduced to 5.5-5.7 and the walls of the vessels are coated with a basic salt. The metal to be coated is immersed intermittently in this solution at 60° C. until the desired thickness is obtained, then boiled with water to convert the coating into artificial brochantite. The work must be thoroughly cleaned before treatment. The coating will then resist weathering in industrial and marine atmospheres apparently indefinitely.—A. R. P.

Accelerated Weathering Tests of Soldered and Tinned Sheet Copper. Peter R. Kisting (*Metal Ind. (Lond.)*, 1932, 41, 133-135, 148-149).—Abstract from *U.S. Bur. Stand. J. Research*, 1932, 8, 365. See *J.*, this volume, p. 355.

—J. H. W.

Corrosion of Bronzes by Vinegar. E. M. Mrak and J. C. LeRoux (*Indust. and Eng. Chem.*, 1932, 24, 797-799; and (abstract) *Met. Ind. (Lond.)*, 1932, 41, 132).—A number of lead-tin bronzes and other copper alloys were tested in 3 ways, viz. by simple immersion, by aeration, and by spray tests, the cider vinegar used being standardized to 4.27% acetic acid. Strips of copper, tin, and lead were also tested under the same conditions. Of the 3 tests, all the metals and alloys with the exception of tin were attacked more severely by the aeration than by the immersion test and still more severely by the spray test. Tin was superior to all the others in the spray tests, probably owing to the formation of a thin white protective film. In all the other cases, rapid oxidation was responsible for a great increase in corrosion in the spray tests. Tin alone (20%) in bronze has no inhibiting effect on corrosion in the aeration tests, this bronze indeed being inferior to copper. In the spray tests, however, the positions are reversed. Copper is superior to all the others in the immersion and aeration tests. Lead offered the least resistance of all in all 3 tests, and corrosion of bronzes increased with increase in lead content. It is recommended that none of the bronzes tested be used in the vinegar industry.—F. J.

Corrosion of [Brass] Evaporator Tubes. F. J. Bullen (*Internat. Sugar J.*, 1932, 34, 151-153; *Chem. Zentr.*, 1932, 103, I., 3109).—The tubes used in sugar evaporators must be resistant to corrosion by acids and acid vapours, air, and sugar syrup, as well as to erosion by gases and liquids. An alloy (composition not stated) has been discovered which has withstood attack in a sugar refinery for more than 8 years.—A. R. P.

Tarnish-Resistant Silver Alloys. K. W. Ray and W. N. Baker (*Indust. and Eng. Chem.*, 1932, 24, 778-781; and *Met. Ind. (Lond.)*, 1932, 41, 127-129).—The ternary system silver-zinc-aluminium, from 75 to 100% silver, and several other alloys were examined with a view to discover, if possible, an alloy having the intrinsic value, hardness, and malleability of sterling silver (silver 92.5, copper 7.5%) and, in addition, a very high resistance to tarnishing. Aluminium alone, up to 4%, gave no increase in tarnish-resistance, nor in hardness; beyond 4%, hardness and brittleness ensued. Zinc gave the greatest tarnish-resisting effect of all the metals studied, but insufficient increase in hardness; up to 25% zinc, malleability was not impaired. No alloys of the ternary system, silver-zinc-aluminium, of equal hardness to sterling silver, were as malleable. Chromium did not alloy in amounts sufficient to improve tarnish-resistance appreciably, nor was any marked improvement found with barium, strontium, or silicon, the addition of which resulted in brittleness. Beryllium had the effect of actually decreasing the tarnish-resistance as well as conferring hardness and brittleness. Tin-silver alloys containing 5% tin were slightly more tarnish-resistant even than the corresponding zinc-silver alloy, but whereas a further increase in zinc gave better resistance to tarnishing, no such improvement occurred with an increase in tin. Nitriding with ammonia at 500° or 600° C. was valueless either for case-hardening or for tarnish-resistance. Several alloys studied were sufficiently hard and malleable and had greater tarnish-resistance than sterling silver, but none was entirely non-tarnishing.—F. J.

American and British Investigations on the Corrosion of Tin Plate. —. Boury (*Ann. Falsif.*, 1931, 24, 144-146; *C. Abs.*, 1931, 25, 3948).—A brief review of recent investigation of the corrosion of tinfoil by foodstuffs.—S. G.

Report on Internal Corrosion of Zinc-Coated Water Pipes. J. Friedli (*Monats.-Bull. Schweiz. Ver. Gas-Wasserfachmännern*, 1932, 12, 65-73; *Chem. Zentr.*, 1932, 103, I., 3108).—For water pipes a deposit of at least 300 grm. of zinc per m.² is necessary for satisfactory protection against corrosion, especially if the zinc is deposited by electrolysis. Hot-dipping generally gives a better coating than electroplating.—A. R. P.

Corrosion of Commercial Metals and Alloys by Phosphoric Acid Solutions. A. Portevin and A. Sanfourche (*Chim. et Ind.*, 1932, Special No. (March), 360-365).—Cf. this *J.*, 1931, 47, 530, 531.—S. G.

Hypochlorite Corrosion is Cut by Addition of Salts and Bases. G. N. Quam (*Food Industries*, 1930, 2, 121-122; *C. Abs.*, 1930, 24, 3610).— Na_3PO_4 0.1-0.5%, added to NaOCl solutions causes a marked lowering in the corrosive action of hypochlorite on metals. An admixture of 0.5% NaOH- Na_2CO_3 or 0.1% $\text{Ca}(\text{OH})_2$ has a similar action. With block tin, NaOCl alone (255 p.p.m.) dissolved 1.1 mg. of tin in 3 hrs. from 3 in.² of surface. The addition of 0.1-0.5% of several detergents reduced the amount of dissolved tin to 0.1-0.4%. The action on nickel, "stainless" steel, and Monel metal was very similar. The rate of deterioration of NaOCl stabilized with NaOH is lower than that stabilized with Na_3PO_4 . The germicidal value of the NaOCl probably is unimpaired by the addition of detergents.—S. G.

Corrosion in Neutral Waters. Ira D. Van Giesen (*J. Amer. Water Works Assoc.*, 1932, 24, 984-994; *C. Abs.*, 1932, 26, 4896).—Corrosion in neutral waters is electrolytic. Van G. outlines the electromotive series and its application.—S. G.

Corrosion from Flue Gases. David Brownlie (*Eng. Rev.*, 1931, 45, 206-207).—B. attributes much of the corrosion of steam-generating plant to excessive sulphur content in the coal, pure lead, as well as lead-antimony alloys, being attacked by the gases at 93° C.; this would indicate a far higher concentration of sulphuric acid in the moisture film than is generally supposed. Careful selection of coal, better design of heaters and economizers, and, where possible, the use of non-corrodible alloys are among B.'s suggestions towards elimination; he emphasizes especially the necessity for pre-heating inlet water, thus obviating local strains likely to result in corrosion-fatigue.—P. M. C. R.

An Unusual Case of Severe Corrosion and its Cause. Anon. (*Eng. Rev.*, 1930, 44, 275-276).—A case of severe corrosion of marine boiler, steam-pipe, feed-water, and auxiliary systems is described, and the cause is traced to leakage in the feed-water heater.—P. M. C. R.

Galvanic Corrosion. Possible Galvanic Effects in the Corrosion of Metals in Milk. W. A. Wesley, H. A. Trebler, and F. L. La Que (*Trans. Electrochem. Soc.*, 1932, 61, 459-475).—See *J.*, this volume, p. 345.—S. G.

Generalization of the Electrochemical Theory of the Oxidation of Metals in a Wet Medium. E. Herzog (*Chim. et Ind.*, 1932, Special No. (March), 351-359; *C. Abs.*, 1932, 26, 3472).—A general discussion of the mechanism of corrosion and protection of metals.—S. G.

The Distribution of Corrosion. S. C. Britton and U. R. Evans (*Met. Ind. (Lond.)*, 1932, 40, 567-570, 599-600).—Read before the Electrochemical Society. See *J.*, this volume, p. 232.—J. H. W.

On Phenomena of Cathodic Passivity. E. Liebreich (*Z. physikal. Chem.*, 1931, [A], 156, 51-76).—Just as is the case with other metals, there is a range of current density in the cathodic polarization of zinc in 0.1N-sulphuric acid in which mechanical passivity occurs. This range lies on that part of the current density-potential curve which commences to rise. A method of following the change of potential of the cathode with increasing polarization is described; it involves connecting the cell as a shunt so that the current strength in the main circuit is almost independent of changes in the shunt circuit. During the formation of the passivating film with increasing current density the potential of the cathode remains constant despite increasing polarization; simultaneously the current density has a tendency to fall. With decreasing polarization, loosening of the passivated film always occurs, contrary to the behaviour of other metals. This is rendered evident by a sudden fall in the potential to more negative values, by the commencement of a vigorous evolution of hydrogen, and by a rapid increase in the current density.—B. Bl.

Corrosion-Resisting Metals for Collieries. C. H. S. Tupholme (*Colliery Eng.*, 1930, 7, 310-311).—Besides stainless iron, the following alloys are considered: Maxilvry (nickel-chromium-iron with a small addition of copper), Duriron, Durimet (nickel up to 35%, silicon, chromium, carbon, and iron), and Everdur. Protective processes noticed are chromium plating, nitriding, metal spraying, and "Fescolizing." The last-named is described as an electrochemical process for depositing nickel, copper, chromium, or cadmium without application of heat. Its use is recommended in the building up of worn parts.
—P. M. C. R.

PROTECTION

Treating the Surface of Aluminium Vessels. Anon. (*Brewery Trade Rev.*, 1932, 46, 371).—The "Eloxal" process (see *J.*, this volume, p. 30) for producing a protective film on aluminium is being investigated by the Brewery Institute in Berlin with a view to its use for brewery vessels.—H. W. G. H.

The Anodic Oxidation of Aluminium and its Alloys. W. L. (*Light Metals Research*, 1932, 2, (4), 1-20; (8), 1-5).—A comprehensive review of the literature on the properties of anodic oxide films and the methods of producing these on aluminium and its alloys. In a foreword, the relative advantages of anodic and chemical oxidation processes are discussed. The throwing power of the anodic process is remarkable, but the coatings are liable to be slightly hygroscopic. An account of recent theories of film formation is given, the properties of the films are outlined, and the effect of the conditions of formation in modifying the properties is discussed. Attention is directed to the difference in the film texture demanded for corrosion resisting and electrical insulating purposes. The main features of the various processes are tabulated, and details given of the present stage of commercial development of each. Subsidiary treatments of the film are discussed. Appendices contain an extensive list of applications of the process, a selected bibliography, and a chronological table of patents and patent applications.—J. C. C.

Protection of High-Strength Light Alloys Against Corrosion. M. Marchies (*Bull. tech. Bureau Veritas*, 1929, 11, 258-259; *Eng. Index*, 1930).—The types of alloys dealt with are aluminium alloys, such as Duralumin, containing 94-95% aluminium, which have a sp. gr. below 3 tons/m.² and a tensile strength equal to that of mild steel. The question of corrosion and its prevention is discussed.—S. G.

The Surface Treatment of Aluminium and its Alloys. Anon. (*Aluminium Broadcast*, 1931, 3, (7), 11-25).—Intelligence Memorandum No. 16 of the British Aluminium Co., Ltd. See *J.*, 1931, 47, 385, 568, 602.—J. C. C.

Aluminium-Coated Duralumin. Anon. (*Machinery (N.Y.)*, 1930, 36, 605).—A brief note to the effect that the [U.S.] Bureau of Standards has proposed the use of pure aluminium as a protective coating for Duralumin, especially when the latter is to be used for aircraft construction, on account of its greater corrosion resistance. Tests have shown that the coated material will withstand 10⁸ alternations of stress.—H. F. G.

Protection of Aluminium and Duralumin by Means of Zinc and Cadmium Electrolytic Coatings. M. Gambioli (*Aerotecnica*, 1932, 12, 314-320).—After mentioning the various methods usually employed for the protection of aluminium and Duralumin (varnishes, anodic oxidation, parkerizing, protalization, &c.), and after having cited the studies of Cournot, Cazaud, &c., G. describes some experiments which he carried out to obtain good electrolytic coatings of cadmium and zinc. The procedure finally employed is described in detail, and a number of corrosion tests are mentioned; they show the high efficiency of these methods of protection.—G. G.

Zinc-Plating of Ferrous Materials by Immersion and by Sherardizing. G. Calbiani (*Metallurgia italiana*, 1932, 24, 728-736).—The electrochemical theory of rusting, methods of protecting ferrous metals, zinc-plating by the hot immersion and by sherardizing, and laboratory and practical tests for

resistance to corrosion are discussed. It is concluded that the first of the two methods is by far the most valuable and that it is the best method for protecting iron against various corroding agents.—G. G.

Hot Galvanizing as it Affects Mild Steel. J. C. Allan and R. L. Geruso (*Heat-Treat. and Forging*, 1930, 16, 70-75; *Eng. Index*, 1930).—A discussion of the effect of hot-galvanizing on the physical properties of cold-worked steel, which has been studied with particular reference to bolt-steel grades. Galvanizing has a deleterious affect on the physical properties of cold-worked steel to an even greater extent than if the steel is merely annealed at 440° C. after overstrain. Common failures of galvanized bolts are analyzed. Cold-worked steel should be thoroughly annealed before galvanizing.—S. G.

Sal-Ammoniac and Flux Conditioners in Metalware Galvanizing. Wallace G. Imhoff (*Amer. Metal Market*, 1932, 39, (115), 5, 8; (116), 8; *C. Abs.*, 1932, 26, 4283).—The characteristics of numerous varieties of sal-ammoniac used for galvanizing, their use in practice, impurities, &c., are described in detail. Sawdust and glycerol are the two most popular flux conditioners.—S. G.

Effect of Zinc Coatings on the Endurance Properties of Steel. W. H. Swanger and R. D. France (*U.S. Bur. Stand. J. Research*, 1932, 9, 9-24; *Research Paper No. 454*; and (summary) *Automotive Ind.*, 1932, 67, 175).—See *J.*, this volume, p. 482.—S. G.

Some Factors Affecting the Preece Test for Zinc Coatings. H. H. Walkup and E. C. Groesbeck (*Met. Ind. (Lond.)*, 1932, 41, 177-178, 201-202).—Abstract of a paper read before the American Society for Testing Materials. See *J.*, this volume, p. 481.—J. H. W.

A Metal Coating Process. Anon. (*Colliery Eng.*, 1930, 7, (71), 32-33).—The Metalayer spraying process feeds metal wire automatically into an oxy-acetylene, oxy-hydrogen, or oxy-coal-gas flame, an air blast projecting the metal on to the surface to be coated. The cooling effect of the blast produces very rapid solidification, so that sensitive and combustible materials can be treated without excessive heating.—P. M. C. R.

The New Protection [Against Corrosion] for Metals. J. Rappaport (*Metalware Ind.-u. Galvano-Tech.*, 1932, 30, 177-178).—A new lacquer ("Parabernol") made by dissolving amber in certain solvents (nature not disclosed) has proved very valuable for protecting highly burnished metals from tarnishing. Films of Parabernol on highly polished metals will withstand sudden temperature changes within the range -13° to $+60^{\circ}$ C. without developing hair-cracks or flaking. The lacquer can be applied by painting or spraying, and the films rapidly harden when heated at 40° C. The films have withstood weathering in the open air for more than 4 months and are completely inert to salt water.—A. R. P.

Production Spray Booths. G. A. Holmes (*Canad. Mach.*, 1932, 43, (13), 21-22).—The increasing use of lacquer finishes necessitates efficient spraying equipment and easy removal of fumes. The latter process is best effected by confining fume production to a booth enclosure provided with an exhaust system. Tunnel booths are used when the objects to be sprayed are introduced and removed on conveyors; open-front booths are designed for the special type of work to be treated, and often contain a rotating table. Types of stock, methods of eliminating pigment from fan blades, and precautions against fire are described.—P. M. C. R.

Gasket Material. Developed by G. E. Laboratory. Anon. (*Automotive Ind.*, 1932, 67, 398).—An odourless, sulphur-free resin product, glyptal, is described as flexible and almost incompressible. The material shows slight brittleness below -18° C., but without affecting jointing efficiency. Bushing assemblies of glyptal with porcelain, brass, copper, and cast iron are said to withstand alternate heating and cooling, while under pressure and in contact with oil. Its use is recommended where resistance to hot oil is important. Directions for fitting are given.—P. M. C. R.

IV.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 614-618.)

Dry Polishing will Retain Graphite and Inclusions. S. F. Urban and Richard Schneidewind (*Metal Progress*, 1932, 22, (2), 39-40).—The method here outlined is claimed to give good results, especially in the case of alloys the constituents of which differ widely from each other in hardness, and to minimize rounding at the edges of microspecimens without the use of special mounting.—P. R.

A Study of the Structure of Electrodeposited Metals. L. B. Hunt (*J. Physical Chem.*, 1932, 36, 2259-2271).—In continuation of previous work (see *J.*, this volume, p. 317), H. discusses the mechanism of electrodeposition with special reference to the interference with crystal growth due to ions, molecules, or particles other than those of the metal being deposited. The theory is extended by the consideration of the processes of adsorption and the conception of a two-dimensional lattice distortion leading to refinement of grain structure.—J. S. G. T.

Electrodeposited ϵ -Brass. H. Kersten and Joseph Maas (*J. Physical Chem.*, 1932, 36, 2175-2177).— ϵ -Brass, of composition and structure similar to that of fused ϵ -brass, can be electrodeposited from a cyanide bath of composition: zinc cyanide, 40 gm.; sodium cyanide, 50 gm.; anhydrous sodium carbonate, 30 gm.; water, to make 1 litre, to which small proportions of copper cyanide ranging from 1.50 gm. to 1.70 gm. are added. Stainless steel electrodes are used and a current density of 2 amp./dm.² is employed. The bath temperature is 50° C.—J. S. G. T.

The Kinetics of Crystallization Processes. (Frhr.) v. Göler and G. Sachs (*Z. Physik*, 1932, 77, 281-286).—A mathematical theory of the crystallization process, based on the assumption of constant rates of formation of crystal nuclei and of crystal growth throughout the process, is developed.—J. S. G. T.

The Rhythmic Crystallization of Melts. I.—A Preliminary Investigation of the Factors Influencing the Phenomenon. John Frederick James Dippy (*J. Physical Chem.*, 1932, 36, 2354-2361).—The production of rhythmic crystallization, i.e. the occurrence of pulsations of growth of crystals, has been observed in the case of thin films of many organic compounds. Supercooling, the presence of an air-interface, and thickness of film are found to control the phenomenon.—J. S. G. T.

A Geometrical Method of Determining the Crystal Axes of Single-Crystal Wires. Bruce Chalmers (*Phil. Mag.*, 1932, [vii], 14, 612-616).—The extension of single-crystal wires of soft metals leads to the occurrence of glide, accompanied by the production of elliptical surface-markings. The axial directions can be deduced from measurements of one of these markings representing the intersection of the glide plane with the surface of the wire, and the displacement of this plane relative to a fixed parallel plane. The geometrical theory of the method is developed. Results accurate to about 1° are given for cadmium.—J. S. G. T.

Evidence of Mosaic Crystals in Copper and Platinum. F. W. Constant (*J. Elisha Mitchell Sci. Soc.*, 1932, 47, 25; *C. Abs.*, 1932, 26, 2679).—Small pieces of copper and platinum were annealed for 3 hrs. at 1000° C. and 1500° C., respectively, ground on one side, polished, and then etched with nitric acid. Photomicrographs showed regularly spaced planes believed to coincide with the π -planes of F. Zwicky's theory of mosaic crystals. The secondary structure has different directions for each individual of the polycrystal, and the spacing of the lines representing the π -planes is a minimum when the section is taken

normal to this set of planes. The minimum distance was 1.2μ for both metals.—S. G.

X-Ray Studies of Phase Boundaries in Thermal Diagrams of Alloy Systems. Cu-Zn Systems. E. A. Owen and Llewelyn Pickup (*Proc. Roy. Soc.*, 1932, [A], 137, 397-417).—An X-ray camera, with which an accuracy of at least 1 part in 4,000 parts is attainable, has been used to investigate the parameter values of the lattices of the different phases in the Cu-Zn alloy system. All ingots examined were previously annealed, to eliminate lattice distortion and to produce the equilibrium condition. A method of determining the phase-boundary compositions from the composition-parameter relation of each phase is developed. This is based on experimental data showing that (1) the increase in parameter with composition in a pure phase region is independent of temperature, and (2) that the parameter values of both phase lattices in a mixed region are constant for change of composition, but change with temperature. The alloys investigated contained from about 30% to 100% of copper. The copper parameter increases in the pure α -region from 3.607, A. for pure copper to the saturated values 3.694, A. at 400° C., 3.695, at 500° C., 3.686, at 800° C. The $(\alpha)-(\alpha + \beta)$ boundary occurs at 65.4% Cu (800° C.), 63.9% Cu (700° C.), 63.5% (650° C.), 62.5% Cu (600° C.), 62.3% Cu (550° C.), 61.8% Cu (500° C.), 61.7% (450° C.), 61.9% Cu (400° C.), and 62.5% Cu (350° C.). The β -phase parameter varies between 2.934, A. at 800° C. (62.7% Cu) and 2.950, A. at 350° C. (43.2% Cu). The $(\alpha + \beta)-(\beta)$ and $(\beta)-(\beta + \gamma)$ boundaries are respectively 59.4% and 50.1% Cu at 800° C., 58.7% and 50.2% Cu at 700° C., 55.4% and 50.6% Cu at 600° C., 51.6% and 50.7% Cu at 500° C., 53.8% and 50.5% Cu at 400° C., 53.3% and 49.75% at 350° C. The range of the γ -phase parameter is from 8.830, A. at 800° C. (43.2% Cu) to 8.874, A. at 380° C. (30.4% Cu). The $(\beta + \gamma)-(\gamma)$ boundary varies from 41.0% Cu at 800° C. to 41.9% Cu at 380° C. with a maximum copper content of 42.25% at about 500-600° C. With a boundary of this nature, the existence of a true compound of fixed composition, Cu_5Zn_8 , is considered untenable. Good agreement is found between boundary compositions deduced from X-ray measurements and by other methods.—J. S. G. T.

Incidence of Lattice Distortion and Orientation in Cold-Rolled Metals. W. A. Wood (*Phil. Mag.*, 1932, [vii], 14, 656-665).—The rate of production of lattice-distortion and preferred orientation during the cold-rolling of copper, Mumetal, nickel, Constantan, and the transformer steels iron-aluminium (4% Al) and iron-silicon (4% Si) has been determined by X-ray analysis. The degree of distortion plotted against the percentage reduction of thickness gives a definite curve marked by an initial rapid rise of distortion to a constant value. Preferred orientation first appears after about 35-50% reduction of thickness has occurred, and then grows rapidly. Lattice-distortion, when it occurs, reaches its maximum value before preferred orientation appears; it is shown that preferred orientation cannot play a primary part in the changes of properties produced by cold-working. Aluminium, lead, and bismuth exhibited no measurable distortion, and platinum very little.—J. S. G. T.

On the Effect of a Secondary Structure upon the Interference of X-Rays. H. M. Eujen (*Phys. Rev.*, 1932, [ii], 41, 265-273).—Theoretical. v. Laue's dynamic theory of X-ray interference is shown to be applicable with a few slight changes to crystals having a general type of secondary structure. The theory is applied to investigate the effect of such a structure on the nature of the X-ray interference maxima. With the "two-dimensional lattice" type of secondary structure, the general effect is to give a fine X-ray structure, which present apparatus would reveal as a weak diffuse background. This type of secondary structure would not produce a broadening of the primary lines, and the fact that sharp primary lines are obtained is not inconsistent with the existence of a secondary structure.—W. H. R.

The Scattering of Cathode Rays by Crystal Surfaces. F. Kirchner and H. Raether (*Physikal. Z.*, 1932, 33, 510-513).—The principles of the scattering of cathode rays by crystal surfaces are described and illustrated by results obtained with crystals of the cubic class.—J. S. G. T.

X-Ray Method of Determining the Sizes of Sub-Microscopic Crystals. G. Harvey Cameron (*Physics*, 1932, 3, 57-69).—Literature of the subject is critically reviewed and proposed methods of determining the sizes of sub-microscopic crystals are tested experimentally. It is concluded that while relative measurements are possible, absolute values of the sizes cannot be relied on. Experimental conditions necessary for accuracy are briefly discussed.—J. T.

A Method for Deducing Accurate Values of the Lattice Spacing from X-Ray Powder Photographs Taken by the Debye-Scherrer Method. A. J. Bradley and A. H. Jay (*Proc. Phys. Soc.*, 1932, 44, 563-579).—A process of analysis of X-ray spectra, comprising methods of calibration and extrapolation, is discussed. Values of the lattice spacing of iron derived from results with different cameras, using specimens of different diameters, are consistent to 1 part in 15,000 parts, the mean value being 2.8605 Å. The value of the lattice spacing for electrolytic nickel, viz. 3.5162 Å., was found to be slightly different from that for a specimen of Mond nickel, viz., 3.5170 Å.—J. S. G. T.

V.—ANALYSIS

(Continued from pp. 618-621.)

Spectrograph Speeds Identification of Elements in Metals. Joseph Geschelin (*Automotive Ind.*, 1932, 67, 358-359, 377).—The quantitative and qualitative application of spectroscopic methods to the rapid analysis of metals and alloys is described. Quantitative estimation of constituents is accurate only in the case of small percentages; G. advocates the adoption of spectroscopic analysis for: (1) checking composition of material bought on specifications limiting the amount of impurities; (2) rapid identification of unknown substances, e.g. in the sorting of scrap; (3) checking foundry mixtures for production of special alloys; (4) quantitative determination of necessary constituents present in minute amounts, as in the development of new materials. Methods and apparatus are described and illustrated, and some important limitations, especially as regards non-metallic constituents, are noted.—P. M. C. R.

Bronze Analysis. P. W. Uhl (*Chemist-Analyst*, 1932, 21, (4), 4-5).—The sample is dissolved in 1:1 HNO_3 and the $\text{SnO}_2\text{-P}_2\text{O}_5$ precipitate is collected, ignited, and weighed. Digestion of the ignited precipitate with boiling 1:3 HCl is said to remove the P_2O_5 without affecting the SnO_2 , which can then be weighed and the P_2O_5 determined by difference. The filtrate from the $\text{SnO}_2\text{-P}_2\text{O}_5$ is used for the determination of Pb as PbSO_4 , Cu by electrolysis, and Fe and Al after separation by the NaOH method.—A. R. P.

Testing Precious Metals with the Touchstone. C. M. Hoke (*Brass World*, 1932, 28, 159-160, 185-186).—(I.) Practical hints for the identification of Pt, Pd, and Au in the presence of one another are given and the use of dimethylglyoxime in the detection of Ni and Pd in precious metal alloys is described. (II.) Describes miscellaneous tests, the action of the blowpipe flame, sp. gr. tests, and the interpretation of carat marks. (See also J., this volume, p. 553.)—J. H. W.

Copper Foil as a Test for Antimony. B. Koone (*Chemist-Analyst*, 1932, 21, (4), 7).—In the Zn-Pt foil test for Sb, the Pt may be replaced by a clean piece of Cu foil.—A. R. P.

Differentiation of Lithium and Strontium by Flame Coloration. E. Macciotta (*Rendiconti Seminario Facolta Scienze Universita Cagliari*, 1931, 1, 55-56; *Chem. Zentr.*, 1932, 103, I., 3324).—A small quantity of the substance is held on a Pt wire in the lower part of the bunsen flame; in the presence of

lithium the whole flame becomes intensely red. If the substance is now moistened with HCl a rain of red scintillations appears if Sr is present; the colour remains permanent in the hottest part of the flame. Ba and Na interfere.—A. R. P.

Separation [of Lead and Tin from Zinc, Nickel, and Manganese] by Means of Hydrogen Sulphide. A. Lassieur (*Chim. et Ind.*, 1932, Special No. (March), 153-156; *C. Abs.*, 1932, 26, 3454).—Although Zn alone is precipitated very slowly at p_H 1.2, in the presence of Pb or Sn it is precipitated almost completely by passing H_2S for 1 hr. and setting aside for 30 minutes; quantitative separation of Pb and Sn from Zn can, however, be effected in 0.42N-HCl by passing H_2S through the cold solution for 1 hr. and setting aside for 18 hrs.

—S. G.

A Simple Method for the Separation of Cadmium and Bismuth in Fusible Alloys. W. H. Keefe and I. L. Newell (*Chemist-Analyst*, 1932, 21, (2), 8-10).—The sample is dissolved in HNO_3 , the SnO_2 removed, and the Pb precipitated as $PbSO_4$. Bi is precipitated with H_2S in 25% H_2SO_4 , the Bi_2S_3 is dissolved in HNO_3 , and the Bi determined as $BiOCl$. The filtrate from the Bi_2S_3 is nearly neutralized with NH_4OH , the Cd precipitated as CdS , and weighed as $CdSO_4$.

—A. R. P.

Determination of Titanium in Alloy Steels. (Separation of Titanium from all Possible Constituents of Alloys. Gravimetric Determination of Titanium in the Purest Form as Titanium Dioxide and its Colorimetric Determination by Weller's Method.) J. Arend (*Z. anal. Chem.*, 1932, 89, 96-100).—Ti may be separated quantitatively from Fe^{++} , Cr^{+++} , Mn^{++} , Co^{++} , Ni^{++} in a CO_2 atmosphere by precipitation with $BaCO_3$. The precipitate is washed with hot CH_3COOH to remove excess of $BaCO_3$, fused with $NaHSO_4$, and the remaining Cu and Fe removed with H_2S in alkaline tartrate solution. The Ti is then precipitated in the acidified filtrate by addition of 8-hydroxyquinoline.—A. R. P.

Improved Method for the Analysis of Gaseous Elements in Metals. N. A. Ziegler (*Electrochem. Soc., Preprint*, 1932, Sept. 175-187).—An apparatus is described and illustrated for determining the gases in metals by heating the sample in a graphite crucible in a vacuum induction furnace, whereby the O_2 is evolved as CO and the H_2 and N_2 are evolved in the elementary state; under the conditions of the test no CO_2 or H_2O is formed. Details and apparatus for collecting, measuring, and analyzing the gases are given. With steel and Ni, all the oxides, even SiO_2 and Al_2O_3 , are completely reduced with evolution of the corresponding quantity of CO; the results obtained are accurate to 0.002%.—A. R. P.

The Prevention of Anodic Losses of Platinum in the Electrolysis of Alkaline Solutions, Especially Ammoniacal Solutions. Erich Reichel [with Werner Beck] (*Z. anal. Chem.*, 1932, 89, 411-421).—In the electrolytic determination of Zn, Ni, Co, or Ga using NaOH or NH_3 electrolytes anodic dissolution of Pt may be prevented by addition of N_2H_4 or NH_2OH salts to the solution.—A. R. P.

Determination of Small Quantities of Antimony in Copper and its Alloys. Wolfgang Boehme and Werner Raetsch (*Z. anal. Chem.*, 1932, 88, 321-324).—Blumenthal's statement that Sb is not completely precipitated by NH_4OH from HNO_3 solutions containing Fe^{+++} is true only if a solution of Sb and Cu salts is used, but if an alloy is dissolved in HNO_3 , and $FeCl_3$ and NH_4OH are then added, all the Sb is carried down by the $Fe(OH)_3$ precipitate.—A. R. P.

Electrochemical Determination of Small Quantities of Arsenic. — Scheremesser (*Pharm. Zeit.*, 1932, 77, 112; *Chem. Zentr.*, 1932, 103, I, 3205).—The apparatus used comprises a U-tube filled with 10% H_3PO_4 and Pb electrodes in each limb. The solution to be tested is introduced into the cathode side and the H_2 and AsH_3 are liberated and passed through a tube containing a Pt or Au filament inside and a metal ring outside; high a.c. between these electrodes decomposes the AsH_3 with the deposition of an As mirror on the tube.—A. R. P.

New Electrolytic Apparatus for Determining Small Quantities of Arsenic and its Application to the Determination of Arsenic in the Presence of Antimony. G. Damany (*Chim. et Ind.*, 1932, Special No. (March), 167-174; *C. Abs.*, 1932, 26, 3453).—A simple, inexpensive apparatus requiring no diaphragm of any sort consists essentially of a 250-c.c. flask closed by a paraffined cork or glass stopper carrying 4 tubes: (1) CO_2 inlet opening just above the level of the liquid, to replace the air before starting the analysis; (2) outlet for the gases containing AsH_3 ; (3) a tube sealed at the bottom and filled with Hg to form an electrical contact, through which passes a Pt-wire hook to carry the coiled double gauze Pt cathode, which is placed as near the bottom of the flask as possible; (4) a tube reaching nearly to the bottom of the flask and containing a Pt strip 0.3×3 cm. coiled into a spiral anode. The anodic O_2 thus escapes freely into the air without mixing with the gases liberated at the cathode. The technique of the process is described, and the necessary precautions are explained, with especial reference to the effect of Sb on the results. With experience As may readily be determined in the presence of 100 times as much Sb.—S. G.

The Determination of Cadmium in Cadmium Cyanide Baths. G. B. Hills (*Chemist-Analyst*, 1932, 21, (2), 7-8).—The solution (10 c.c.) is evaporated with 15 c.c. of 1:1 H_2SO_4 and HNO_3 until SO_3 fumes are evolved and organic matter is destroyed. The solution is diluted to 200 c.c., treated with 7 c.c. of HNO_3 , and electrolyzed to remove Cu. The electrolyte is again evaporated, the Fe removed with NH_4OH , and the filtrate acidified with HCl and, after addition of 15 gm. of sodium acetate, titrated with $\text{K}_4\text{Fe}(\text{CN})_6$ using $\text{UO}_2(\text{CH}_3\cdot\text{CO}_2)_2$ as indicator.—A. R. P.

Application of Spacu's Reaction to the Micro-Determination of Copper. J. Golse (*Bull. Soc. Pharm., Bordeaux*, 1931, 69, 247-269; *Chem. Zentr.*, 1932, 103, I., 3090-3091).—The Cu is separated from Zn and other interfering metals by precipitating with $\text{Na}_2\text{S}_2\text{O}_3$, the precipitate is ignited to oxide, the oxide is dissolved in HNO_3 , and the solution evaporated with HCl to dryness. The residue is dissolved in 6 c.c. of 0.1N- $\text{CH}_3\cdot\text{CO}_2\text{Na}$, the solution diluted to 10 c.c., treated with 1 c.c. of $\text{C}_5\text{H}_5\text{N}$, 5 c.c. of 0.05N-NaCNS, and 20 c.c. of CHCl_3 , and thoroughly shaken to extract the Cu pyridine thiocyanate. The aqueous layer is evaporated to dryness, the residue dissolved in 10 c.c. of H_2O , and the excess NaCNS destroyed with NaOBr , the excess of which is determined iodometrically. A blank test with all the reagents is run and the difference between the two titrations gives the $(\text{CNS})_2^{\frac{1}{2}}$ equivalent to the Cu.—A. R. P.

Estimation of Small Amounts of Iron in Copper. Bert Park (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1932, 4, 247-248).—In sampling Cu by cutting with Fe tools serious contamination of the surface of the metal with Fe may occur, hence the turnings should be treated with cold 1:10 HCl for 2 hrs. prior to weighing the sample for assay. Stellite tools cause much less serious contamination than ordinary steel tools; high-speed tungsten-steel tools cause nearly 3 times as much contamination as Stellite.—A. R. P.

On the Determination of Silver in Solutions of Potassium Argentocyanide [Silver Plating Baths]. A. Wogrinz (*Z. anal. Chem.*, 1932, 89, 120-121).—The Ag is separated by treating the bath with NaOH and fine Al powder (free from grease). The deposit is washed, dissolved in HNO_3 , and the Ag determined volumetrically with NH_4CNS .—A. R. P.

Determination of Sodium in Aluminium. I.—Chemical Analysis. R. W. Bridges and M. F. Lee (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1932, 4, 264-265).—Three methods are described: (A).—The metal is melted in an Fe crucible and kept just above the melting point for 15 minutes; after cooling, crucible and button are leached with H_2O and the Na in the solution is determined volumetrically with 0.01N- H_2SO_4 and back-titration with NaOH

using methyl-red as indicator. The process should be repeated until no more Na is removed. (B).—The metal (1 gm.) is dissolved in 1 : 1 HCl, the solution evaporated to 5 c.c., and the Na precipitated by adding 100 c.c. of Zn- UO_2 acetate reagent. Next day the precipitate is collected in a sintered glass crucible, washed first with the reagent, then with $\text{C}_2\text{H}_5\text{OH}$, and finally with $(\text{CH}_3)_2\text{CO}$. After drying at 105°C . the substance contains 1.495% Na. The reagent is made by dissolving $\text{UO}_2(\text{CH}_3\text{CO})_2$ 10, $\text{Zn}(\text{CH}_3\text{CO})_2$ 30, and $\text{CH}_3\text{CO}_2\text{H}$ 9 gm. in H_2O and diluting to 130 c.c. (C).—The metal is dissolved in HNO_3 with the aid of HgCl_2 and the Al removed as $\text{Al}(\text{NO}_3)_3$, aq. by crystallization from conc. HNO_3 . The filtrate is evaporated and the remaining Al, &c., removed with NH_4OH and H_2S . Finally, the Na is weighed as Na_2SO_4 . All operations are conducted in quartz vessels and a blank is put through with all the reagents.—A. R. P.

Direct Gravimetric Determination of Sodium in Commercial Aluminium. Earle R. Caley (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1932, 4, 340-341).—The method is similar to that described by Bridges and Lee (cf. preceding abstract, method B) except that MgUO_2 acetate is used instead of the ZnUO_2 compound.—A. R. P.

Determination of Sodium in Aluminium. II.—Spectrographic Analysis. A. W. Petrey (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1932, 4, 265-267).—The metal is burnt in a graphite arc and the spectrum obtained compared with that produced by standards containing known percentages of Na previously determined by chemical analysis. The lines used for comparison are λ 5889.97 and 5895.93 for up to 0.02% Na and λ 5682.68 and 5688.22 for 0.02-0.04% Na.
—A. R. P.

A Rapid Method of Dissolving Lead Alloys Preparatory to the Determination of Tin and Antimony. B. S. Evans (*Analyst*, 1932, 57, 554-559).—To avoid difficulties due to the insolubility of metastannic acid Pb-Sn alloys may be dissolved by heating with 15 c.c. of 60% HClO_4 and 10 c.c. of syrupy H_3PO_4 in a flask fitted with a condenser and a trap containing 1 : 1 HCl to collect any SnCl_4 which may distil. Sn may then be determined by diluting the contents of the flask and trap with H_2O , reducing the SnCl_4 with NaH_2PO_2 , and titrating the SnCl_2 with I_2 . For Sb-Pb alloys the H_3PO_4 should be omitted; the solution of the alloy in HClO_4 is boiled with dilute HCl, reduced with SO_2 , and titrated directly with KBrO_3 .—A. R. P.

Determination of Tin in Ferrotungsten and in Tungsten Ores. Karl Kiefer (*Z. anal. Chem.*, 1932, 88, 243-249).—The alloy (5 gm.) is fused with Na_2O_2 in an Fe crucible, the melt dissolved in 150 c.c. of H_2O , and the solution mixed with 200 c.c. of HCl, which precipitates most of the W as hydrated WO_3 . A few Fe turnings are added to reduce MnO_2 , the solution is diluted to 500 c.c., and the WO_3 filtered off; 200 c.c. of the filtrate are heated with 1.3 gm. of Al powder to reduce Sn^{++++} to Sn^{++} and remaining WO_3 to blue W_2O_5 . When all the Al is dissolved, FeCl_3 solution is added until the blue colour changes to yellow, and the remaining WO_3 is precipitated in a readily filtrable form. The filtered solution is reduced with 0.2 gm. of Al and the SnCl_2 titrated as usual with I_2 .—A. R. P.

The Titration of Divalent Tin with Potassium Chlorate. Rosa M. Kulwarskaja (*Z. anal. Chem.*, 1932, 89, 199-201).— SnCl_2 may be titrated accurately with KClO_3 in hot concentrated HCl using 1 drop of 0.1N- FeCl_2 solution as indicator. When all the SnCl_2 is oxidized the liquid becomes yellow. Large quantities of FeCl_2 interfere, but Sb and As are without action. The method may be used for the determination of Sn in alloys &c. after reduction to SnCl_2 by Pb or Sb.—A. R. P.

Quantitative Separation of WC and W_2C from Tungsten, and the Conditions of Formation of the Two Carbides. Ichirō Iitaka and Yasuzo Aoki (*Bull. Chem. Soc. Japan*, 1932, 7, 108-114).—[In English.] WC reacts vigorously

with Cl_2 at 800°C ., W at 550°C ., and W_2C below 550°C .. The difference in reactivity allows a separation to be effected by means of Cl_2 . When powdered W and C are heated together, W_2C is formed chiefly at low temperatures; with rise of temperature the formation of WC increases rapidly, and remains undecomposed even after very slow cooling.—E. S. H.

Use of 8-Hydroxyquinoline, Strychnine, Brucine, and Quinoline in the Separation of Vanadium from Arsenic. A. Jilek and V. Vicoický (*Chem. Listy*, 1932, 26, 16–18).—These reagents precipitate vanadate free from arsenate from CH_3COOH solutions of the two acids; ignition of the precipitates gives V_2O_5 . As can be recovered from the filtrate by precipitation with H_2S , but the results obtained are usually a little high.—A. R. P.

Rapid Determination of Zinc and Other Impurities in Cadmium. H. G. Isbell (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1932, 4, 284–286).—Colorimetric methods are described for the determination of small quantities of Zn, Cu, Fe, and As in commercial Cd. Zn is determined as $\text{ZnCu}[\text{Hg}(\text{SCN})_2]_2$ adsorbed in an excess of $\text{ZnHg}(\text{SCN})_4$, Cu by the xanthate method, Fe with thioglycollic acid, and As by the Gutzeit test. Pb is determined electrolytically as PbO_2 and S volumetrically with I_2 by the evolution method.—A. R. P.

On the Determination of Small Quantities of Zinc in Nickel. A. Wogrinz (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 229).—The solution of the metal in HCl is neutralized with NaOH and sufficient KCN added to convert the metals present into double cyanides; 5 grm. of Na_2S are added, and the solution is set aside for 24 hrs. The precipitated ZnS is collected, washed with dilute $\text{CH}_3\text{CO}_2\text{Na}$, and converted into $\text{Zn}_2\text{P}_2\text{O}_7$ for weighing.—A. R. P.

Rinnmann's Green Test for Zinc. A. A. Benedetti-Pichler (*Indust. and Eng. Chem. (Analyt. Edn.)*, 1932, 4, 336–337).—A drop of the solution to be tested is placed on a filter-paper impregnated with a solution of 4 grm. of $\text{K}_3\text{Co}(\text{CN})_6$ and 1 grm. of KClO_3 in 100 c.c. of H_2O . The paper is heated until it bursts into flame. On cooling, a green spot will appear if the solution contains more than 1 mg. of Zn per c.c.—A. R. P.

VI.—LABORATORY APPARATUS, INSTRUMENTS, &c.

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

(Continued from pp. 621–624.)

New Apparatus for the Study of Transformations of Alloys. Isotherma Dilatometer. Registering Thermomagnetometer. P. Chevenard (*J. Phys. Radium*, 1932, [vii], 3, 264–280).—Full descriptions are given of the construction and uses of the apparatus. The micro-dilatometer registers the variation of the length of the specimen at constant temperature as a function of the logarithm of the time. The thermomagnetometer registers by means of a mirror the variation of susceptibility of ferromagnetic substances with the temperature. The instrument is not affected by perturbations of the earth's magnetic field.—E. S. H.

A Method for Measuring Very High Values of [Electrical] Resistance. G. M. Rose, Jr. (*Rev. Sci. Instruments*, 1931, 2, 810–813).—A method of measuring electrical resistances of values above 10^9 ohms by determining the current forced through the resistance by a known voltage, employing a Pliotron valve as current indicator, is described.—J. S. G. T.

A Precision Aperiodic Thermostat. Otto H. A. Schmitt and F. O. Schmitt (*Rev. Sci. Instruments*, 1932, 3, 467–473).—A form of electrically heated and water-cooled thermostat operating over the range 10° – 40°C ., with constancy of temperature to within less than 0.001°C ., is described.—J. S. G. T.

Plating Metallic Laboratory Ware for Resistancy. Sol. A. Bernstein (*Chemist-Analyst*, 1932, 21, (4), 5).—To prevent corrosion it is recommended that crucible tongs, tweezers, and spatulas be plated with gold or platinum.—A. R. P.

Parallel Plate Plastometry. R. L. Peek, Jr. (*J. Rheology*, 1932, 3, 345-371).—Apparatus is described for submitting plastic materials, including metals and alloys in the range of hot-working, to compression between parallel plates under conditions of close temperature control, and its applications and theory are discussed.—J. S. G. T.

Note on Julius Suspensions. M. J. Brevoort (*Rev. Sci. Instruments*, 1931, 2, 447-449).—A form of anti-vibration support for galvanometers of high sensitivity is described.—J. S. G. T.

A Simple Method of Measuring Small Vapour Pressures. Wilhelm von Meyeren (*Z. physikal. Chem.* 1932, [A], 160, 272-278).—A new vacuum instrument, the "Vakuscope," is described. By its use pressures between 0.01 and 80 mm. of mercury may be simply measured even in the presence of vapours.
—B. Bl.

A Greaseless and Chemically Inert Valve for High Vacua. Herman C. Ramsperger (*Rev. Sci. Instruments*, 1931, 2, 738-749).—A valve incorporating a silver bellows coated with fused silver chloride is described. Wood's metal is used in the manufacture of the bellows. *Inter alia*, the making of seals between metals and glass is discussed.—J. S. G. T.

A New Mercury Vapour Lamp for Laboratory Use. Isay Balinkin and D. A. Wells (*Rev. Sci. Instruments*, 1932, 3, 388-391).—A form of mercury-in-Pyrex glass lamp, suitable for operation on d.c. of 60-120 v., is described.—J. S. G. T.

Internal Attachment for Vertical Optimeter. Anon. (*Automotive Ind.*, 1932, 67, 285).—An adjustable internal attachment to the Zeiss standard vertical optimeter is described. The original type can with this addition be applied to inside as well as outside measurements, whilst means are provided for accurately determining taper and for finding both internal and external diameter of bore.—P. M. G. R.

Electric Precision Gauge of Great Accuracy. Anon. (*Machinery (N.Y.)*, 1930, 36, 435-436).—See *J.*, this volume, p. 242.—H. F. G.

An Oscillator for the Crystal of an X-Ray Spectrograph. Gerald W. Fox (*Rev. Sci. Instruments*, 1932, 3, 71-72).—Apparatus comprising a steel worm and bronze gear for rotating the crystal in de Broglie's method of X-ray crystal analysis is described.—J. S. G. T.

An X-Ray Powder Diffraction Apparatus of New Design. T. M. Hahn (*Rev. Sci. Instruments*, 1931, 2, 626-631).—A simple form of X-ray spectrometer is described which reduces the time required to produce a readable diffraction pattern as a comparatively large sample is used to produce the pattern, and as the weaker diffraction spots are formed near the sample.—J. S. G. T.

A Gas X-Ray Tube for Crystal Structure Analysis. H. Kersten (*Rev. Sci. Instruments*, 1932, 3, 145-150).—A gas X-ray tube in which large current-carrying capacity is secured by providing effective water-cooling, is described.
—J. S. G. T.

An X-Ray Reflection Spectrograph. H. Kersten (*Rev. Sci. Instruments*, 1932, 3, 384-387).—An X-ray spectrograph designed for use with the X-ray tube previously described (preceding abstract) is referred to.—J. S. G. T.

An Improved Laue Camera. H. Kersten and William Lange (*Rev. Sci. Instruments*, 1932, 3, 493).—A form of Laue camera for X-ray crystal analysis designed to compensate for unequal exposure of parts of the film at different distances from the crystal is described.—J. S. G. T.

Electronic Devices as Aids to Research. A. W. Hull (*Physics*, 1932, 2, 409-431).—Recent improvements and applications of electronic devices, including X-ray tubes, the photo-electric tube, and the thyatron, are briefly discussed.—J. S. G. T.

VII.—PHYSICAL AND MECHANICAL TESTING AND RADIOLOGY

(Continued from pp. 625-627.)

Inspection of Metals. A Discussion of Metallurgical Testing.—I., II. A. A. Robertson (*Chem. Eng. Min. Rev.*, 1932, 24, 267-273, 307-311).—(I.) A paper read before the Melbourne University Metallurgical Society. (II.) Pickling solutions for aluminium and aluminium alloys are (1) 5% caustic soda used hot or (2) 25% caustic soda used cold. Immerse the articles for 2-3 minutes in solution (1) or for 10 minutes in solution (2), rinse, remove the adherent black film by dipping in 50% nitric acid, rinse in cold and in boiling water, and dry. Etching solution: 10% caustic soda used cold. Immerse for 2-3 minutes, rinse, and wipe off the black deposit. For brass and bronze the pickling solution is 50% nitric acid used cold; etching solution: 10% cupric ammonium chloride with sufficient ammonia added to dissolve the precipitate. For magnesium and its alloys: pickling solutions (1) carbolic acid, (2) 25% nitric acid. Dip into either solution for 30 seconds, rinse, dip into 10% cold caustic soda, and then into boiling water containing a trace of potassium bichromate, and dry. Etching solution: 1% nitric acid in acetone or methylated spirits.—J. H. W.

Examination of Boiler and Condenser Tubes. Anon. (*Eng. Rev.*, 1932, 46, 120).—A portable instrument for the inspection of the internal surfaces of tubes, hollow shafts, turbine rotors, &c., is described. A polished nickel tube of very narrow bore carries at one end an eye-piece, and at the other an electric lamp, which illuminates the surface to be inspected through a slot in the instrument tube. A system of mirror, prism, and lenses transmits the image of the surface to the eye, with minute irregularities in high relief owing to the oblique illumination of the surface. Various lengths and diameters of instrument are available.—P. M. C. R.

Testing Machines and their Applications. P. Field Foster (*Machinery (Lond.)*, 1931, 39, 77-79).—Cf. *J.*, this volume, p. 490. Descriptions are given of the construction and use of the Amsler mirror and the Ewing extensometers.—J. C. C.

Non-Destructive Testing of Welds. Anon. (*Mech. and Welding Eng.*, 1932, 6, 100-101).—Reprinted from *Oxy-Acetylene Tips*, 1931, 10, 155-156. See *J.*, this volume, pp. 91, 446.—H. W. G. H.

Machines Gauge Wearing Quality of Finishes. Anon. (*Compressed Air Mag.*, 1932, 37, 3956).—An apparatus for testing lacquers and other finishes for their relative resistance to handling and to mechanical wear consists of a chamber containing a standard grade of sand, kept in circulation by injected compressed air. A disc, previously coated with the selected finish, is rotated at high speed in the testing chamber, and waste material is withdrawn by suction, which effects partial cooling at the same time. Finishes tested include bronzing liquids with an aluminium powder base, and various japan finishes, but the method is capable of much wider application.—P. M. C. R.

The Resistance of Copper and its Alloys to Repeated Stresses. I.—Tough-Pitch Copper, Annealed, and Cold-Worked. H. W. Gillett (*Metals and Alloys*, 1932, 3, 200-204).—A summary of recent work with suggestions for further research. Relatively few reliable data have been published on the resistance of cast copper to repeated stress or on the effects of reversed bending or axial loading.—A. R. P.

Influence of the Shape of Specimen on Tensile Strength and Elongation of Thin Light Metal Sheets. K. Schraivogel (*Jahr. deut. Versuchsanst. Luftfahrt*, 1931, 485-494).—Tensile tests have been made with Duralumin, Lantal, and Elektron sheets of varying dimensions. The tensile strength values are unaffected by the ratio of the thickness to the width of the specimen (R_s).

With $R_s = 6-10$, fracture occurs perpendicular to the axis of the specimen, whereas when R_s exceeds 10, the fracture is inclined to this axis. In the first case the specimen contracts at the side, whereas in the second case there is no such contraction; similarly, when the fracture is transverse, the elongation is dependent on R_s , but independent of this ratio when the fracture is inclined. The elongation also changes with the ratio length:cross-section of the specimen, much more so with aluminium alloys than with Elektron. The validity of Bertella's empirical relation $\delta_l/\delta_{10} = (11.3 \sqrt{F_0/l})^p$ between the elongations (δ_l and δ_{10}) for different gauge-lengths (l and $11.3 \sqrt{F_0}$) is confirmed (p is a constant). Hence it is possible to use test-pieces of a definite shape from sheets of different thickness and to obtain comparable results by a simple calculation. A suitable shape appears to be that recommended by the Deutsche Verband für die Materialprüfungen der Technik (German Society for Testing Materials).—B. Bl.

Effect of Cold-Working on the Izod Notched-Bar Impact Value of Monel Metal. N. B. Pilling (*Met. Ind. (Lond.)*, 1932, 41, 229-230).—Abstract of a paper read before the American Society for Testing Materials. See *J.*, this volume, p. 430.—J. H. W.

RADIOLOGY

Material Testing and X-Ray Cinematography. G. Kögel (*Angew. Chem.*, 1932, 45, 43-44).—X-ray examination of metals shows only density differences, but gives no indication of the position in the specimen of the faults (blowholes, &c.) unless photographs are taken from several positions, which is a tedious operation. With the aid of X-ray cinematography, however, the position of the faults may be rapidly determined at relatively low cost. Suitable apparatus for the work is described.—A. R. P.

The Permeability of Copper, Aluminium, and Lead for Filtered Heterogeneous X-Rays Determined by Means of the Photographic Indication. Max Widemann (*Metallwirtschaft*, 1932, 11, 383-386).—From measurements of the permeability of copper, aluminium, and lead for heterogeneous X-rays, curves have been derived from which great differences in thickness in pieces of these metals can be determined by radiograms.—v. G.

What the X-Ray Tells About Castings. Richard K. Akin (*Machinery (Lond.)*, 1932, 40, 230-231, and *Machinery (N.Y.)*, 1932, 38, 593-594, 693).—A general, illustrated, review.—J. C. C.

Argus-Eyed Radium. Anon. (*Compressed Air Mag.*, 1932, 37, 3847).—The use of radium salts or radon gas in the non-destructive testing of metallic bodies is briefly described, and some advantages and limitations are indicated.—P. M. C. R.

VIII.—PYROMETRY

(Continued from p. 628.)

Temperature Measurement. The Mercury Thermometer. J. Marteret (*Science et Industrie*, 1932, 16, 230-236; 329-331).—Cf. *J.*, this volume, p. 370. An account (part of a series dealing with all types of temperature measurement) of the construction, necessary corrections, proper use, and limitations of the mercury thermometer. The question of lag receives special attention. Methods of graduating and calibrating thermometers for various purposes are discussed and illustrated, and several special types of thermometer are described.—P. M. C. R.

The Temperatures Reached with Solid Carbon Dioxide. J. H. Awbery (*J. Sci. Instruments*, 1932, 9, 200-202).—A note. If blocks of solid carbon

dioxide are used for obtaining a constant low temperature, care must be taken to avoid rapid sublimation. If a large block is well insulated its temperature is uniform, but if rapid sublimation is occurring the temperature at the surface may fall by 10° or 15° C., and even crushing into small pieces may have a considerable effect.—W. H. R.

Modern Pyrometer Effects Savings in Brass Foundry. Anon. (*Daily Metal Reporter*, 1930, 30, (82), 11).—The installation of a Thwing pyrometer in the Elliott Brass Foundry, U.S.A., has effected a large reduction in rejections from castings varying widely in size and material.—P. M. C. R.

IX.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Continued from pp. 629-637.)

ELECTRODEPOSITION

The "High Acid" Chromium-Plating Process. —. Rassow and L. Wolf (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 225-227).—The new "high acid" chromium plating bath is free from sulphates, but contains up to 4% of another acid (nature not stated); the bath has a better conductivity than the sulphate bath and gives good plates when the chromic acid content lies between 400 and 150 grm./litre. High current yields are obtained with current densities of 4 amp./dm.² and higher, and readily oxidizable metals, e.g. brass, may be plated without an intermediate nickel layer. Up to 0.75% iron in the bath does not affect their operation. The resistance of the deposits to corrosion (salt spray test) is claimed to be superior to that of any other type of chromium-plate.—A. R. P.

Chromium Plating of Aluminium. A. E. (*Machinery (Lond.)*, 1932, 39, 469).—A brief survey.—J. C. C.

Eighty-Five Thousand Chromium-Plated Gauges Used in One Plant. Charles O. Herb (*Machinery (N.Y.)*, 1931, 37, 817-820).—See J., this volume, p. 492.—J. C. C.

Calculations in Chromium Plating. F. Dobrovsky (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 251-252).—The costing of chromium plating work is discussed.—A. R. P.

On the Possibility of the Use of Chromium Anodes in Chromium Plating. Joachim Korpium (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 227-228).—Chromium dissolves directly as chromic acid from a chromium anode at 100% current yield, but is deposited at the cathode at only 15% current yield. Chromic salts are not oxidized to chromic acid at a chromium anode, but are quantitatively oxidized at a lead anode. By using lead and chromium anodes with surface areas in the ratio of 85 : 15, therefore, the chromic acid content of the bath may be kept constant.—A. R. P.

The Hygienic Advantages of the "Chromprotekt" Coating Layer for Chromium-Plating Baths. Karl Schuch (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 231-232).—Cf. this J., 1931, 47, 548. The "Chromprotekt" oil layer on chromium-plating baths is shown to prevent entirely the formation of chromic acid spray and to safeguard workmen against the industrial diseases usually associated with chromium plating. The oil itself has no deleterious action on the skin. (See also following abstract.)—A. R. P.

Skin Diseases Caused by the Use of Protective Films on Chromium-Plating Baths. C. Wolters and A. Brandt (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 206).—Evidence is given which shows that the oil film "Chromprotekt" used on chromium-plating baths to prevent spray itself produces dermatitis and that, even when the oil film is used, efficient ventilation of the space above the bath and provision of long rubber gloves for the workmen are still necessary. (See also preceding abstract.)—A. R. P.

The Throwing Power of Copper, Nickel, Zinc, and Chromium Plating Baths.—A. Wilhelm (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 178–180, 249–251).—A review of recent work on the determination of throwing power, and on the factors which govern the throwing power of various plating solutions.
—A. R. P.

The Deposition of Copper in the Presence of Gum Arabic. Robert Taft and Oren R. Bingham (*J. Physical Chem.*, 1932, 36, 2333–2353).—The mass of cathode deposits produced by the electrolysis of neutral and acid solutions of copper sulphate increases to a limiting value with increasing concentration of gum arabic. Cathode deposits in neutral solutions of copper sulphate contain more copper than is produced in a copper coulometer placed in series with such baths, and the proportion of such “excess copper” increases with increase of temperature of the bath. It is suggested that copper oxides (-ous and -ic) and gum arabic are adsorbed simultaneously on the surface of newly-deposited copper crystals in neutral copper sulphate solutions; from acid solutions, gum arabic alone is adsorbed.—J. S. G. T.

A Photographic Study of the Growth of Electrolytic Striations [on Copper Deposited Electrolytically in Presence of Gum Arabic]. Robert Taft and Oren R. Bingham (*J. Physical Chem.*, 1932, 36, 2446–2454).—A photographic record of the growth of striations on copper deposited electrolytically in the presence of gum arabic shows that the striæ are probably attributable to the adsorption of a complex consisting of gum arabic-copper hydroxide on the surfaces of the deposited crystals of copper. The cathode polarization of copper is increased by the presence of gum arabic.—J. S. G. T.

Electrodeposition of Iron, Copper, and Nickel Alloys. II.—Discussion of Results Obtained from Cyanide Solutions. Lawrence E. Stout and Charles L. Faust (*Trans. Electrochem. Soc.*, 1932, 61, 341–362).—See *J.*, this volume, p. 96.—S. G.

American and European Nickel-Plating Practice. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 201–205).—Methods of cleaning various metal articles prior to nickel plating and the plating procedure used in several American and European plating works are described in some detail, and the composition of numerous plating baths and their uses are tabulated.—A. R. P.

Problems in High Current Density Nickel and Chromium Deposition. N. R. Laban (*Met. Ind. (Lond.)*, 1931, 39, 63–64; and discussion, 110–112, 153–159).—Abstract of a paper read before the Electroplaters' and Depositors' Technical Society. See *J.*, this volume, p. 314.—J. H. W.

Researches on Nickel Stripping Baths. H. Krause (*Mitt. Forschungsinst. Edelmetalle*, 1932, 5, 104–107, 121–126).—The use of commercial sulphuric acid in electrolytic stripping baths for removing nickel plate (old or faulty) from brass or iron is fraught with considerable danger to the operators, as with more than 2 v. (and 7–8 v. are usually used) large quantities of arsine are evolved; the same remarks apply to the addition of arsenious acid to the bath, a procedure which has been recommended for improving its efficiency. Addition of tartrates, acetates, sulphates, or urea to arsenious acid baths reduces but does not prevent evolution of arsine.—A. R. P.

The Determination of the Thickness of Electrodeposits of Nickel, Copper, and Silver Baths by Means of Nomograms. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 181–182).—The construction of a nomogram for reading directly from the time of deposition and the current density the thickness of electrodeposited films of nickel, copper, and silver is illustrated.—A. R. P.

Operation and Care of Silver-Plating Baths. Alfred Wogrinz (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, 30, 252–253).—The necessity for strict analytical control of the cyanide, carbonate, and silver content of silver-plating baths is emphasized.—A. R. P.

The Fescol Process. Anon. (*Automobile Eng.*, 1932, 22, 415–416).—Recent developments in electrochemical deposition as applied to automobile com-

ponents are discussed. Nickel is deposited either to salvage worn parts by building up to the original dimensions or in some cases by building up to oversize to allow of machining, or for the initial protection of parts and components from corrosion. Deposited nickel has a Brinell hardness of 250-400. Chromium is deposited either on a nickel deposit or directly on the base metal and has a Brinell hardness of 850-1000, and is particularly suitable for limit gauges where corrosion and erosion are likely to be encountered, for spring shackle pins on commercial vehicles, on plate clutches, on the journals and pins of crankshafts, on camshafts, and in the bores of cylinder liners to reduce wear. A brief description of the operations in the process of depositing both nickel and chromium is also given.—J. W. D.

Electroplating Deposit Control. Anon. (*Machinery (Lond.)*, 1932, 39, 581-585).—Much greater control of quality and thickness of deposit than is usually obtained is possible if proper supervision and testing are maintained—preferably by the works chemist. Important items that should receive attention are composition of the bath, anode spacing, temperature, current density, arrangement and spacing of work, circulation and filtration of solution, and general cleanliness. With regard to the thickness of deposit, examples are quoted to show how this may vary from one part of an article to another and also according to the position of the article in the vat. Recommended standards for the average weight of coatings of various metals are tabulated, and the determination of thickness by stripping methods is described in some detail. Stripping solutions are divided into two categories: those which do not attack the base metal, and those which attack it slightly. Tables of constitution, working temperature, and mode of attack of a number of each type are given.—J. C. C.

Recent Advances in Metal Problems. Anon. (*Brass World*, 1932, 23, 161-162).—A review of some of the more important investigations on cadmium, zinc, electrodeposition on light metals, and immersion coatings, is undertaken.—J. H. W.

Rubber-Lined Solution Tanks for Automatic Plating Machines. Anon. (*Met. Ind. (N.Y.)*, 1932, 3, 228).—Large steel tanks lined with hard rubber are illustrated.—A. R. P.

Degreasing of Metal Articles. H. Krause (*Mitt. Forschungsinst. Edelmetalle*, 1932, 6, 13-19).—A brief description of the various methods used in removing the grease from metal articles which are to be plated. Numerous recipes for alkaline degreasing baths are given.—A. R. P.

Tells of Aluminium Plating Method on Smooth Surface. M. Ballay (*Daily Metal Reporter*, 1931, 31, (33), 6).—From a paper by M. Ballay, *Compt. rend.*, 1930, 190, 305-308, and *J. Four. élect.*, 1930, 39, 96-97. See this *J.*, 1930, 43, 606.—P. M. C. R.

Electrochemical and Electrometallurgical Industries. H. T. S. Britton and R. A. Robinson (*Ann. Rep. Prog. Applied Chem.*, 1931, 16, 331-357).—During 1931 there were no outstanding advances in, but a steady increase of, the applications of electrolytic and electrothermal processes. In connection with electroplating, much attention was given to the causes of faulty coatings, particularly of nickel and chromium. Many references are given to the deposition of aluminium, tantalum, and tungsten from molten baths; to the electroplating of aluminium; and to the deposition of metals from anhydrous ammonia baths, a process which is practicable only in certain sharply-defined cases; to electroplating in general; to rectifiers utilizing coated plates of aluminium, tantalum, and magnesium, and to electrolytic rectifiers employing tantalum, aluminium, and nickel electrodes; to primary and secondary cells, and particularly to the influence of antimony in lead accumulator plates on self-discharge and sulphation troubles; to induction furnaces, refractories and electrodes for various types of electric furnace; to materials for protecting resistance furnace windings; and to the modification of the surface condition of metals by treatment with high-frequency oscillations.—H. F. G.

ELECTROREFINING, &c.

The Development of the Electrolytic Process of Extraction of Metals at the "Norddeutsche Affinerie" at Hamburg. Walter Schopper (*J. Four. elect.*, 1932, 41, 171-179).—From *Metallgesellschaft Periodic Rev.*, 1932, (6), 29-39. See *J.*, this volume, p. 452.—J. H. W.

Recovery of Precious Metals from Electrolytic Copper Refining at the Canadian Copper Refiners Plant, Montreal East, Quebec. C. W. Clark and A. A. Heimrod (*Trans. Electrochem. Soc.*, 1932, 61, 77-90; and (slightly condensed), *Met. Ind. (Lond.)*, 1932, 40, 491-494).—See *J.*, this volume, p. 372.—S. G.

ELECTROCHEMISTRY—GENERAL

Studies of Fully Organized Anodic Layers on Aluminium. J. E. Lilienfeld, L. W. Appleton, W. M. Smith, and J. K. Nieh (*Trans. Electrochem. Soc.*, 1932, 61, 531-548).—See *J.*, this volume, p. 100.—S. G.

On the Equilibrium $\text{Ni} + \text{Co}^{++} \rightleftharpoons \text{Ni}^{++} + \text{Co}$ and on the Cobalt Potential. T. Heymann and K. Jellinek (*Z. physikal. Chem.*, 1932, 160, 34-38).—The cobalt potential, determined from the equilibrium $\text{Ni} + \text{Co}^{++} \rightleftharpoons \text{Ni}^{++} + \text{Co}$ in nitrate solution at 25° C., is -0.268 v.—B. Bl.

Studies on Overvoltage.—V. A. L. Ferguson and Graham M. Chen (*J. Physical Chem.*, 1932, 36, 2437-2445).—An oscillograph-commutator system, adapted to the study of transient electrode phenomena, is described. Results confirm those previously obtained, employing the commutator-potentiometer system.—J. S. G. T.

The Effect of Applied Voltage on Electrolysis in the Residual Current Range. Glenn H. Damon (*J. Physical Chem.*, 1932, 36, 2497-2503).—[*Note by Abstractor.*—Residual currents were first studied by Helmholtz, and refer to currents maintained in electrolytes by applied voltages below the decomposition e.m.f. of the electrolytes. There is no visible liberation of decomposition products. Helmholtz attributed the phenomenon to the depolarizing effect of dissolved gases.] D. shows that the magnitude of the residual current depends to a marked extent on the magnitude of the impressed e.m.f.; above 0.5 v., the residual current is a function of the applied voltage, whilst for lower voltages the residual current is practically constant. The presence of air has a greater effect on the residual current for high than for low voltages.—J. T.

Electrochemical Periodicities. Ernest S. Hedges (*Nature*, 1932, 129, 870-871).—Cf. *J.*, this volume, p. 83. Oscillations of potential, having a duration of about 1 second and an amplitude of about 0.1 v., were observed when copper was made the cathode in 10% nitric acid at low current densities (about 5 milliamp./cm.²). No gas was evolved. The phenomenon is complementary to that reported by Butler and Armstrong (*J.*, this volume, p. 452).—E. S. H.

A Bridge for the Measurement of the Conductance of Electrolytes. Paul H. Dike (*Rev. Sci. Instruments*, 1931, 2, 379-395).—A form of Wheatstone bridge for the precise measurement of the resistance of electrolytes, using a.c., is described. An accuracy of $\pm 0.005\%$ is possibly attainable.—J. S. G. T.

Electrolytic Valve Action and Electrolytic Rectifiers. Edgar Newbery (*Proc. Roy. Soc.*, 1932, [A], 137, 134-145).—The behaviour of valve electrodes including aluminium and lead, tantalum and platinum, bismuth and nickel, antimony and lead, bismuth and lead, in electrolytes including sodium phosphate, sulphuric acid, and sodium hydrate has been investigated. Valve action is considered to be due to an adherent insulating anodic film which is penetrable to H ions, but not to the anions present. Rectifying action occurs when such a film is not reducible by the electrolytic hydrogen produced on it, and is also unchanged by further anodic action. The film responsible for the rectifying action of an aluminium electrode is the oxide only. Hydration of this oxide destroys its rectifying efficiency.—J. S. G. T.

X.—INDUSTRIAL USES AND APPLICATIONS

(Continued from pp. 638-610.)

White Bearing Metal Alloys. Leland E. Grant (*Metals and Alloys*, 1932, 3, 138-145, 150, 152-157; and (summary) *Metallurgist* (Suppt. to *Engineer*), 1932, 8, 117-119, 133-134).—A correlated abstract in which the structures and properties of lead- and tin-base bearing alloys are discussed and the effect thereon of nickel, arsenic, bismuth, zinc, iron, aluminium, and tin oxide is described. The article contains a lengthy bibliography.—A. R. P.

Uniting Babbitt Lining and Shell. W. E. Warner (*Machinery* (N. Y.), 1930, 36, 885).—The bearings are Babbitted 0.001-0.002 in. under size, and a mandrel having a taper of about 0.0015 in. is forced through the bearing with an arbor press. This operation compresses the Babbitt metal and produces a bearing with a smooth, hard surface.—H. F. G.

Invents Self-Lubricating Bearing Metal with Wide Variety of Uses. Anon. (*Daily Metal Reporter*, 1930, 30, (204), 6).—A self-lubricating bearing designed for motors, the run of which is short and subject to long interruptions, is made by mixing metallic powders with soap-producing ingredients, and subjecting the product to a pressure of about 40,000 lb./in.². The temperature is gradually raised to 205° C., after which the pressure is again increased. The bearing is ready for fitting after releasing the pressure and cooling.—P. M. C. R.

Seizures of Electric Motor Shafts. Edward Ingham (*Colliery Guardian*, 1932, 144, 970-971).—After reviewing some principles of lubrication, I. considers the selection of bearing metals, the use of which he prefers to that of ball or roller bearings, as being less liable to destructive failure through admission of grit, small inaccuracies of fitting, or fracture. Phosphor-bronze is preferred to white-metal on account of the latter's fusibility.—P. M. C. R.

Essential Properties of Bearing Metals. C. H. Bierbaum (*Mech. World*, 1932, 91, 606-607).—Abstract from *Iron Age*, 1932, 129, 774-776, 817, of a paper read at a Conference on Metals and Alloys at Cleveland, O., U.S.A. See *J.*, this volume, pp. 179 and 453.—F. J.

Aluminium. Anon. (*Giesserei u. Maschinenbau Zeit.*, 1932, 5, (3), 8-10).—A summary of the manufacture, alloys, and commercial uses of aluminium.
—W. A. C. N.

Aluminium as a Bearing Alloy. N. M. (*Aluminium Broadcast*, 1931, 3, (10), 19).—Aluminium alloy bearings are said to be satisfactory against really hard surfaces which will not tear or flake. There seems to be less "lapping" of the hard surface than with bronze bearings, as grit embeds itself more readily in the bearing.—J. C. C.

Aluminium in the Worsted and Allied Industries. Anon. (*Aluminium Broadcast*, 1931, 6, 21).—A brief list of the uses of aluminium in textile machines and equipment.—J. C. C.

Aluminium and its Alloys—Its Uses in Leather-Dressing and Skin-Dyeing Factories. Constantine Szmukler (*Aluminium Broadcast*, 1931, 3, (18), 8-12).—Cf. *J.*, this volume, p. 373. A £200 prize essay in a competition organized by the European producers of aluminium for suggested new uses of the metal. The process of leather dressing is described and an account given of the items of equipment which are or could be made of aluminium or Duralumin with the advantage that all dangers of rust staining would be avoided.
—J. C. C.

Progas Aluminium Tubing. Anon. (*Aluminium Broadcast*, 1931, 3, (21), 18).—Aluminium gas piping is manufactured for interior work.—J. C. C.

Aluminium as Packing Material for Canned Goods. Gulbrand Lunde (*Tids. Hermetikind.*, 1932, 18, 205-216; *C. Abs.*, 1932, 26, 4887).—Aluminium is very suitable for packing canned goods, especially sprat sardines and herring

sardines in oil, kippers, fresh herring, and fish balls. This metal is not resistant to tomato products and others which are highly acid or salted. Its employment must be temporarily limited to products that are not too acid or salt; otherwise hydrogen swells may occur. In packing unsmoked sardines in aluminium cans, they should not be too moist. With fish balls, the stock should be neither too concentrated nor too salt. The advantages claimed for aluminium are: no blackening of cans, no metallic taste or scent, no solution of detrimental metal in the goods, easy opening of the cans, and their lighter weight. The metal from which the cans were made contained about 99.4% aluminium.—S. G.

Aluminium for Oil-Lease Tanks is Studied. L. Schmidt, J. M. Devine, and C. J. Wilhelm (*Daily Metal Reporter*, 1931, 31, (105), 8).—Reported from *U.S. Bur. Mines Rep. Invest.* No. 3066, 1931, 1-17. See this *J.*, 1931, 47, 556.

—P. M. C. R.

[Aluminium Reflectors for] Electric Cap Lamps. Edwin Lyon (*Colliery Engineering*, 1932, 7, 267-271).—Special reflectors introduced into miner's cap lamps to obviate glare are advantageously made of aluminium, with matt surface, which produces an even distribution of light, and if kept clear has a high reflecting efficiency. Silver-plated reflectors soon tarnish without special attention. Chromium-plated or nickel reflectors need less attention than either aluminium or silver, but require the use of some such diffusing medium as a frosted bulb or prismatic glass.—P. M. C. R.

Modern Die-Castings of Aluminium. G. M. Rollason and Sam Tour (*Metal Progress*, 1932, 21, (1), 32-37).—Adapted from a paper prepared for the Non-Ferrous Data Sheet Committee of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers and the American Society for Steel Treating.—P. M. C. R.

Two New [Aluminium] Alloys Useful in Jewellery Manufacture [Silberit; Ultralumin]. Anon. (*Daily Metal Reporter*, 1932, 32, (24), 9).—Silberit, an aluminium-nickel-silver alloy, and Ultralumin, containing more than 90% aluminium together with nickel, copper, and a rare ingredient of the thorium group, are mentioned as suitable for use in jewellery without plating. Ultralumin is especially resistant to sea-water corrosion.—P. M. C. R.

Light Alloys in Motor Vehicle Construction. Frank Jardine (*Metals and Alloys*, 1932, 3, 173-176).—Examples are given of the use of aluminium alloys in the construction of motor cars, heavy goods lorries, railway coaches, and road cars and the effect of substituting aluminium alloys for iron alloys on the cost of the vehicle, the reduction in weight, and the cost of running is discussed. Aluminium appears to be more economical than iron.—A. R. P.

Commercial Vehicle Bodywork in Aluminium. N. Minaur (*British Aluminium Co. Intelligence Mem.* No. 22; and *Aluminium Broadcast*, 1931, 3, (12)).

—J. C. C.

The Increase of Capacity in Transportation by Means of the Use of Light Metals. Ad. M. Hug (*Alluminio*, 1932, 1, 244-246).—An illustrated article on the use of light alloys in transportation, from Swiss, English, French, and Italian practice.—G. G.

A New Type of Auto-Tower with a Light Metal Platform. Anon. (*Alluminio*, 1932, 1, 181-183).—A description of a new and interesting Fiat car, with a tower of light metal which can reach to a considerable height. The platform which is electrically insulated can project 4.5 m., and can also turn on its shaft.—G. G.

Aluminium Alloys in the U.S.S. Akron. G. O. Hoglund (*Metals and Alloys*, 1932, 3, 178-180).—The framework of the airship is made of "17SRT" alloy consisting of aluminium with 4% copper and 0.5% each of magnesium and manganese. After heat-treatment this alloy has a yield-point of 46,000 lb./in.² and a tensile strength of 61,000 lb./in.² with an elongation of 10-15%. The

method of building up the framework is illustrated and briefly described; Duralumin rivets are used throughout and the whole is protected from corrosion by anodic oxidation in dilute chromic acid followed by painting with aluminium paint.—A. R. P.

Aircraft Wings and their Structures. C. Minelli (*Aerotecnica*, 1931, 11, 1091-1118).—Deals with aeronautical construction and with various problems concerning wings and structures; most of the structural systems used to-day are discussed. Questions of material—light alloys, steel, &c.—are dealt with.—G. G.

Constructing Fuselages for Airplanes. E. F. Lake (*Machinery* (N.Y.), 1930, 36, 702-708).—The disadvantages of Duralumin, as compared with chrome-molybdenum steel, are noted.—H. F. G.

Cars for Rope Railways. Anon. (*Alluminio*, 1932, 1, 108; and *Schweiz. Bauzeit.*, 1932, 19, 124).—A description of the new light cars of the Gerschnialp-Trübssee cable-way over Engelberg in Switzerland. Compared with the old heavier steel cars, the new ones, constructed in Avional (Duralumin), are of 57.5 kg., instead of 112 kg., dead-weight per person.—G. G.

An Italian Cable-Way with Cars made of Light Alloys. Anon. (*Alluminio*, 1932, 1, 180).—The Cassino-Montecassi cable-way has cars made entirely of Duralumin; these can carry 16 persons, with a dead-weight of 37 kg. per person.—G. G.

Use of Duralumin for Mine Skips and Cages. G. H. Ridley (*Aluminium Broadcast*, 1932, 3, (25), 9-10).—Duralumin skips, lined on the sides with manganese steel and on the bottom with a special form of rubber, and Duralumin cages are being used in various South African gold mines. Savings in weight of 37% and 40%, respectively, are thereby obtained, with corresponding operating advantages.—J. C. C.

Aluminium Alloy Skips and Cages Increase Mine Output. Anon. (*Compressed Air Mag.*, 1932, 37, 3942).—The use of light alloys such as Duralumin for cages and skips has greatly increased the net lifting capacity of mine hoists. Three such skips, each of 4 tons capacity, have been installed in one Canadian mine, and each weighs 3000 lb. less than the equivalent regulation steel skip. Certain German pits have installed cages of Duralumin, effecting a 50% increase in carrying capacity.—P. M. C. R.

Aluminium in Wireless Construction. C. H. E. Ridpath (*British Aluminium Co. Intelligence Mem.*, No. 26; and *Aluminium Broadcast*, 1931, 3, (15)).—J. C. C.

Anticorodal Not Suitable for Contacts. Anon. (*Aluminium Broadcast*, 1932, 3, (25), 18).—Tests on Anticorodal carried out by the Schweizerische Elektrotechnische Verein on the lines of their standard specifications showed that it is not suitable for contacts in switches or plugs on account of its tendency to oxidation and excessive burning.—J. C. C.

Conductors in Aluminium Alloys [Aldrey]. C. Pramaggiore (*Alluminio*, 1932, 1, 80-107).—A fairly wide, illustrated study of the uses of aluminium and aluminium alloys in the electrical industry. Big transmission lines of Aldrey, Aldrey-steel, and aluminium-steel; the properties and characteristics of Aldrey; forms and dimensions of wires and conductors; and erection of transmission lines constructed of Aldrey are dealt with.—G. G.

Aluminium Overhead Lines in Italy. Rtz. (*Elektrotech. Zeit.*, 1932, 53, 365).—Owing to its poor mechanical properties, aluminium is not very satisfactory for overhead electrical transmission wires, hence the 130,000-v. transmission line between Morbegno and Voghera is made of 30 aluminium wires with 7 interwoven steel strands, all the wires being 2.7 mm. in diam. Part of the high-tension transmission is effected with wires of an alloy of aluminium with 0.6% silicon, 0.4% magnesium, and 0.3% iron; the electrical conductivity of this alloy is 31.5.—B. Bl.

The Use of Aluminium Conductors for the Transmission Lines of the "S.F.I.A.C." Anon. (*Alluminio*, 1932, 1, 43-44).—A description of the hydro-electric works and transmission lines of the "Società Forze Idrauliche Alto Cadore."—G. G.

List of Transmission Lines with Tension up to 60,000 Volts, Executed in Italy with Aluminium Conductors. Anon. (*Alluminio*, 1932, 1, 252).—A table giving data relating to transmission lines made of aluminium, Aldrey, aluminium-steel, Aldrey-steel, &c.—G. G.

Canadian Copper Mines to Receive Electric Power over Aluminium Lines. Anon. (*Daily Metal Reporter*, 1930, 30, (88), 6).—Power is to be transmitted to the Hudson Bay and Sherritt copper mines over aluminium wire; the same material is to be used for the Ottawa-Toronto Hydro-Electric Power Cable, the wire in this case being 1.25 in. in diam. The adoption of aluminium is due to its low price as compared with copper.—P. M. C. R.

General Cable Announces Insulated Aluminium Wire. Anon. (*Daily Metal Reporter*, 1930, 30, (231), 10).—The use of aluminium wire in electrical transmission, at first confined to bare conductors, is extended to insulated materials. The metal is stranded with steel where extra strength is required, but the cables are lighter than the equivalent copper conductors, the increased radiating surface ensures cooler running, and it is claimed that disturbance due to underground short-circuits is less with the new conductors than with earlier types.—P. M. C. R.

Aluminium in the Construction of Furniture. N. Minaur (*British Aluminium Co. Intelligence Mem.* No. 13, and *Aluminium Broadcast*, 1931, 3, (8)).—See this *J.*, 1931, 47, 398.—J. C. C.

Aluminium and Steel in the Construction of the Buildings of the "Radio City" in New York. Anon. (*Alluminio*, 1932, 1, 178-180).—An illustrated description of the uses of aluminium alloy panels in the construction of the great "Radio-" or "Rockefeller City" building in the centre of New York.—G. G.

Aluminium Doors Successful on Timber Dry Kilns. Anon. (*Daily Metal Reporter*, 1931, 31, (178), 6).—Kiln doors for drying timber possess high insulating properties when constructed of 1 in. of heat-insulating material between 20-gauge aluminium sheet. Other advantages claimed are lightness, reduction of fire risk, long life, resistance to steam and acid vapours, and absence of warping.—P. M. C. R.

Metal Walls, Frame, and Floors for New Type Home. Anon. (*Daily Metal Reporter*, 1931, 31, (76), 8; and *Aluminium Broadcast*, 1931, 3, (10), 25).—An account of "Aluminaire," a house built of metal and glass, exhibited at the Architectural League Show, New York.—P. M. C. R.

Aluminium as a Roofing Material. E. S. Woodward (*Sheet Metal Worker*, 1931, 22, 71-72; and (reprint) *Aluminium Broadcast*, 1931, 3, (10), 21-24).—Alloy 3S sheet in a thickness of 20 gauge B. and S. is recommended as sufficient to withstand all normal service conditions, and is particularly valuable in that it is resistant to sulphur atmospheres. Bitumastic paint or, less frequently, asphalt felt is used to avoid direct contact with other metals, concrete, or gypsum block. Some outstanding examples of aluminium-roofed buildings are mentioned.—J. C. C.

Aluminium for Roofs. H. Froidevaux (*Schweiz. Baumeister Zeitung Hoch-und Tiefbau*, 1930, Special Suppt. (49) and (50); and (abridged translation) *Aluminium Broadcast*, 1931, 3, (12), 3-5).—J. C. C.

Aluminium Roofing Tiles. E. V. Pannell (*Aluminium Broadcast*, 1931, 3, (17), 10-12).—Aluminium tiles, which may be protected with a plain or dyed anodic coating, are being manufactured from 22 S.W.G. sheet.—J. C. C.

The Alfol System of Heat Insulation. N. Minaur (*British Aluminium Co. Intelligence Mem.* No. 35; and *Aluminium Broadcast*, 1931, 3, (19), 16-18).—J. C. C.

New Metallic Thermal Insulator "Alfol." Anon. (*Alluminio*, 1932, 1, 110-111).—A description of Alfol, which is made of crumpled aluminium foil.
—G. G.

Milk Bottles made of Pasteboard. Anon. (*Alluminio*, 1932, 1, 42-43).—Bottles of hard paper or pasteboard, covered internally with aluminium foil, are used in Paris for milk; similar vessels have received or might receive a number of other applications, for holding liquids, or alimentary products.
—G. G.

Aluminium Paint in Industry. F. H. (*Aluminium Broadcast*, 1931, 3, (22)).—A general review.—J. C. C.

Practical Experiments with Aluminium Paint. C. Bianchi (*Alluminio*, 1932, 1, 247-248).—A detailed report of some experiments carried out by the Italian Navy in connection with the use of aluminium paint. Consumption, cost, surface covered, and time employed as compared with other paints are considered. The saving in total cost by using aluminium paint was found to be 44%; the economy in weight is of the order of 88%. The important advantage of a better resistance to corrosion must be added to the other advantages of aluminium paint.—G. G.

The Effect of Priming Coat Reduction and Special Primers upon Paint Service on Different Woods [Aluminium Paint Primers]. Anon. (*Aluminium Broadcast*, 1931, 3, (7), 8).—Abstracted from a publication of the Forest Products Laboratory, Madison, Wis., U.S.A. Aluminium paint used as a primer under ordinary house paints shows a considerable advance over present standard practice. Variation in paint behaviour is reduced, and flaking from summerwood is delayed, although not entirely prevented. The addition of aluminium powder to standard primers has been proposed with a view to shield the oil next the wood from ultra-violet light, but tests showed it to have no appreciable effect on the behaviour of coatings.—J. C. C.

[Use of Aluminium Paint, Calorizing, and Galvanizing for Prevention of] Corrosion of Mains. Anon. (*Colliery Engineering*, 1932, 9, 308-309).—Among methods of protecting iron and steel mains against corrosion, aluminium paint is recommended as giving efficient protection and a good appearance. "Sublimed blue lead," a fume product, gives a film of remarkable toughness and adhesive quality. Galvanizing and calorizing are also considered. The latter process consists in heating the piping in a reducing atmosphere in contact with finely-divided aluminium, which forms a homogeneous alloy coating with the piping material.—P. M. C. R.

Permite Resalum [Aluminium Paint] Offered in Three Grades. Anon. (*Automotive Ind.*, 1932, 66, 755).—"Permite Resalum," an aluminium paint in a synthetic resin vehicle, can be obtained in heat-resisting, acid-resisting, or weather-resisting grades; the paint may be applied by brushing, spraying, or dipping in each case. The vehicle is said to be chemically inert and highly waterproof.—P. M. C. R.

Manufacture of Aluminium Inks and Paints. W. Lewis (*British Aluminium Co. Intelligence Mem.*, No. 27; and *Aluminium Broadcast*, 1931, 3, (18)).
—J. C. C.

Denitriding in Salt Baths and Molten Aluminium. H. H. Ashdown (*Machinery (N.Y.)*, 1932, 38, 921-923).—The surfaces of nitrified articles can be softened by heating in aluminium powder at 660° C. or, more rapidly, by immersing for a few minutes in molten aluminium. The effect is considered to be due to a change in the state of the nitrogen combination and a partial diffusion of the nitrides. Nitrified dies used for aluminium die-castings are not affected, presumably owing to the speed at which the alloy solidifies.
—J. C. C.

Arsenic. Paul M. Tyler and Alice V. Petar (*Trans. Electrochem. Soc.*, 1932, 61, 125-130; and *Indust. Australian*, 1932, 87, 199).—See J., this volume, p. 375.—S. G.

Chromium. General Information. Lewis A. Smith (*U.S. Bur. Mines, Information Circ. No. 6566*, 1932, 1-31; and (abstract) *Met. Ind. (Lond.)*, 1932, 41, 30-32, 56-58).—A review.—S. G.

Copper Tubes in Domestic Water Supplies. Anon. (*Cuivre et Laiton*, 1931, 4, 567-574).—It is stated that copper and lead are preferable to iron for conducting domestic water supplies. Extensive tests have been undertaken on the internal corrosion of pipes made of these three metals when left in contact with ordinary water under varying conditions. Measurements of the internal diameter of numbers of tubes have been taken with the object of estimating the rate of attack over long periods. A table has been compiled showing equivalent tube diameters after taking the rate of corrosion into consideration, when hot and cold water are passing. When compared with lead, copper shows much greater mechanical properties and of course considerable saving in weight. A last section is devoted to the utility of brass tubes for domestic purposes.

—W. A. C. N.

Heat Transmission to Liquids Flowing in [Copper] Pipes. T. K. Sherwood and J. M. Petrie (*Indust. and Eng. Chem.*, 1932, 24, 736-745).—New data are presented on heat transmission to water, acetone, benzene, kerosene, and *n*-butyl alcohol flowing in both stream-line and turbulent motion through a 0.494-in. internal diameter steam-jacketed copper pipe.—F. J.

"Aluminium-Bronzes": What Specifications Should be Required? R. Oiseau (*Aciers spéciaux*, 1932, 7, 263-269).—The properties of "aluminium-bronzes" are discussed and the specifications of the alloy when required for various purposes are suggested. Two alternatives emerge from these considerations: (1) rigid tolerances for the mechanical properties, including, if necessary, limited proportions of certain elements or impurities, or (2) chemical analysis. It is not practical to insist on both.—J. H. W.

Considerations of Surface Condensers. Paul Quinio (*Arts et Métiers*, 1932, 85, 292-299).—A description is given of the construction of surface condensers in 70 : 30 brass, 76 : 22 : 1 (aluminium-) brass, Soovill metal, 70 : 29 : 1 (tin-) brass, 70 : 30 and 30 : 70 copper-nickel, and Monel metal. These alloys are used on account of their good mechanical properties and resistance to corrosion. They require careful heat-treatment in most cases to prevent season-cracking.

—J. H. W.

"Yorcalbro" Condenser Tubes. Anon. (*Aluminium Broadcast*, 1931, 3, (6), 12).—Abstract of a pamphlet issued by the Yorkshire Copper Works, Ltd. "Yorcalbro" is an aluminium-brass. See also this *J.*, 1931, 47, 20.—J. C. C.

Your [Nickel-Brass] Door-Key. Anon. (*Nickel Bulletin*, 1932, 5, 129).—A brief description of the manufacture and method of operation of Yale door-keys made of nickel-brass containing 11% nickel.—J. H. W.

New Phosphor-Bronze Cuts at Higher Speeds. Anon. (*Daily Metal Reporter*, 1932, 32, (9), 5).—It is claimed that Anaconda "special" phosphor-bronze, containing approximately copper 88, tin 4, zinc 4, and lead 4%, possesses good bearing qualities and can be machined at the same speed as leaded yellow brass. The minimum tensile strength in rods up to 0.5 in. in diameter is stated to be 31.2 tons/in.².—P. M. C. R.

Efficiency and Application of Worm Gearing. H. E. Merritt (*Machinery (N.Y.)*, 1930, 36, 684).—Abstract of a paper read before the Institution of Mechanical Engineers. With a case-hardened steel worm, a phosphor-bronze (copper 88, tin 11-12%) worm-wheel is recommended; manganese bronze wheels are less satisfactory.—H. F. G.

Glue Vehicles for Bronze Powders. W. Ludwig (*Farbe u. Lack*, 1932, 354; *C. Abs.*, 1932, 26, 4967).—Special requirements of glue vehicles for bronze powders are: no impairment of the metallic lustre of the powder, easy wetting, and chemical neutrality.—S. G.

Recapping a Winding Rope [with White Metal]. Henry H. Greig (*Colliery Guardian*, 1932, 144, 152-154).—A paper read before the East of Scotland Mining Students' Association, Heriot-Watt College, Edinburgh. The capel or socket is usually of iron, filled with white metal, the recommended composition of the latter being: lead 50, tin 40, antimony 8.5, bismuth 1.25%. The melting point is 232° C. and the pouring temperature 360°-372° C. The serving, cleaning, and setting of the rope, and the pouring of the metal, are described in detail, with dimensions, filling and cooling times, and several diagrams.—P. M. C. R.

Oxide Choice Important in Battery Manufacture. W. H. Rowley (*Daily Metal Reporter*, 1930, 30, (217), 10).—From an address before the National Battery Manufacturers' Association, Cleveland, U.S.A. R. considers the preparation and properties of lead and its oxides, and the grading and selection of the latter for use in storage batteries.—P. M. C. R.

Magnesium: Its Technology of Production and Use. John A. Gann (*Met. Ind. (Lond.)*, 1932, 40, 593-596).—Abstract of an address delivered to the American Institute of Mining and Metallurgical Engineers; reproduced from *Min. and Met.*, 1932, 13, 179-182. See *J.*, this volume, p. 380.—J. H. W.

Magnesium Alloys in Aircraft-Engine Construction. G. D. Welty (*J. Soc. Automotive Eng.*, 1932, 30, 112-115).—See *J.*, this volume, p. 184.—W. P. R.

Dow Metal Used in 4-Car Trailer. Anon. (*Automotive Ind.*, 1931, 67, 399).—Two types of trailer are described in which Dow metal is largely used, both structurally and in the provision of such details as non-skid grating facings for ramp and loading devices. The saving of weight, as against wooden-floored steel trailers of similar capacity, is rather more than 50%.—P. M. C. R.

Mercury Vapour in Industrial Heat Transfer. Crosby Field (*Chem. and Met. Eng.*, 1932, 39, 216-217).—Steady progress has been made in the development and application of mercury vapour as an industrial heat-transfer medium, particularly in its use in heating, cooling, and temperature-controlling systems in connection with chemical processes. The advantages of mercury are: (1) it does not dissociate and therefore there is no fouling of the heat-transfer surfaces, nor any change in quantity of the medium (mercury); (2) low freezing point obviates danger of freezing, even when plant is shut down, and requires no thawing accessories; (3) high density enables small pipes and low pressures to be employed and size of equipment to be reduced; (4) high density obviates pumping, gravity returns being possible under most conditions; (5) non-inflammability; (6) no action on steel, the cheapest constructional material available; (7) mercury-vapour proof welds are readily obtainable; (8) latent heat of vaporization varies from 128 B.th.u. per lb. at 0.4 lb./in.² abs. pressure to 118 B.th.u. per lb. at 73 lb./in.² abs. pressure. Mercury-vapour heating, cooling, and temperature-control systems may readily be employed to provide for effective temperature control, elimination of hazard, and for any temperature up to 500° C. Other advantages are low operating and maintenance costs, immediate "pick-up" from one temperature to another, small building space, high heat transfer, high effective temperature fall available, and simple attachment to any type of apparatus. Any source of heat can be used.—F. J.

Molybdenum. V. C. (*La Nature*, 1932, (2877), 268).—Deals with preparation, mode of occurrence, and uses of molybdenum.—W. P. R.

Nickel and Monel Metal. Reidar Lund (*Teknisk Ukeblad*, 1931, 78, 506-509; *C. Abs.*, 1932, 26, 3764).—A review, considering particularly the various new applications of nickel and Monel metal in industry, the household, and architecture.—S. G.

Some Notes on the Common Uses of Nickel. Antony Seton (*Met. Ind. (Lond.)*, 1932, 41, 243-245).—A brief account of the extraction of nickel from its ores, the effects of sulphur and manganese on the metal, and its uses in alloys, in plating, and for miscellaneous purposes.—J. H. W.

The Suitability of Nickel for Milk Plants Increased by the Utilization of a New Alloy with Chromium. E. C. Badeau (*Milk Plant Monthly*, 1932, 21, 45-46; *Chem. Zentr.*, 1932, 103, II., 607).—An alloy of nickel with 14% chromium has proved highly resistant to the usual conditions prevailing in dairies.

—A. R. P.

Nickel Coinage.—Some Recent Issues. Anon. (*Nickel Bulletin*, 1932, 7, 153).—Brief details of pure nickel coinages recently issued by Belgium, the Irish Free State, and the Vatican City are given.—J. H. W.

Vicrometal Developed for Use as Valve Seats. Anon. (*Daily Metal Reporter*, 1932, 32, (23), 4).—Vicrometal, a nickel-chromium alloy, is claimed to be highly resistant to corrosion and to retain its polished surface at superheating temperatures, after years of service. It is recommended for use in valve seating, with discs of nickel-copper alloy.—P. M. C. R.

Uses for the Platinum Metals. Bernard Holman (*Canad. Min. J.*, 1931, 52, 566-567; *C. Abs.*, 1931, 25, 3940).—A brief discussion of the precious metals refinery of the Mond Nickel Co. at Acton. Platinum of 99-93% and palladium of 99-94% purity are produced. The development of a small-scale laboratory method for the recovery of palladium from jewellers' lemel and "white-gold" scrap would help to extend the use of palladium.—S. G.

Fusible Tin Plugs. C. S. Darling (*Mech. World*, 1932, 91, 337).—Experiment has shown that the failure of a fusible plug to function is caused by the formation of a crust having a high melting point. Melted tin at the fire end of the plug is prevented from discharging freely by deposited ash, thus causing oxidation and eventual substitution of tin by copper from the wall of the firebox; also a slight leak of water containing calcium sulphate or magnesium sulphate results in the deposition of a hard, compact mass. Stannic oxide has a melting point of 1127° C. and the sulphates a melting point of 1300° C. It is suggested that, by arrangement with the insurance companies, the plug should be renewed periodically, say annually, and its fusible condition guaranteed.—F. J.

Colliery Boiler Plant: Fusible Plugs. Edward Ingham (*Colliery Guardian*, 1932, 145, 518-520).—The fusible plug safeguards boilers against overheating of the furnace crowns, by melting, and allowing water to enter the furnace and extinguish the fire. Lead, the material originally used, is liable to oxidation and consequent incomplete fusion; tin is preferable, but the tin-lead-bismuth alloys, offering a wide selection of melting points for various types of practice, are most often used. An annulus of the fusible metal is embedded in an infusible outer casing, generally made of gun-metal, as is the infusible core. The latter falls out when the white metal fuses, leaving a free channel for the escape of water and steam. The position, maintenance, and fitting of plugs are discussed and causes of failure are considered.—P. M. C. R.

The Use of "Widia" Tool Metal in the Coal-Mining Industry. Anon. (*Indian Engineering*, 1932, 91, 394-395).—The special advantages of employing Widia cutting edges for bar picks, chain picks, rock drilling bits, and coal drillers are not confined to an increase of more than 300% in actual performance, but include easy re-sharpening, obviating the complex processes required by ordinary tool-steels, with their concomitant risk of spoiling; reduced weight, and increased ease in cutting hard coal. The low resistance to shock of Widia is counteracted by the use of tools where the cutter is completely embedded in the holder, the cutting edge being the only projecting portion.

—P. M. C. R.

High-Class Whitemetalling on Connecting Rods. Anon. (*Met. Ind. (Lond.)*, 1932, 40, 561-562).—Notes are given describing a well-tried method of producing direct on to steel connecting rods, white-metal linings that will stand up to the most stringent duties, such as those obtaining in aeroplane engines.—J. H. W.

Zinc in Water Supplies. Edward Barton and Otis Melvin Weigle (*Indust. and Eng. Chem.*, 1932, 24, 463-465).—Tests are described on samples of water

containing zinc in solution, and apparently no harmful effect was produced in rats by giving them drinking water containing varying amounts of zinc sulphate in solution. Zinc in many drinking waters is derived from galvanized iron pipes and storage tanks in which the use of pure zinc would lessen the amount dissolved by the water. A field test for zinc in water is described, a Pyrex tube containing 1 c.c. sulphuric acid being two-thirds filled with the water sample. About 1 c.c. of a 10% potassium ferrocyanide solution is added, and the tube shaken, the presence of zinc causing opalescence.—F. J.

Report of Committee B-4 on Electrical Heating, Electrical Resistance, and Electric Furnace Alloys. Dean Harvey and F. E. Basir (*Amer. Soc. Test. Mat. Preprint*, No. 1, 1932, 1-3).—Among the subjects under discussion are the following—standardization of methods of testing thermostatic metals; testing methods, materials and calibration curves for thermocouples; the temperature coeff. of sheet resistance material, such as manganin. It is suggested that in the chemical analysis of metallic materials for electrical heating perchloric acid should be used instead of nitrohydrochloric acid for the solution of Group III elements. The ascarite absorption method for carbon is put forward to replace the present volumetric one. Mention is also made in the report of the progress in testing metals at high temperatures, in testing for thermal conductivity, life of heater wires, temperature resistance constants, and the bending properties.—W. A. C. N.

The Designer Has a Wide Choice of Materials. James Vincent (*Machinery* (N.Y.), 1932, 38, 831-832).—A general review, in which the properties of some modern alloys are outlined.—J. C. C.

Alloys in Aircraft Engines Discussed at Conference. R. R. Moore (*Daily Metal Reporter*, 1931, 31, (236), 11).—Report of an address before an industrial conference held at the Case School of Applied Science, U.S.A. The selection of alloys for various structural details is discussed, and the importance of foundry practice is emphasized.—P. M. C. R.

A New Protected Metal. Anon. (*Automotive Ind.*, 1932, 86, 654).—A laminated metal-felt material is described. Saturants suited to the type of service desired can be chosen and applied, and fireproof types are available. Forming operations do not destroy the adhesion between felt and metal.

—P. M. C. R.

Rapid Development of Glass Machinery Presents Unusual Problems. Anon. (*Nat. Glass Budget*, 1931, 47, (1), 3; *Ceram. Abs.*, 1931, 10, 491).—In the past 20 years the development of machinery for glass production has been rapid. The manufacture of glass machinery presents unusual problems. Many parts are exposed directly to the high temperature of molten glass, and other parts are alternately exposed to molten glass and then cooled by water or air blast. The modern glass machine should use nearly all the newly developed materials. Glass moulds are made of carefully selected fine-grain iron, and knockout arms are of aluminium. Monel metal, Nichrome, tungsten-carbide materials, Ascoloy, Elkonite, Nitralloy, and other special alloys having many different physical properties have some use in glass machinery for which they are especially well suited.—S. G.

Sprayed Metal Coating for Clay Products. Anon. (*Ceram. Age*, 1931, 17, (1), 17-20; *Ceram. Abs.*, 1931, 10, 475).—Metal in wire form is melted and sprayed on widely differing substances such as metal, wood, glass, porcelain, paper, concrete, plaster, &c. This process has proved commercially serviceable. The sprayed metal coatings may be turned, ground, filed, milled, shaped, or polished. The metal wire feeds automatically through an oxy-acetylene flame. It consumes about 15 ft.³ of acetylene and oxygen per hr. and 50 ft.³ (at 50 lb./in.²) of compressed air per minute. The spray covers a circle of about 2 in. in diameter on a surface 5 in. from the nozzle. In general, the nozzle is held about 4 in. from the surface. The temperature of the surface

risers but slightly, and it is possible to apply the coating on the most delicate objects. The process is being used for spraying fused quartz in building up large lenses. Freezing and thawing tests have indicated that no differential expansion occurs which might affect the durability of the coating. Charges for coating vary between 10 and 25 cents per ft.² for the material and a labour cost which varies with the cleaning and polishing requirements. It is possible to reheat the metal below its melting point for decorating purposes. The coating may be built up to any thickness within reason.—S. G.

Cathode Sputtering; a Commercial Application. H. F. Fruth (*Physics*, 1932, 2, 280-288).—The theory of cathode sputtering, its advantages and limitations are discussed. The commercial equipment and technique for applying gold electrode surfaces to diaphragms of types of microphones are described. By proper design of the plant, a uniform deposit can be obtained. Adherence and continuity are obtained by a special treatment for cleaning the diaphragms (Duralumin). The glossy roll finish on Duralumin is broken by a brass wire scratch bush; the diaphragms are then scrubbed in acetone, rinsed in ether, and rubbed dry with filter paper. An extensive bibliography on cathode sputtering is appended.—J. S. G. T.

Eye-Protection Glasses with Metal Coatings. Oscar Knapp (*Keram. Rund.*, 1930, 38, 151-153; *Ceram. Abs.*, 1930, 9, 928).—The ordinary protective glasses absorbing ultra-violet and infra-red rays in which the absorbing medium is incorporated in the glass have two disadvantages: (1) the absorption of these rays increases the temperature of the glasses and the area between the glasses and the eye, and (2) spectacle lenses which differ in thickness in different spots have varying absorptive powers. A method of coating glass by cathodic sputtering of metals produces protective lenses free from the disadvantages mentioned. The removal of the undesirable wave-lengths is by reflection rather than absorption. The percentage transmission for certain wave-lengths depends on the thickness of the coating. Platinum-coated glasses reflect all the ultra-violet up to 300 $\mu\mu$, but very little more of the infra-red than of the visible. Some gold-coated glasses reflect all the ultra-violet up to 330 $\mu\mu$, about 30% of the visible, and about 65% of the infra-red at 1200 $\mu\mu$. Some silver-coated glasses permit transmission of about 45% of the visible rays, only about 20% at 1000 $\mu\mu$, and 0 at 300 $\mu\mu$. A mixture of gold and silver is darker than any of the foregoing for the visible rays, but excludes practically 100% of the ultra-violet and infra-red. Such glasses are also efficient in preventing the overheating of preparations, lenses, &c., in micro-projection work.—S. G.

XI.—HEAT-TREATMENT

(Continued from p. 570.)

[Heat-Treatment of Aluminium and its Alloys by the] Boeing Airplane Company. J. B. Nealey (*Heat-Treating and Forging*, 1932, 8, 433-434).—There are 2 types of equipment for heat-treating aluminium and its alloys: (1) where the parts are placed directly in the heating chamber, and (2) where they are immersed in a tank of hot liquid. A brief description of a plant employing the latter process is given.—J. H. W.

Bright-Annealing of Copper in Electric Furnaces. E. Fr. Russ (*Z. Metallkunde*, 1932, 24, 188-191).—An illustrated description of a large electric furnace ($3.5 \times 5.7 \times 1.1$ m.) constructed by R. for the bright-annealing of Elmore copper sheets (3.1×5.3 m.) with a charge of up to 25,000 kg. using nitrogen or carbon dioxide as protective gas. Results of mechanical tests and microscopic investigations of bright-annealed copper sheet are given.

—M. H.

On the Heat-Treatment of Metal Strip in Continuous Annealing Furnaces. —I. O. Junker (*Z. Metallkunde*, 1932, 24, 162-164).—(1) The temperature

of 63 : 37 brass strip during its passage through a continuous annealing furnace has been calculated as a function of the wall temperature of the furnace, and the surface condition (radiation number) of the sheet and the wall of the furnace. (2) The heating curve sheet temperature-annealing period of 63 : 37 brass depends on whether the sheet is annealed soft, cold-rolled, or coated with a layer of oil, cold-rolled sheet requiring a much longer anneal to reach the temperature of the furnace than soft annealed or oil-coated sheet.

—M. H.

Variety of Citroen Steels and Heat-Treatments Limited by Extensive Standardization Programme. Joseph Geschelin (*Automotive Ind.*, 1932, 67, 290-292, 316).—The Citroen standard specifications for selection and heat-treatment of both ferrous and non-ferrous structural materials, are quoted and discussed.—P. M. C. R.

XII.—JOINING

(Continued from pp. 570-572.)

The Closing of Hollow Rivets with the Cross-Stay Clinch-Hammer (Snap-head). A. Westlinning (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1931, 3, 411-413).—Describes the closing of hollow rivets of Lantal in light metal construction by means of a special riveting hammer.—M. H.

Lantal and Lantal Riveting. Otto Repp (*Aluminium Broadcast*, 1931, 3, (9), 2-34).—A full translation with curves and sketches, from *Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1930, 2, 229-279. See *J.*, 1931, 47, 400.

—J. C. C.

Aluminium Solders. Edmund R. Thews (*Met. Ind. (Lond.)*, 1932, 40, 659-660, 664).—Modern aluminium solders are of 2 classes: (1) soft solders, containing either zinc or tin as the alloying base, and (2) hard solders, composed chiefly of aluminium with 5-30% of other constituents. Straight zinc-tin solders rich in zinc range from 80 : 20 to 50·2 : 48·6 zinc-tin, but most soft solders have tin as the chief alloying constituent and contain tin 46-83, zinc 0-35, aluminium 0-30, lead 0-26, and copper 0-10%, with a small proportion of other elements. They are much more expensive than the zinc-base solders, but are more fluid and more easily applied and their corrosion resistance and durability are far superior. All the tin-rich solders exhibit a comparatively wide melting (softening) interval. The soft aluminium solders as a group are of little use in producing reliably strong and durable joints. If correctly composed and applied, the hard aluminium-rich solders give joints practically as strong and corrosion-resistant as the base material. The melting temperature is relatively high, 1000°-1050° F. (540°-565° C.). They require the use of fluxes composed of mixtures of chlorides and fluorides of alkalis and alkaline earths, and often contain lithium salts. A number of other constituents, sometimes as many as 10, are added to lower the melting temperature.—J. H. W.

Aluminium Solder [Alumaweld]. Anon. (*Compressed Air Mag.*, 1932, 37, 3810).—See *J.*, this volume, p. 383.—P. M. C. R.

The Composition of Silver Solders. Ralph J. Snelling (*Deut. Goldschmiede-Zeit.*, 1930, 33, 543-544; *C. Abs.*, 1931, 25, 3949).—Silver solders usually are silver-copper or silver-copper-zinc alloys. The zinc lowers the melting point, but decreases the strength and ductility. An alloy containing silver 65, copper 20, and zinc 15% melts at 695° C. and has good properties. For use on second quality articles the solder may contain only 25% or 30% silver. Several % of cadmium can be added to silver solders with advantage. Tin or nickel are also sometimes used. Iron and other impurities should be carefully avoided.—S. G.

Brazing Metals with Silver Solders. A. Eyles (*Machinery (N.Y.)*, 1932, 38, 348-350, 430-431).—The physical properties ("flowpoint," "melting point," tensile strength, elongation, density, and electrical conductivity) of representative silver solders are tabulated and discussed. The characteristics of fluxes

made from mixtures of borax and boracic acid and the question of correct brazing temperature are discussed, and an account is given of the method of brazing stainless iron and steel.—J. C. C.

["Sil-Fos"] A New Brazing Alloy. Anon. (*Machinery* (N.Y.), 1932, 38, 771).—"Sil-Fos" is a self-fluxing brazing alloy with a low melting point of 705° C. See this *J.*, 1931, 47, 596, and this volume, pp. 53, 186.—J. C. C.

On the Use of Cadmium [in Solders]. Anon. (*Giesserei und Masch. Zeit.*, 1932, 5, (1), 7-8).—A typical cadmium solder has the following composition—tin 50; cadmium 25; lead 25%. The disadvantages of this and similar alloys so far advanced are: (1) the alloys low in tin assume a darker colour than ordinary solders; (2) the ease with which cadmium is oxidized; (3) joints are not easy to make or always perfect. The addition of small quantities of zinc reduces the amount of oxidation, but the addition should not exceed 3%. Fluxes should contain zinc chloride. A typical flux contains—zinc chloride, 65, potassium chloride 14, sodium chloride 11, ammonium chloride 10%.

—W. A. C. N.

[Kester] Flux-Cored Solder. Anon. (*Mech. World*, 1932, 91, 615-616).—Under the name of "Kester," soft solders are supplied in hollow-wire form, containing the flux in pockets. Various brands contain different fluxes, e.g. acid core solder containing a flux of chlorides and usable for all general work except aluminium and certain aluminium alloys; also resin-cored solder, suitable for manufacture and repair of electrical equipment.—F. J.

New Electric Heater for Soldering Irons. A. Eyles (*Mech. World*, 1932, 91, 222).—A new method of electrically heating soldering tools is described and illustrated. A special alloy-steel stud is screwed through the copper bit, projecting about $\frac{1}{4}$ inch on each side of the flats and serving as a heating element. The stud is gripped in the jaws of an electrical heater which raises the bit to soldering temperature in less than a minute. The advantages claimed are low current consumption, preservation of tin-coating, long life of tool, due to absence of pitting from gas-fumes, and absence of danger.—F. J.

Soldering Metals without a Soldering Iron. Anon. (*Machinery* (Lond.), 1931, 38, 177; *correspondence*, 408, 600).—Workshop notes.—J. C. C.

An Aid to Heavy Soldering. R. H. U. A. E. (*Machinery* (Lond.), 1931, 38, 823; 1931, 39, 111).—Workshop notes.—J. C. C.

The Joining of Aviation Tubes. Anon. (*Cuivre et Laiton*, 1930, 3, 13-14).—Three different types of joints are illustrated and their details examined.

—W. A. C. N.

Some Notes on Welding Aluminium and Duralumin. A. Eyles (*Mech. World*, 1932, 91, 228).—No method is more generally satisfactory than autogenous welding, although Duralumin suffers in mechanical properties when heated during the process. Arc-welding of aluminium and its alloys is now a practical production method, flux-coated electrodes and a suitable flux being necessary. Full workshop notes are given. For jointing Duralumin in structural work riveting is preferable to welding.—F. J.

The Welding of Aluminium. Anon. (*Zentral-Europ. Giess.-Zeit.*, 1931, 4, (9), 4-6).—One of the difficulties in welding aluminium is that owing to its low melting point the metal is molten before there are any markedly visible effects. A flux having the trade name "Autogal" is suggested. In order to reduce the rapid extraction of heat from the weld line the use of heavy pieces of copper, or other like material, laid parallel with the weld is recommended. The welder must work quickly in order not to cause too much metal to become fluid. A review is given of the uses to which aluminium and its various alloys are put, especially where welding is serviceable.—W. A. C. N.

The Electric Arc Welding of Aluminium. A. E. (*Machinery* (Lond.), 1930, 37, 231).—Aluminium was first successfully welded by W. C. Heraeus, of Hanau, Germany, who exhibited welded vessels, &c., at the Paris Exhibition in 1900; the process was described in the *Electrochemist and Metallurgist*, March 1901,

from which extracts are quoted. A brief note is given of the modern arc-welding method.—H. F. G.

Welding of Aluminium Furniture. Anon. (*Anz. Berg.-Hütten-u. Masch.*, 1932, 54, (53), 3-5).—B. Bl.

How to Weld Duralumin. Anon. (*Aero Digest*, 1929, 15, 164; *Eng. Index*, 1930).—Precautions to be observed in preparing and welding Duralumin are discussed. Sheet Duralumin should be spaced $\frac{1}{8}$ in. per ft. of seam. The tensile strength which can be expected of welds made in Duralumin varies with the methods used in heat-treating and quenching.—S. G.

Brewery Plant of Copper and Aluminium Welded by Oxy-Acetylene. Anon. (*Soudeur-Coupeur*, 1932, 11, (4), 1-4).—Describes and illustrates typical fabricated plant.—H. W. G. H.

Oxy-Acetylene Welding of Copper Fermentation Vats. Anon. (*Mech. and Welding Eng.*, 1932, 6, 70-71, 73).—Describes the fabrication of eighteen vats, 6 ft. 4 in. diam. \times 8 ft. 6 in. high, from $\frac{3}{8}$ -in. copper plate.—H. W. G. H.

Autogenous Welding of Copper. A. Desgranges (*Cuivre et Laiton*, 1930, 3, 209-211).—The conditions of heating, choice of copper free from oxide, adoption of suitable fluxes, and manipulative details are considered. Autogenous welding under proper conditions gives very satisfactory joints.—W. A. C. N.

On the Autogenous Welding of Copper. The Influence of Oxide on the Different Conditions during the Thermal Treatment and Fusion of Copper. Le Grix (*Cuivre et Laiton*, 1930, 3, 261-264).—A discussion, illustrated by photomicrographs, on the transformations which occur in the oxide particles in copper during the heating for welding purposes. The growth of the eutectic and the effect of varying the metal to which the copper may be welded are studied. The influence of the presence of oxide on the strength of the joint is carefully reviewed.—W. A. C. N.

Autogenous Welding of Copper Fire-Boxes. E. Weese (*Metallurgist (Suppt. to Engineer)*, 1932, 8, 94-95).—A summary of a paper in *Z. Metallkunde*, 1932, 24, 11. See *J.*, this volume, p. 257.—R. G.

The Premag Process of Copper Welding. Anon. (*Machinery (Lond.)*, 1930, 37, 232).—In the Premag process, which is especially suitable for vessels for chemical works and breweries and for varnish boilers, alloy filler rods coated with flux are used; the technique is readily acquired.—H. F. G.

"Premag" Welding of Copper in Australia. J. D. Millar (*Indust. Gases*, 1932, 13, 28-30; and *Welder*, 1932, 3, (30), 18-22).—Typical examples of welded copper work are illustrated. The average test-figures obtained are given as 13.5 tons/in.² ultimate stress and 32.5% elongation on 4 in. Microscopic examination failed to detect any cuprous oxide in the welds.—H. W. G. H.

Welding of Extruded Bronze. Ira T. Hook (*J. Amer. Welding Soc.*, 1932, 11, (4), 42-46).—The composition and properties of the commercially extruded alloys are reviewed, with regard mainly to their weldability. Since most of these are used in architectural work, the colour of a welded or soldered joint is of great importance. The oxy-acetylene process is recommended for welding and silver soldering and the advantages of a large jet and a soft flame are pointed out. Emphasis is laid on the need for welding these materials in a continuous run without even the interruption occasioned by dipping the rod in the flux. The seam should be painted, and the rods coated beforehand, with a suspension of the flux in alcohol.—H. W. G. H.

The Jointing of Fine Brass Wire Gauze with the Oxy-Acetylene Flame. Anon. (*Indust. Gases*, 1932, 13, 46-47).—An extremely fine jet is used, the orifice being about 1/100 in. in diam. The joint is made with silver solder, filings of which are mixed with a solution of brazing flux and painted on the edges to be joined. The gauze is clamped between steel plates and, for long seams, the blowpipe is fixed in a travelling jig.—H. W. G. H.

The Autogenous Welding of Lead. Anon. (*Soudeur et Oxy-Coupage*, 1932, 9, 139).—The four principal methods to be used are described—viz. horizontal

welding on the flat; welding vertically, upwards; welding on a slope, upwards; welding horizontally, the sheets being placed vertically and the edge of the lower one turned out to form a trough to retain the molten metal. In each case, the edges of the sheets overlap. A large bend is illustrated to show where the second, third, and fourth methods were used.—H. W. G. H.

Autogenous Welding of Lead and its Alloys—Ancient and Modern. E. B. Partington (*Met. Ind. (Lond.)*, 1931, 39, 487-489).—Abstract of paper read before the Institution of Welding Engineers. See *J.*, this volume, p. 113.

—J. H. W.

Welding, Cutting, and Leadburning at the Army Vocational Training Centre, Aldershot. Anon. (*Indust. Gases*, 1932, 13, 13-16).—The syllabus, which includes non-ferrous materials, is discussed and illustrations of the work carried out are given.—H. W. G. H.

Welding Cast Elektron Crankcases. Hans A. Horn (*Autogene Metallbearbeitung*, 1932, 25, 135-138).—The behaviour of Elektron under the welding flame is very different from that of aluminium alloys, although it is as easily welded. It cannot be puddled and special filler rods and flux must be used. The latter is hygroscopic and must be kept perfectly dry: liquid fluxes are useless for cast Elektron. The welding flame should be about half the size used for aluminium. Castings must be carefully preheated.—H. W. G. H.

Gas-Welded and Brazed Joints for High Nickel Alloys. F. G. Flocke, J. G. Schoener, and R. J. McKay (*J. Amer. Welding Soc.*, 1932, 11, (3), 12-16).—See *J.*, this volume, p. 188.—H. W. G. H.

Some Practical Notes on Welding Monel Metal. Anon. (*Machinery (Lond.)*, 1931, 37, 733-734; *correspondence*, 1931, 38, 13).—The oxy-acetylene process is recommended for welding Monel metal, using a saturated solution of boric acid in alcohol as a flux. It is preferable to weld in one operation, and to build up the joint above the surface so as to ensure the absence of oxide inclusions in the main section. Castings should be maintained at a dull red heat during welding. In a subsequent letter, a flux made by dissolving equal volumes of borax, boric acid, and water glass in hot water is recommended.—J. C. C.

Notes on Welding Monel Metal. C. B. G. E. D. (*Machinery (Lond.)*, 1931, 39, 17, 238).—Workshop notes.—J. C. C.

Welding Bimetal. Hans A. Horn (*Autogene Metallbearbeitung*, 1932, 25, 145-147).—The joining of samples of a silver-copper bimetal is discussed. It is not possible to weld both sides. In short seams, the silver side may be welded and the copper brazed, but in long seams even the silver side must be soldered—using a rod of high silver content.—H. W. G. H.

Hard Facing for High-Pressure Work. Anon. (*Oxy-Acetylene Tips*, 1932, 11, 57).—Boiler feed-pump valves were faced with Stellite by the oxy-acetylene process and a considerable increase in length of life was obtained.—H. W. G. H.

Hard Facing Metals. F. P. Gormeley (*Internat. Acetylene Assoc. Proc.*, 1928, 128-134).—See this *J.*, 1930, 43, 626.—H. W. G. H.

A Time-Saving Operation. Anon. (*Oxy-Acetylene Tips*, 1932, 11, 73).—Describes the re-Babbitting of the bearings in a large press, by the aid of the oxy-acetylene blowpipe, without dismantling.—H. W. G. H.

Chemical Industry Uses Gas Welding. R. C. Hosterman (*Acetylene J.*, 1930, 31, 491-496; *C. Abs.*, 1930, 24, 4751).—A discussion of the application of oxy-acetylene welding to pipe racks, pipe assemblies, tanks, reaction vessels for high temperature and pressure, aluminium distillation equipment, and chromium-nickel alloys. Welded tank plans, details of welded joints, and specifications for oxy-acetylene-welded pressure vessels more than 12 in. in diam., carrying a pressure of 30 lb./in.², are given.—S. G.

Distribution of Stress in Parallel Welding Fillets. H. M. MacKay and A. M. Bain (*Canad. J. Research*, 1930, 3, 260-271).—A mathematical theory is developed for the distribution of stress in welded joints with parallel fillets, in

the case where each of the members connected by the weld is of uniform cross-section. The theory is verified by strain measurements on two specimens of the type of joint considered.—S. G.

Autogenous Welding. R. Granjon and P. Rosemberg (*Cuivre et Laiton*, 1930, 3, 69-70, 117, 118).—Definitions of the various terms used are given and discussed. The different methods of assembling the pieces to be welded are described and some are illustrated. There follow short accounts of the processes by which welds are produced. The advantages and disadvantages are included.—W. A. C. N.

Arc Welding with Alternating Current. G. W. Stubbings (*Mech. World*, 1932, 91, 318).—A d.c. welding machine is relatively complicated and costly and the successful application of a.c. for welding purposes would greatly simplify the outfit. The most important difficulties are: (1) starting the arc, which necessitates an undesirably high voltage on open circuit, and (2) arc-control, particularly difficult when using the small currents required for thin material. A new type of a.c. arc-welding outfit has recently been developed, consisting of a transformer provided with means of adjusting the current by small stages, together with a subsidiary oscillating circuit, the object of which is to stabilize the arc. The arrangement of the component parts of the gear is shown in a diagram and the theory explained. In point of lightness, portability, and cheapness the a.c. equipment is well in advance of the d.c. plant.—F. J.

Electric Welding with Atomic Hydrogen by the Arcatom Process. Anon. (*Génie civil*, 1932, 100, 319-320).—A general description of an atomic hydrogen welding outfit. The equipment includes a specially wound transformer with 9 stages giving a current from 20 to 70 amp., according to the thickness of the article to be welded. All types of steel, aluminium and its alloys, copper and nickel can be welded by this method. Curves are given showing the consumption of power, of tungsten electrodes, and of hydrogen required to weld two plates 1 m. in length and varying from 1 mm. to 6 mm. in thickness. Welds made with atomic hydrogen flame are characterized by excellent ductility.—W. P. R.

Atomic Hydrogen Welding. Samuel Martin (*Mech. World*, 1932, 91, 366-367).—Abstracted from *Iron Age*, 1932, 129, 537. See *J.*, this volume, p. 326.—F. J.

The Oxy-Acetylene Process in the Chemical Industry. R. C. Hosterman (*Internat. Acetylene Assoc. Proc.*, 1929, 133-146).—See *J.*, this volume, p. 258.—H. G. W. H.

Procedure for Testing the Safety in the Working of Acetylene Equal-Pressure Plant. W. Rimarski and H. Friedrich (*Autogene Metallbearbeitung*, 1932, 25, 98-106).—The conditions necessary for safety in acetylene plant are briefly reviewed. Systems of supply are described which are tested under the worst conditions which could occur in practice. Explosions are started at various points in the pipe system by electrical ignition, and the resulting pressures measured at various points by observing the indentations on standard test-pieces produced by hardened steel balls attached to small pistons. The results are discussed, and some units, found satisfactory under test, are illustrated.—H. W. G. H.

The New Keel Multi-Flame Blowpipe. F. C. Keel (*J. Amer. Welding Soc.*, 1932, 11, (2) 16-19).—Reprinted from *Welding J.*, 1931, 28, 137-140. See *J.*, this volume, p. 115.—H. W. G. H.

The Oxyacetylene Flame. D. Seférian (*Génie civil*, 1930, 98, (12), 298).—Abstract of an article by S. in *Rev. Soudure autogène*, 1929, 21, 1870. See *J.*, this volume, p. 114.—W. P. R.

The Effective Fighting of Acetylene Fires. Carl Timm (*Schmelzschweißung*, 1930, 8, 56-57; *C. Abs.*, 1932, 28, 3670).—The origin and causes of acetylene ignition are discussed. Nitrogen and carbon dioxide snow have been found to

be the most effective extinguishers. Carbon tetrachloride, on the contrary, should be avoided, because of the danger of phosgene gas being formed in the heat of the acetylene flame.—S. G.

The New Symbols for Welded Joints According to DIN 1912. A. Hilpert (*Autogene Metallbearbeitung*, 1932, 25, 161-166).—Illustrates, describes, and explains the additions and alterations given in the latest issue of the DIN standard symbols for welded joints.—H. W. G. H.

Welding in Switzerland. C. F. Keel (*Internat. Acetylene Assoc. Proc.*, 1928, 144-164).—Only ferrous applications are discussed. Right-hand welding—especially vertically upward—is recommended for thicknesses of more than $\frac{1}{2}$ in. and, with this procedure, the oxy-acetylene process is said at least to equal the arc method in cost for structural welding. The procedure recommended requires the blowpipe nozzle to be moved steadily in the line of the weld without oscillation, and it is pointed out that this is admirably suited to automatic welding.—H. W. G. H.

Practical Hints for the Welder. W. Kemsics (*Giesserei- u. Masch. Zeit.*, 1932, 5, (1), 9-10).—Deals with welding faults and their causes; normal types of welds; the welding of cast-iron, brass, and aluminium; welding powders; conditions for clean cutting; the efficient handling of repairs. One of the ever-recurring mistakes is stated to be that the welding rod is not held at its correct distance from the molten material. The various types of welding practice are discussed.—W. A. C. N.

Comparative Investigation of Forward and Backward Welding. — Bardtke and — Matting (*Autogene Metallbearbeitung*, 1931, 24, 159-164, 175-178).—Tests carried out on M.S., 6-16 mm. thick, show the advantage of backward welding ("rechtsschweissung") in both economy and quality of weld produced. The greater speed of welding possible with this method reduces costs of labour, gas, and flux.—H. W. G. H.

Economy of Forward and Backward Welding for "Building-Up." — Bardtke and — Matting (*Autogene Metallbearbeitung*, 1932, 25, 184-187).—The article refers to ferrous materials. Backward welding is found to have definite advantages in economy and technique. With highly skilled welders, however, no improvement in quality of the welds is obtained.—H. W. G. H.

Methods of Welding—Overhead Welding. Anon. (*Soudure et Oxy-Coupage*, 1932, 9, 135).—A special technique is recommended in which the welder places himself directly under the line of the seam and welds towards himself, the filler rod preceding the blowpipe.—H. W. G. H.

Methods of Welding—Welding on an Incline with Two Passes. Anon. (*Soudure et Oxy-Coupage*, 1932, 9, 143).—This is the last of a series of articles on welding methods, in which practical details of technique are described. Forward welding is recommended.—H. W. G. H.

Concerning Welding Speeds. R. Meslier (*Rev. Soudure Autogène*, 1932, 24, 2430-2431).—A protest against exaggerated claims for rapid welding.—H. H.

Pinholes and Blowholes in Metals and Welds. H. A. Horn and K. Tewes (*Autogene Metallbearbeitung*, 1932, 25, 88-92).—Attention is mainly given to ferrous materials, but the welding of copper and nickel is briefly considered. In the former case, a filler rod is recommended containing a deoxidizing element and silver. It is emphasized that the gases for flame welding must be pure; the presence of sulphur is especially to be avoided in the case of nickel. Right-hand welding for nickel and high nickel alloys is recommended for avoiding porosity. X-ray investigation is suggested as the only satisfactory, non-destructive method for detecting blowholes.—H. W. G. H.

Controlling Expansion and Contraction. Anon. (*Oxy-Acetylene Tips*, 1932, 11, 67-71; and (summary) *Welding News*, 1932, 3, 17-19).—Practical suggestions on methods of compensating for heat effects during welding of sheet, worked shapes, and castings.—H. W. G. H.

XIII.—WORKING

(Continued from pp. 573-577.)

Aluminium Sheet Production. XIII.—Finish Rolling. Robert J. Anderson (*Metallurgia*, 1932, 6, 11-14, 45-48, 85-86, 121-122).—The finish-rolling operations in the production of aluminium flat sheet and coil are discussed. The general principles of finish rolling are dealt with first, and then details of the practice employed in the manufacture of grey plate, bright flat sheet, and coil are given. Pack-rolling in the production of light-gauge flat sheet is also described. Lubrication of the metal on the finishing passes is considered, and the drafts and number of passes in reducing to the finished gauge are fully discussed. The essential differences in the finish rolling of flat-sheet stock as compared with coil are emphasized, the discussion being concerned principally with the practice employed in finish rolling commercially pure aluminium and the softer alloys, but some information is also given as applying to hard alloys such as Duralumin. Finally, brief consideration is given to recent, and probable future, tendencies in rolling methods as influenced by demands for close gauge tolerances, the necessity for decreasing labour costs of finish rolling, and other factors, and in this connection some experiments carried out to determine the feasibility of rolling wide aluminium strip on four-high continuous mills, are described.—J. W. D.

Experimental Rolling-Mill Equipment in the Metrovick Research Laboratories. Anon. (*Met. Ind. (Lond.)*, 1932, 41, 282).—Brief description of the experimental rolling and heat-treatment plant of the Metropolitan-Vickers Electrical Co.—J. H. W.

Faults in the Manufacture of Silver Sheet.—II. E. Raub (*Mitt. Forschungsinst. Edelmetalle*, 1932, 6, 29-32).—The danger of overheating 830-fine silver during hot forging is illustrated and discussed; above 779° part of the metal liquefies and during hammering this liquid is forced out through the surface. Small inclusions of steel particles in a silver melt do not make their presence known until the metal is rolled into thin sheet or until it is sawn, when hard spots are noticed.—A. R. P.

Effect of Temperature and Impurities on the Rolling of Zinc. I.—Rolling Tests on Electrolytic and Refined Zinc at Different Temperatures; II.—Effect of Impurities on the Rolling of Zinc. O. Bauer and P. Zunker (*Metallwirtschaft*, 1932, 11, 289-292, 303-306; (abstract) *Z. Metallkunde*, 1932, 24, 191-192).—Small ingots (200 grm.) of zinc were rolled at various temperatures until fracture ensued. Above 110° C. electrolytic zinc, and above 130° C. refined zinc can readily be rolled without fracturing. Statements in the literature that rolling in the range 120°-140° C. is particularly difficult could not be confirmed. The re-formation of the casting structure of electrolytic zinc begins at 90° C. with 30% reduction of thickness and at 190° C. after 20% reduction; for refined zinc the corresponding reductions are 60% and 30%. With impurities up to 1%, lead has no effect on the rolling properties, copper and antimony are relatively harmless, iron and especially tin are very objectionable, as is also cadmium above 0.25%, the limit of solid solubility.—v. G.

Effects of the Direction of Drawing on the Arrangement of the Micro-Crystals in Aluminium Wire and on its Tensile Strength and Broken Fracture. Takeo Fujiwara (*Mem. Coll. Sci. Kyoto Imp. Univ.*, 1932, [A], 15, 35-42).—[In English.] The arrangement of micro-crystals in drawn aluminium wire was examined by photomicrographs and by Laue patterns. Micro-crystals having a crystallographic axis [111] inclined to the direction of drawing towards the exterior, and thus lying in a cone, are most predominant in wire drawn in one

direction. In wire drawn alternately in reverse directions the arrangement in the exterior part is such that the [111] axes are inclined to the axis of the wire on both sides, interior and exterior, and the amount of the angular displacement is less than in the wire drawn in one direction. In both wires the inclination of the [111] axis becomes smaller as the core of the wire is approached, and also the diameter is reduced by successive drawings. The change in the arrangement is marked in specimens reduced by 87% and 89% by drawing, but diminishes with further reduction, being scarcely recognizable at a reduction in diameter of 94%. Wires drawn in one direction only are harder and more brittle than those drawn alternately in reverse directions; the tensile strength and the fracture also differ in the two cases.—E. S. H.

Investigation of Duralumin Wire. I. G. Schulgin (*Trans. Central Aero-Hydrodynamic Inst. No. 83, 1931, 1-93; Sci.-Res. Inst. Supreme Council Nat. Econ., No. 450*).—[In Russian, with English summary.] The methods of manufacturing Duralumin wire in the U.S.S.R. and abroad are reviewed. It is concluded that in order to obtain a high-grade wire the original ingot must be perfectly sound, and careful control must be maintained of the conditions of the initial heating, rolling, annealing between passes (both the time and temperature), and drawing (including accuracy of shape of the die and degree of the final annealing). The various samples of wire were examined for their chemical composition (the copper content varied from 2.03 to 4.89%, cf. Table III), mechanical properties (tensile strength, shear stress, Brinell hardness, resistance to a twisting stress, resistance to a bending stress of 90°, cf. Tables IV-XII and Figs. 7-16), and microstructure. It was found that to ensure a clean surface, the final pass must be carried out hot with a circular and not rectangular cross-section of the ingot. The optimum conditions for quenching in water at room temperature from the point of view of economic manufacture are 480°-500° C. for a copper content up to 3%, and 520° C. for a copper content greater than 3.5%. The resulting wire has an average tensile strength of from 35.5 kg./mm.² for copper = 2%, to 45 kg./mm.² for copper = 5%; an elongation coeff. of 20-23%, a limiting shear stress from 21.5 to 27 kg./mm.², resistance to twist from 38 turns to 19 turns, and resistance to bending from 8 bends to 4 bends. In general, the strength of the wire (both tensile and shear) rises with rise in quenching temperature to 535° C. with the copper content up to 4%. With a higher percentage than this, the strength has a tendency to fall at a quenching temperature of 475°-500° C., remains steady at quenching temperatures of 525°-535° C., and falls markedly above 575° C. With increase in diameter of the cross-section the mechanical properties are lowered. The limiting number of turns and bends remains almost constant with quenching temperatures between 475° and 535° C., the number of turns increasing with the rate of twisting as the temperature is raised. Although overheating of the alloy lowers the mechanical properties, yet it has no noticeable effect on the microstructure. The limiting quenching temperature for the alloy is 550° C. for copper above 3.5%, and 535° C. for copper below 3.5%. In practice, however, it is not desirable to raise the temperature above 520° C. under works conditions, since errors of temperature measurement are possible, which might result in overheating.—M. Z.

Notes on the Manufacture of Enamelled Copper Wire.—IV. Roger Campredon (*Caoutchouc & Gutta-percha, 1932, 29, 15875*).—Cf. J., this volume, p. 236.—S. G.

Wire Weaves an Industrial Romance. Anon. (*Indian Engineering, 1932, 92, (11), 216-217*).—A short account of the development of the Birmingham wire-drawing industry.—P. M. C. R.

The Manufacture of Thin-Wall Tubing. William S. Iyhne (*Machinery (N.Y.), 1930, 36, 860-864*).—Cf. J., this volume, p. 387.—H. F. G.

On Plastic Shaping in Calculation and Experiment. E. Siebel (*Stahl u. Eisen*, 1931, 51, 1462-1468; and (summary and discussion) *Metallurgist* (Suppt. to *Engineer*), 1932, 8, 22-24).—A summarized report (see this *J.*, 1931, 47, 311, 565, and this volume, p. 56).—J. W.

Impact Extrusion of Aluminium. Herbert H. Hall (*Amer. Machinist* (*Eur. Edn.*), 1932, 76, 925-928).—By means of the impact process of extrusion with large presses at high working speed, many unusual shapes can be formed with aluminium. The process, which is usually done cold, is described in some detail. The Hooker process, in which the metal, instead of squirting up round the punch, flows down around the point of the punch through an opening in the die, is also described.—J. H. W.

Electrolytic Conductors Produced in Aluminium by Impact Extrusion. Anon. (*Iron Age*, 1932, 130, 220).—Describes the steps in the process of making electrolytic conductors in aluminium by impact extrusion.—J. H. W.

Variations in Microstructure Inherent in Processes of Manufacturing Extruded and Forged Brass. Ogden B. Malin (*Pennsylvania State Coll., Mineral Ind. Exp. Station, Tech. Paper No. 1*, 1932, 1-9).—A paper read before the American Institute of Mining and Metallurgical Engineers. See *J.*, this volume, p. 503.—S. G.

The Judge Lead Press. Anon. (*Met. Ind. (Lond.)*, 1932, 41, 174, 185).—Describes a press for lead-sheathing cable. Pressure is applied to the lead in a direction parallel with the cable, with the advantages that there is no longitudinal weld, no tendency of the lead to corrugate, low oxidation of the lead, low extruding pressure (12 ton/in.² maximum for pure lead and 15 ton/in.² maximum for alloys), easy changeability of the points and dies, central heating near the admission of the lead, and hence easy temperature control.—J. H. W.

Data for Designing Sheet Aluminium Parts. K. George Selander (*Machinery* (N.Y.), 1930, 36, 608-610).—The advantages of producing many parts from sheet aluminium by blanking, bending, and forming operations are noted. "51-S" Alloy, which is largely used in the manufacture of furniture, is recommended; four grades are available, viz., soft, quenched, aged, and hard. The soft grade has tensile strength 30,000-40,000 lb./in.²; yield-point 15,000-20,000 lb./in.²; elongation on 2 in., 20-30%; and Brinell hardness 55-70. Tables are given for obtaining the blank sizes for formed aluminium parts, and for the layout dimensions of blanks for various shapes. Another table gives the shearing strengths of screw threads in aluminium alloy sheets, and may be employed for estimating the strength of screwed fastenings.—H. F. G.

Furnaces and Hammers for Forging Aluminium. J. B. Nealey (*Metal Progress*, 1932, 22, (1), 43-46).—Besides Duralumin, which at its forging temperature is quite hard, the alloys "25S" (copper 4.4, silicon 0.8, manganese 0.75%), "super-Duralumin" ("25S" with magnesium 0.35%), and "51S" (silicon 1 and magnesium 0.6%) are considered. These are softer at their forging temperatures than is Duralumin, whilst possessing considerable strength in the forged condition. The carefully controlled forging practice at the Cleveland works of the Aluminum Company of America is described and illustrated.—P. M. C. R.

Hopper for Brass Shells. J. E. Fenno (*Machinery* (N.Y.), 1930, 36, 625-626).—An illustrated description of a method of feeding brass shells to a power press in which hooks lift the shells from the reservoir and drop them into a suitably placed chute.—H. F. G.

Methods of Bending Aluminium Tubing. F. V. Hartman (*Amer. Machinist* (*Eur. Edn.*), 1932, 76, 819-821).—The simplest method of bending aluminium tubing is by means of 2 pins on a flat plate, but requires some skill. Bending over a form is safer, and the use of a mandrel is an additional precaution against the collapse of the tube. A filler of sand, rosin, pitch, tar, or a low-melting

alloy, such as Wood's alloy, is used with a simple method of bending for making complicated bends. Hot bending requires more care, although the material may be softer. The choice of a suitable alloy for pipes is discussed.—J. H. W.

Hack-Saw Cutting. Anon. (*Machinery (Lond.)*, 1930, 36, 601-602).—The blade speeds of various types of machine are discussed, and tables are given of the most suitable pitch of the saw teeth for cutting bronze, aluminium, brass, copper, and steels by hand and in light and heavy power machines. The coolant recommended contains 1 lb. of soda and a very small quantity of soluble oil per gallon; greasy or oily coolants should not be used.—H. F. G.

Machinability Measured by Simple Tool. O. W. Boston and C. E. Kraus (*Metal Progress*, 1932, 22, (3), 29-33).—The tool dynamometer described is intended for comparative routine testing, either for uniformity and ease of cutting, machinability, influence of cutting fluid, and skin characteristics. The results obtained compare favourably in point of accuracy with those obtained by other methods; the apparatus is simple and the cost of working low.—P. R.

Rolling Grooves in Aluminium Pistons for Airplane Engines. H. T. Laffin (*Machinery (N.Y.)*, 1930, 36, 611).—Cf. *J.*, this volume, p. 259.—H. F. G.

Machining Airplane Engine Cylinder Heads. Charles O. Herb (*Machinery (N.Y.)*, 1930, 36, 763-765).—Cf. *J.*, this volume, p. 388.—H. F. G.

Diamond Boring Applied to Production Work. Anon. (*Machinery (N.Y.)*, 1930, 36, 775-777; and *Met. Ind. (Lond.)*, 1930, 36, 617-619).—An account is given of (a) the finish-boring of bronze bushings, $\frac{3}{4} \times \frac{3}{4}$ in., to within 0.0002 in.; (b) the setting up and boring of a bronze pump body; (c) the boring of bronze bushings in valve rocker arms; and (d) the finish-boring of brass valve bodies. The spindle speed employed is 4000 r.p.m., the feed ranges from 0.0006 to 0.0015 in. per revolution, and the depth of cut averages 0.005-0.01 in.—H. F. G.

Piercing Holes in Brass Part. Jacob H. Smit (*Machinery (N.Y.)*, 1930, 36, 800).—In reply to a query, it is stated that 0.098-in. holes cannot be satisfactorily punched in $\frac{1}{4}$ -in. thick brass strip, and that drilling is the only practicable method.—H. F. G.

Tapping Aluminium. W. E. Warner (*Machinery (N.Y.)*, 1930, 36, 711).—Cf. *J.*, this volume, p. 118. A larger tapping hole than usual is necessary with soft aluminium. Molten tallow or beeswax is very effective as cutting lubricant.—H. F. G.

Tapping Brass Fittings with Tap of Unusual Length. Anon. (*Machinery (N.Y.)*, 1930, 36, 591).—Brass lubricator fittings, $\frac{1}{2}$ in. in diam., are tapped at the rate of 20 per minute by means of a tap having a cutting portion 1.25 in. long and a 16-in. long shank. The fittings feed on to the shank, and are removed automatically at intervals.—H. F. G.

Interesting Milling Operations in Motor-Car Shops. Anon. (*Machinery (Lond.)*, 1930, 36, 561-563).—Describes, *inter alia*, the side milling of an aluminium cylinder block at the rate of 15 per hr. on a standard type of duplex milling machine.—H. F. G.

Chromium-Plating Cutting Tools Multiplies their Wear-Life and Saves Many Man-Hours. Joseph Geschelin (*Automotive Ind.*, 1932, 66, 748).—The hardness, resistance to corrosion, and wetting, and low coeff. of friction of metallic chromium would appear to favour its use as a coating for cutting tools. Types of tool where chromium plating has been employed with success are enumerated, and certain cases of failure are explained. Reports of attempted commercial applications are quoted, and estimates are given of the increased life and performance of certain tools.—P. M. C. R.

Present Practice in the Use of Cutting Fluids; Progress Report No. 2 of the Sub-Committee on Cutting Fluids of the A.S.M.E. Special Research Committee on Cutting of Metals. S. A. McKee (*Trans. Amer. Soc. Mech. Eng.*, 1930, 52, (Machine Shop Practice), (13), 103-108; *C. Abs.*, 1930, 24, 4743).—There is presented in tabular form information obtained by questionnaire from 68 large

users of cutting fluids. The first table, which is a general summary, lists the number of plants using any of 3 general types of cutting agents (dry, water or emulsions, oils or oil mixtures) for each of 19 machining operations on low-carbon, high-carbon, cast and alloy steels, cast-iron, brass, copper, and aluminium. Other tables give more detailed information pertaining to the cutting agents used for the various operations on a given metal.—S. G.

Choice of Cutting Fluids Simplified by Research. Joseph Gschelin (*Automotive Ind.*, 1932, 67, 36-39).—Sulphurized cutting fluids are found to replace lard-oil products advantageously where high speeds or heavy cuts are used; the cooling effect of the sulphurized oil appears to outweigh possible ill-effects in the finish; these may be eliminated by selecting a correct concentration. The balance of evidence is in favour of a combination of sulphurized and lard-oil products, but the oil must form a stable emulsion and be free from actively corrosive ingredients: further, the correct concentration should be carefully determined and vigorously maintained.—P. M. C. R.

Carboly Tools at the White Motor Plant. Anon. (*Machinery (N.Y.)*, 1930, 36, 980-982).—A general account of the use of tungsten carbide tools at the works of the White Motor Co.—H. F. G.

The Lapping of Tungsten Carbide Tools. H. J. Wills (*Machinery (N.Y.)*, 1930, 36, 718-719).—See *J.*, this volume, p. 576.—H. F. G.

Applying Stellite to Trimming Dies. Charles E. Harriman (*Machinery (N.Y.)*, 1930, 36, 550).—See *J.*, this volume, p. 388.—H. F. G.

Grinding Carboly. Anon. (*Abrasive Ind.*, 1930, 11, (5), 22; *Ceram. Abs.*, 1930, 9, 491).—The regrinding of Carboly grooving tools is the greatest factor affecting their life and successful performance. To obtain the maximum life from Carboly grooving tools it is absolutely necessary that they be lapped on the sides and ends. A straight edge set at 90° to the cutting face and a steady rest, set to the proper front degree clearance, must be used. It is only necessary to lap off from 0.0025 to 0.0004 in. to put the tool back in good cutting condition. Care should be taken to keep the tool from slipping away from the straight edge set at 90° C. to the cutting face.—S. G.

XIV.—FINISHING

(Continued from pp. 577-579.)

Abrasives. II.—Corundum and Diamond. V. L. Eardley-Wilmot (*Canad. Dept. Mines Bull. No. 676*, 1931, 1-53).—General, with an extensive bibliography.—S. G.

Adhesion of Glue to Fused Alumina Abrasives.—II. Henry R. Power (*Metal Cleaning and Finishing*, 1931, 3, 675-676; *Ceram. Abs.*, 1931, 10, 745).—Tests have shown that the closeness of abrasive sizing does not affect adhesion of abrasive and glue. Maximum adhesion is obtainable by use of high-test glues.—S. G.

Adhesion of Glue and Fused Alumina Abrasives.—III. Henry R. Power (*Metal Cleaning and Finishing*, 1931, 3, 989; *Ceram. Abs.*, 1932, 11, 146).—The developments in abrasives that have been rapidly advancing in recent years and have brought out treated products with a specific surface adhesion for glue, known as surface tenacity abrasives, have made it possible to use a lower quality glue with no loss of adhesion value in some polishing operations.—S. G.

Black Oxidized Finishing. L. C. Hudgins and H. A. Cameron (*Monthly Rev. Amer. Electroplaters' Soc.*, 1932, 19, (3), 17-20).—A jet-black oxidized finish on brass is obtained by immersion in a cold, vigorously agitated solution of 2 lb. of basic copper carbonate in 4 gall. of ammonia and 8 gall. of water. The best results are obtained on ground, scoured, or sand-blasted surfaces; bright-

dipped surfaces usually colour non-uniformly. Black finishes on copper are best obtained in a warm solution of 2 oz. of potassium sulphide in 1 gall. of water.—A. R. P.

Colouring of Cadmium Deposits. H. Krause (*Met. Ind. (Lond.)*, 1932, 40, 648).—Short abstract from *Z. Metallkunde*, 1931, 23, 283. See *J.*, this volume, p. 192.—J. H. W.

The Surface Improvement of Silver Articles. E. Raub (*Mitt. Forschungsinst. Edelmetalle*, 1931, 5, 57–66).—A slightly condensed reprint of an article in *Korrosion u. Metallschutz*, 1931, 7, 134; see *J.*, this volume, p. 328.—A. R. P.

Researches on the Potassium Permanganate-Copper Sulphate Pickle [for Colouring Copper Alloys]. H. Krause (*Mitt. Forschungsinst. Edelmetalle*, 1931, 5, 77–83).—Although the composition of brown pickling baths for copper alloys may be varied within fairly wide limits, the best results are obtained with 2.5–7.5 grm./l. of potassium permanganate and 5–10 times as much copper sulphate. Excess of permanganate reduces the adherence of the deposit, but excess of copper sulphate is harmless. The bath should be kept just below boiling point, and after a short immersion the articles should be rubbed with a soft mop, then again immersed until the desired colour is obtained. The pickle can be used with copper, tin-bronzes, brass, Tombak, and copper and brass-plated articles, provided that the plating is not too thin.—A. R. P.

Pickling Solutions for Nickel and Nickel Alloys. — Krause (*Mitt. Forschungsinst. Edelmetalle*, 1931, 5, 55).—Pure nickel is best pickled in 20% sulphuric acid at 60°–80° C. Most nickel alloys can be pickled in 5–10% sulphuric or 1 : 4 hydrochloric acid containing 1.5–2% potassium dichromate to prevent deposition of copper on the metal surface. Nickel and Monel metal may be satisfactorily pickled in a mixture of 204 grm. of sulphuric acid (*d* 1.6), 72 grm. of sodium nitrate, 84 grm. of sodium chloride, and 1 l. of water; the pickle is used at 70° C. and should be well stirred during use. The pickled articles after rinsing in water should be washed with dilute ammonia, then again washed with water before drying.—A. R. P.

The Pickling and Cleaning of Metals. II.—III.—Some Considerations of the Chemical Reactions Involved. David Brownlie (*Sheet Metal Ind.*, 1930, 4, 425–427, 519–520; *C. Abs.*, 1932, 26, 3471).—B. elaborates his statement in Part I that corrosion is due to electrical as well as chemical action. By placing a boiler under definite potential through dynamo connections it has been found that corrosion can be made to cease immediately, even when salt water is being used, and existing scale comes off. It is suggested that this could be applied to an improved pickling practice. Inhibitors and restrainers used and available for pickling baths are discussed.—S. G.

[Temperature of Pickling Solutions.] Anon. (*Compressed Air Mag.*, 1932, 37, 10).—Steam for heating and agitating a pickling bath for removing scale from wire rods is injected through an automatically regulated valve operating at 82° C. By this means acid consumption is lowered and fume production greatly lessened.—P. M. C. R.

Continuous Rotary Pickling Machine. N. Ransohoff, Inc. (*Metal Cleaning and Finishing*, 1931, 3, 839; *Ceram. Abs.*, 1932, 11, 12).—A four-section rotary pickling machine capable of handling work up to 24 in. long is said to achieve a considerable saving in labour, time, and acid. The operation and construction of the machine are described.—S. G.

"Metso"—A New Cleaner for Aluminium. Anon. (*Aluminium Broad-cast*, 1931, 3, (6), 20).—"Metso" is a proprietary form of sodium metasilicate. A 1% solution is, in certain cases, said to clean aluminium without corroding the surface.—J. C. C.

Tests for Cleanliness [of Metals]. C. L. Mantell (*Metal Cleaning and Finishing*, 1932, 4, 25–26, 33–34; *C. Abs.*, 1932, 26, 2679).—The widely-used water-break test for determining the cleanliness of metal parts as they come

from the cleaning bath is shown to be unreliable. The need for better tests is stressed, and examples are given in which various tests for pinholes are reversed so as to give useful methods for detecting uncleanness.—S. G.

New Process of Metal Cleaning. Anon. (*Metal Cleaning and Finishing*, 1931, 3, 921; *Ceram. Abs.*, 1932, 11, 84).—A new process has been made possible, partly by triethanolamine, an organic base, certain compounds of which have exceptional emulsifying properties. The compounds of triethanolamine known as "Emulso Primer" Nos. 1, 2, and 3, give emulsification, colloidal suspension, deflocculation, and free rinsing to the cleaning solution. Other features of this process are described.—S. G.

Buffer Action of Cleaning Solutions. C. L. Mantell (*Metal Cleaning and Finishing*, 1931, 3, 723-726; *Ceram. Abs.*, 1931, 10, 827).—The phenomenon of buffer action in cleaning operations is explained.—S. G.

Composition and Uses of Heavy-Duty Metal Cleaners. C. L. Mantell (*Metal Cleaning and Finishing*, 1931, 3, 305-306; *Ceram. Abs.*, 1931, 10, 484).—The various constituents that enter into the composition of heavy-duty metal cleaners, their value as detergents, cost considerations, and other points are discussed.—S. G.

Equipment for Cleaning Metal.—IX. R. W. Mitchell (*Metal Cleaning and Finishing*, 1931, 3, 711-714; *Ceram. Abs.*, 1931, 10, 827).—Cf. this J., 1931, 47, 603, and this volume, p. 192. A discussion of temperature with relation to the cleaning operations. A brief explanation is given of the various methods of measuring temperature, with conversion tables for the Centigrade and Fahrenheit scales.—S. G.

Equipment for Cleaning Metal.—X. R. W. Mitchell (*Metal Cleaning and Finishing*, 1931, 3, 793-796; *Ceram. Abs.*, 1932, 11, 12).—The various types of thermometers and temperature regulators used in cleaning operations are discussed and illustrated.—S. G.

Equipment for Cleaning Metal.—XI. R. W. Mitchell (*Metal Cleaning and Finishing*, 1931, 3, 869-874; *Ceram. Abs.*, 1932, 11, 84).—Systems and devices for controlling temperatures in various tanks are described, discussed, and illustrated.—S. G.

Equipment for the Cleaning of Metal.—XII. R. W. Mitchell (*Metal Cleaning and Finishing*, 1931, 3, 953-957; *Ceram Abs.*, 1932, 11, 161).—Agitation is an invaluable aid in most cleaning operations, particularly with recessed parts, irregular surfaces, or where solid-particle dirt is caked on. In the application of agitation to industrial cleaning a regular circulatory, non-turbulent flow is desired, the primary object being that the solution should meet the surface to be cleaned at as high a velocity as possible. Agitation may be secured by causing the solution to flow over the work or by moving the parts to be cleaned through the cleaning solution. Some of the means employed for agitation which are described include (1) ordinary convection currents due to heat; (2) agitation baffle plates or shields; (3) ejectors and injectors; (4) compressed air; (5) pumps; (6) propellers; (7) steam guns, and (8) electric cleaners.—S. G.

Some Notes on Grinding Aluminium and Magnesium Alloys. A. E. (Machinery (Lond.), 1932, 39, 521).—Workshop notes.—J. C. C.

Centreless Spherical Grinding [of Monel Metal Balls]. Anon. (Machinery (N.Y.), 1930, 36, 977).—Centreless grinding has been successfully applied to the finishing of Monel metal balls, $\frac{1}{4}$ -4 in. in diam., to within limits of 0.0002 in.—H. F. G.

Grinding Allowances. Anon. (Machinery (Lond.), 1930, 36, 757).—Grinding allowances are determined primarily by the turned finish, the method of heat-treatment, and the amount of work necessary to remove the excess of metal by grinding. The factor first mentioned depends on the tolerance on

the finished size, and on the type of machine used, which is largely a question of economics. Variations of size due to heat-treatment are rarely consistent and vary from one workman to another.—H. F. G.

XV.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 641-642.)

The 10th Foundry Congress, Paris, May 1931. M. F. Renaud (*Rev. Mét.*, 1932, 29, 140-155).—Papers on various subjects relating to the founding of metals and alloys are given in *resumé*.—H. S.

The Object and Function of Various Deoxidation Media in the Casting of Metal. H. W. R. (*Giesserei u. Maschinenbau-Zeit.*, 1932, 5, (5), 1-3).—A discussion of the fundamental principles of the reactions which are promoted when deoxidants are added to molten metals and alloys.—W. A. C. N.

The "Castability" of Alloys. The Relationship with the Solidification Interval. A. Portevin and P. Bastien (*Génie civil*, 1930, 100, 321).—See J., this volume, p. 329.—W. P. R.

New Deoxidizing Process for Aluminium Perfected. Anon. (*Daily Metal Reporter*, 1932, 32, (16), 6).—The tensile strength of remelted aluminium is said to be materially increased, and the colour of the metal improved, by remelting in a triple chamber furnace with controlled temperature and regulated atmosphere. The resultant metal is claimed to have a somewhat lowered sp. gr., effecting a 5% economy in weight of castings.—P. M. C. R.

"Aluminium-Bronze" in the Foundry. Wesley Lambert (*Met. Ind. (Lond.)*, 1932, 41, 195-196, 221-223).—Several difficulties are associated with "aluminium-bronze" castings of more than medium weight. These alloys usually consist of 90 : 10 copper-aluminium, with frequently up to 3% iron. Nickel 3-4% is also used for marine propellers. Their normal tensile strength is 65,000 lb./in.², with an elongation of 15-20%. Heat-treatment consists of quenching from a high temperature, sometimes followed by annealing. Straight copper-aluminium alloys are liable to self-annealing, but this is prevented by the addition of iron or nickel. These metals also increase the endurance of the alloys. Manganese raises both the tensile strength and permanent-set limit without impairing the ductility. Lead is rarely added except when high resistance to wear and low friction are required. Allowance must be made for melting losses in melting and only the purest copper must be used. "Silicon-copper" is recommended as a deoxidizer. Notes are given on the introduction of alloying metals, foundry manipulation, precautions in skimming, and against self-annealing, cast-on test-bars, and melting.—J. H. W.

Notes on "Manganese-Bronze." F. A. W. Livermore (*Met. Ind. (Lond.)*, 1932, 41, 175-176).—"Manganese bronze" is really a brass to which have been added small amounts of aluminium, iron, and manganese for strengthening and compacting the alloy. The range of composition is : copper 55-60, zinc 35-40, iron 1.0-1.5, manganese 0.25-3.0, aluminium trace-1.0, tin trace-1.0, lead 0.25-0.50%. The function of the manganese is to effect the alloying of the iron, and it is added as ferro-manganese or more usually as cupro-manganese. "Manganese-bronze" is melted in graphite crucibles, the iron, manganese, and copper first under charcoal, the aluminium and then the zinc being added later. For a low-grade alloy, secondary material may be used and melted in a reverberatory furnace.—J. H. W.

"Taurus" Bronzes. Anon. (*Met. Ind. (Lond.)*, 1932, 40, 666).—Short abstract of a booklet entitled "Taurus Bronze Castings," published by Messrs. David Brown & Sons (Huddersfield), Ltd. See following abstract.—J. H. W.

The Art of Bronze Founding. Anon. (*Met. Ind. (Lond.)*, 1932, 41, 51-52).—Full abstract of a publication by Messrs. David Brown & Sons (Huddersfield), Ltd., entitled "Taurus Bronzes." The criteria by which sound bronzes should be judged and the method of selecting such bronzes are discussed, and the influence of composition on the physical properties of the alloys is emphasized. The process of centrifugal casting, as practised by the above-mentioned firm, including the selection of the raw material, melting practice, analysis, and physical tests, is described.—J. H. W.

Control Temperature in Cupola Bronze Melting. T. Mauland (*Foundry*, 1931, 59, (13), 40-41).—Abstract of paper read before the American Foundrymen's Association. See *J.*, this volume, p. 127.—F. J.

The Influence of Nickel on Cast Bronze. N. B. Pilling and T. E. Kihlgren (*Giesserei u. Maschinenbau-Zeit.*, 1932, 5, (3), 1-6).—Abstracted from *Trans. Bull. Amer. Found. Assoc.*, 1931, 2, (7), 93-110. See this *J.*, 1931, 47, 607.—W. A. C. N.

The Selection and Treatment of Gear Materials. F. W. Rowe (*Mech. World*, 1931, 89, 12-14, 27-29).—Abstract of a paper read before the Manchester Association of Engineers. See *J.*, this volume, p. 126.—F. J.

England's Wonder Bells. Ernest Morris (*Met. Ind. (Lond.)*, 1932, 41, 99-100).—A brief description of some of the largest bells constructed in England from early to more recent times.—J. H. W.

Cupola Melting of Brass. T. Mauland (*Iron Age*, 1931, 128, 83, 136; and *Met. Ind. (Lond.)*, 1931, 38, 841; *Foundry Trade J.*, 1931, 45, 90; *Foundry*, 1931, 59, (13), 64-65).—Abstracts of a paper read before the American Foundrymen's Association. See *J.*, this volume, p. 127.—J. H. W.

Brass Casting. F. A. W. Livermore (*Met. Ind. (N.Y.)*, 1932, 30, 318).—Practical hints.—A. R. P.

Deep Etching of Brass Applied to Gating Problems. R. W. Parsons (*Met. Ind. (Lond.)*, 1931, 39, 177-179; *Foundry*, 1931, 59, (11), 51-53).—Abstracts of a paper read before the American Foundrymen's Association. See *J.*, this volume, p. 265.—J. H. W.

The Manufacture of Nickel-Brass. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1932, 53, 313-314).—Nickel-brasses, under many trade names, consist of copper 60-65, nickel 15-25%, and the remainder zinc. The melting and casting of an alloy containing copper 62, nickel 15, zinc 25.5, cupro-manganese 0.4, and 20 : 80 lead-tin alloy 0.1% are described. The use of a deoxidizing agent, such as cupro-manganese, phosphor-copper, cupro-magnesium, or nickel-manganese, gives the alloy a high density and a good ring. The melting point of the alloy is very high, and this introduces difficulties, for if the melting temperature is not high enough, the alloy will not be properly melted and mixed, and if it is too high, the resulting alloy is liable to be porous. The metals are melted in a crucible under glass and borax, and 3% excess zinc is added to replace the loss by volatilization. The construction and preparation of the moulds and the precautions to be taken to obviate pin-holes and segregation are described.—J. H. W.

The Fundamentals of Brass Foundry Practice. R. R. Clarke (*Met. Ind. (Lond.)*, 1932, 41, 147-148).—Copper-base alloys work best when remelted using a proportion of between 60 : 40 and 40 : 60 old to new metal. Metals of a higher melting point than copper are best added in concentrated form as a copper alloy. There are many neutral fluxes available, crushed charcoal giving good results [? as a flux]. Most of the alloys have a narrow pouring temperature range which must be adhered to. The future of melting probably lies in the direction of electric furnaces.—J. H. W.

Melting and Casting Magnesium Alloys. Edmund R. Thews (*Canad. Chem. and Met.*, 1932, 16, 68-73).—The best procedure comprises melting the metal

at 730°–750° C., heating rapidly to 825° C., stirring well to collect the impurities into the protective flux layer, and casting at 680°–780° C. into moulds preheated at 300°–400° C. Sand moulds should have 3–4% of sulphur mixed with the sand. Magnesium begins to oxidize at 650° C. and absorption of nitrogen commences at 670° C. Suitable fluxes for melting magnesium are given.—A. R. P.

The Use of Alloys of Magnesium (Maximum Qualities for Manufacture and Minimum Tolerances from the Normal). R. de Fleury and — Benmakrouha (*Compt. rend.*, 1932, 194, 1739–1741).—An abstract of work undertaken under the auspices of the Service des Recherches de l'Aéronautique. If C = castability, E = elastic limit, A = elongation, r = percentage of rejects, then the

extent of depreciation, 0 , after n remelts is given by $0 = \frac{C_1 - C_n}{C_1}$ or $0 =$

$$\frac{1}{\tau_1} - \frac{1}{\tau_2}$$

$\frac{1}{\tau_1} - \frac{1}{\tau_2}$. The coeff. of the depreciation after each remelt, α , is given by

$(1 - \alpha)^n = 1 - 0$. If m = gross amount of the ratio charge of furnace : output, and M = net result when rejects are taken into account, then $M(1 - r) = m$. The depreciation at the end of n remelts, $r_n =$

$$\frac{\alpha A [1 - A^n (1 - \alpha)^n]}{1 - A(1 - \alpha)} \text{ or } \tau_\infty = \frac{\alpha A}{1 - A(1 - \alpha)}. \text{ The value of } \tau \text{ for } n = \infty \text{ is a}$$

measure of the normal minimum tolerance comparable with each special operation in the workshop routine. The authors suggest that, when it is not possible to introduce all the rejects into the furnace without spoiling the quality for a particular job, it would be possible to work with two types of job, using a suitable quantity of scrap for the high-grade one, and all that was left over for the second, lower grade one.—J. H. W.

Viscosities of Fluxes and Slags for Melting Magnesium. — Hardouin, — Cochet, and — de Fleury (*Compt. rend.*, 1932, 194, 2143–2144).—Foundry conditions require fluxes for melting magnesium not to contain chlorides, to be fusible and very fluid at the beginning of melting, and to be converted to very viscous and little fusible protective slags at the moment of pouring. Tests of the viscosity by measuring the torque exerted on a metal cylinder placed in a rotating crucible of molten mixtures of various salts showed that very small variations of composition in a binary system were sufficient to modify the viscosity to an important extent. An example of this is a mixture of sodium borate and boric anhydride, as follows :

$\text{Na}_2\text{B}_4\text{O}_7$	...	...	11	15	20	22.5	25	78
B_2O_3	...	...	89	85	80	77.5	75	72
Poises at 700° C.	...	200	600	220	500	900	500	

—J. H. W.

Silver Rolling Bars. H. Moser (*Mitt. Forschungsinst. Edelmetalle*, 1931, 4, 103–107; 5, 1–7).—To obtain satisfactory ingots of 925- or 835-fine silver for rolling into sheet the metal should be cast into iron moulds having a wide top or "gate-end." The moulds should be tilted at an angle of 20°–30° C. to the vertical and the metal poured in slowly but steadily, avoiding splashing from the side of the mould on which it falls; sufficient metal should be poured into the mould so that the gate end is almost completely filled when the whole has solidified, so as to prevent the development of shrinkage voids in the pipe. Splashing during pouring results in entrapment of air in the casting, which produces cuprous oxide around the gas pores, which themselves are filled with nitrogen, and this produces blisters when the rolled sheet is annealed. Melting

should be done under a layer of wood charcoal using electrolytic copper and pure silver; about 0.5 grm. of 10% phosphor-copper is added per kg. of alloy just prior to casting. Examples are given of the type of bars and cylindrical ingots obtained by casting both grades of silver with different casting and mould temperatures and different rates of pouring.—A. R. P.

The Reduction of a Medal from an [Existing] Larger Medal. Anon. (*Z. ges. Giesserei-Praxis: Der Modellbau*, 1932, 53, 295-296).—The reduction of large medals by successive castings in plaster of Paris moulds is described, each casting giving a reduction in diameter of 4.5%. A low-melting point lead-tin alloy, such as lead 30, tin 20, bismuth 50%, is used, which melts at 95° C., the final medal being cast in such an alloy as copper 83, zinc 12, tin 5%.—J. H. W.

Modern Equipment in a Railroad Babbitting Shop. O. H. (*Machinery (N.Y.)*, 1932, 38, 834).—A brief illustrated description of electric melting furnaces and pots with automatic temperature control installed at the Canadian National Railway Shops at Stratford, Ontario.—J. C. C.

Presses for Converting Scrap into Bales for Furnace and Crucible Charging. Anon. (*Mech. World*, 1932, 91, 542-543).—Baling-presses for pressing loose scrap material into compact masses suitable for charging into melting furnaces are illustrated and described. In the working of the horizontal machines, the ram of the press is actuated by steel ropes, the number of ropes varying with the size of the press and the materials which it handles, operating on the block and tackle system, the power being transmitted to each rope by means of a patented scroll, geared up to the driving pulley. The ram is brought to rest at a predetermined point by an adjustable stop which determines the thickness of the bale, throwing the driving-belt on to the idler pulley. A frictionally-driven reverse motion gear, working in conjunction with the idler pulley, and through an independent scroll on the horizontal machine, returns the ram to the filling position, the reverse gear being automatically thrown out at the end of the return stroke. The finished bales are ejected by means of a hand-operated ejector.—F. J.

Waste Prevention by Melting Down Scrap Metal. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1932, 53, 264-265).—A big recovery of metal can be effected by utilizing scrap metal, but melting this material necessitates many precautions and rigid control, which are discussed in detail.—J. H. W.

Practical Experience in Making Centrifugal Castings of Non-Ferrous Metals. Erich Becker (*Z. ges. Giesserei-Praxis: Das Metall*, 1932, 53, 291-294, 311-312).—The centrifugal casting of 80 : 12 : 8 lead-bronze, Delta metal, 90 : 10 bronze, red brass (copper 85, tin 8, lead 5, zinc 2%), and other alloys in both horizontal and vertical moulds is described. The success of the operation is largely dependent on the peripheral velocity of the mould, which must be regulated according to the diameter of the mould and also to the nature of the alloy. The structure of centrifugal castings is needle-like near the wall of the mould, but a little way in becomes uniform. The outer and middle layers are very dense, and free from impurities and from holes, whilst the inner layers and the inside of the tube contain many holes and slag inclusions. The surface of the mould must be very clean and smooth, and to protect this surface it is coated with a mixture of paraffin and graphite or lamp-black.—J. H. W.

Casting in Permanent Moulds. Anon. (*Automobile Eng.*, 1932, 22, 333-384).—A description is given of an American process for the production of castings in large quantities in permanent moulds constructed of light hollow cast iron covered with a layer of highly refractory material very resistant to abrasion and penetration. The moulds are mounted on a revolving table and successively pass through a cycle of operations, which include setting of the cores, smoking with an acetylene flame, and after casting, automatic removal of the castings, and cleaning. A machine equipped with 12 single moulds has

an output of 400 castings per hr., and it is stated that the castings are free from shrinkage and are of denser metal.—J. W. D.

Permanent Mould Foundry Practice for Bronze Castings. Henri Marius (*Met. Ind. (Lond.)*, 1931, 39, 74-75, 103-104).—Abstract of a paper read before the American Foundrymen's Association. See J., this volume, p. 123; also 1931, 47, 606.—J. H. W.

Material for Permanent Moulds. A. Eyles (*Machinery (N.Y.)*, 1930, 36, 886).—Cast-iron moulds and tungsten steel cores are recommended for the casting of aluminium. Brief notes on the construction and use of such moulds are given.—H. F. G.

Improved Equipment Widens Field for Die-Castings. William M. Lester (*Iron Age*, 1932, 130, 253-254).—The two principal methods of die-casting are described. They are the type which uses plunger mechanism under positive mechanical pressure and the type which depends on an air goose-neck device where air pressure forces the alloy from a closed chamber into the mould. This latter method is used for die-casting aluminium-base alloys, but entails certain difficulties. These are explained and the procedure adopted to overcome them is described. By using improved mechanism, a superior grade of casting with respect to both solidity and surface finish can be obtained.

—J. H. W.

Aluminium Pressure Casting. Anon. (*Aluminium Broadcast*, 1931, 3, (17), 7-8).—A brief account of the construction of the Armstrong Whitworth aluminium die-casting machine.—J. C. C.

Aluminium Pressure Die-Casting Machine. Anon. (*Mech. World*, 1932, 91, 10).—A new die-casting machine is illustrated and described. It has been designed to be operated by unskilled labour (one attendant per machine). Special features include a safety valve in the high-pressure air-line to prevent any pressure being admitted to the melting-pot before the die has been closed and locked on to the nozzle, and a quick-filling device for the melting-pot cover. The metal-container and its nozzle are the only parts requiring periodical renewal. Automobile carburettor bodies (aluminium alloy) can be produced at the rate of 40 per hr. and small, simple components at a faster rate by casting in multiple dies.—F. J.

Wear in Aluminium Die-Casting Machines. Anon. (*Machinery (Lond.)*, 1931, 37, 797).—The addition of 1.5-2% of iron to aluminium alloys is said to reduce their tendency to erode the dies of die-casting machines.—J. C. C.

Makes Die-Castings at High Pressure with Low Melting Temperature. F. L. Prentiss (*Iron Age*, 1932, 129, 1246-1247).—The advantages of high-pressure die-castings with uniform and low melting temperatures are discussed, and the operations as carried out in zinc-base die-castings in which close dimensional limits are required are discussed.—J. H. W.

Reconditioning a Die-Casting Machine. W. E. Warner (*Machinery (N.Y.)*, 1930, 36, 673).—A practical note. The careful cleaning of old, gritty, white metal before re-using reduces wear on the machine.—H. F. G.

Material for Die-Casting Dies. Jacob H. Smit (*Machinery (N.Y.)*, 1930, 36, 801).—Heat-resistant alloy steel is necessary for the dies used for die-casting aluminium. Notes are given on the construction of such dies. The minimum wall thickness on small die-castings is about $\frac{1}{16}$ in., and on larger castings about $\frac{1}{8}$ in. The smallest hole that can be cast in aluminium is about $\frac{1}{32}$ in. in diameter, and the finest practicable external thread is of 20 threads per in.

—H. F. G.

Electrolytic Process for Making Metal Patterns. Charles O. Herb (*Machinery (N.Y.)*, 1931, 38, 241-243; and *Machinery (Lond.)*, 1932, 39, 677-679).—Patterns, cope and drag plates, and core boxes are made in metal by the Electrochemical Pattern and Manufacturing Co., Detroit, U.S.A., by depositing

copper on plaster moulds, which can be cast in the first instance from wooden or metal patterns. The copper shells, which are $\frac{1}{4}$ in. thick, are backed with white-metal. It is claimed that in this way metal patterns closely accurate to size, with smooth surfaces, and having good wearing properties, can be cheaply produced.—J. C. C.

Modern Machine Moulding Practice. Anon. (*Machinery (Lond.)*, 1931, 37, 697-700; 38, 65-69, 357-361).—Describes and illustrates the construction of typical jolting machines with stripping and turnover mechanisms, shockless jolting machines, rock-over machines, electro-pneumatic jolters, electric and hand-operated jolting machines, and hydraulically operated machines.

—J. C. C.

The Control of Hardness and Other Mould Properties. H. W. Dietert (*Trans. Amer. Found. Assoc.*, 1932, 40, 63-70; discussion, 70-71).—The control of the sand condition in the rammed mould is a very important connecting link between sand control of heap sand and casting defects. The first step in mould control is a knowledge of how mould hardness affects the other physical properties of the sand in the mould. An arbitrary definition of mould hardness is given and the method of testing described. D. shows how increase of clay bond affects the mould properties, and discusses the relations of these properties. He also shows the effect of sand grain-sizes on the permeability and hardness.—S. G.

Sands and Sand Testing. J. G. A. Skerl (*Met. Ind. (Lond.)*, 1931, 38, 645-646).—Abstract of paper read before the Institute of British Foundrymen, and discussion. See this *J.*, 1931, 47, 609.—J. H. W.

An Investigation of Moulding Sands. I. D. Derechinskii (*Domez*, 1931, (1), 57-90; *C. Abs.*, 1932, 26, 3212).—[In Russian.] A detailed review of the literature of moulding sands, as to their chemical composition, water moisture content, grain-size, gas permeability, refractoriness, density, &c. A list of 74 references is given.—S. G.

Venting Dry-Sand Moulds. J. H. List (*Mech. World*, 1932, 91, 431-432).—The moulding of a large casting is described. To ensure a dry floor, a pit having concrete bottom and walls is prepared. A liberal layer of large-sized coke is placed on the bottom, followed by a layer of straw, and then by a layer of black sand. At each corner of the pit a large vent-pipe must be placed, leading from the coke to about 3 ft. above the shop-floor. The operation of drying and the function of venting are discussed.—F. J.

Intricate Core Work. J. H. List (*Mech. World*, 1932, 91, 335-336).—A considerable test of ability on the part of the patternmaker lies in making core-boxes for intricate castings. A really successful core-box not only ensures that the cores will be adequately supported against flotation strains, but will also allow of quick and accurate assembly. A typical and accurate example is described in detail and illustrated.—F. J.

Mineral Oils. Alfred W. Nash and A. R. Bowen (*Ann. Rep. Prog. App. Chem.*, 1931, 16, 87-120).—Contains among other matters references to work published during 1931 on the production and properties of lubricating oils, on core oils for foundry work, and the essential properties of oils for binding sand cores.—H. F. G.

Industrial Furnaces for Gas. XV.—Ovens for Core Baking. Lawrence E. Biemiller (*Amer. Gas. J.*, 1932, 136, (6), 27-28).—Truck type ovens and conveyor ovens are briefly described and illustrated.—J. S. G. T.

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[This extensive study of the embrittlement of hot-galvanized structural steel came about in a request from several interested parties to the A.S.T.M. to sponsor research on embrittlement phenomena which had been of concern to transmission tower engineers and consumers and producers of hot-galvanized steel products. Industries which were desirous of getting a true understanding of the causes and cure for embrittlement contributed several thousand dollars in money and materials to carry on the work. The Battelle Memorial Institute was engaged to do this under the general direction of a special sub-committee of A.S.T.M. Committee A-5 on Corrosion of Iron and Steel. On this special committee were representatives of steel manufacturers, fabricators and galvanizers, users (chiefly public utilities and carriers), and zinc producers.]

The present publication comprises the official report of the investigation by the Battelle Memorial Institute in the form of a comprehensive technical paper of 83 pages by Samuel Epstein, and the 1932 report of the special sub-committee in charge, including a "Tentative Recommended Practice for Safeguarding Against Embrittlement of Hot-Galvanized Structural Steel Products and Procedure for Detecting Embrittlement." For convenient reference, the "Standard Specifications for Zinc (Hot-Galvanized) Coatings on Structural Steel Shapes, Plates, and Bars and Their Products" are included.

More than 170 heats of Bessemer, duplex, and open-hearth steel in the "as rolled," pickled, and galvanized conditions, with punched and drilled holes, were examined in several thousand tests. The results of these are summarized and given in many charts and tables in the technical paper. In addition, this gives a brief history of the problem, outlines the several testing methods used, and gathers the results in clear form with careful analysis and interpretation of these.]

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[Covers: Properties; occurrence; uses (metallurgical uses, preparation of metallic chromium, ferrochromium, chromium alloys; refractories; chemical uses, chrome plating); marketing chromite; domestic tariffs; world trade in 1929; world production; world resources (U.S.A., Southern Rhodesia, Union of South Africa, New Caledonia, Cuba, India, Yugoslavia, Russia, Greece, Turkey, Japan, summary); political and commercial control.]
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- *Swanger, W. H., and France, R. D. *Effect of Zinc Coatings on the Endurance Properties of Steel*. (U.S. Department of Commerce, Bureau of Standards. Research Paper No. 454; reprint from "Bureau of Standards Journal of Research," Vol. 9, July, 1932.) Med. 8vo. Pp. 9-24, with 11 illustrations. 1932. Washington, D.C.: Superintendent of Documents. (5 cents.)
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- *Tyler, Paul M. *Sodium and Potassium Metals*. (U.S. Department of Commerce, Bureau of Mines, Information Circular No. 6579.) 4to. [Mimeographed.] Pp. 7. 1932. Washington, D.C.: Bureau of Mines.
[Deals with: general description, uses, history, occurrence, extraction, domestic and foreign production, imports, tariff duties, markets and prices, list of manufacturers and dealers.]
- *Umhau, John B. *Consumption of Primary Tin in the United States During 1930*. (U.S. Department of Commerce, Bureau of Mines, Information Circular No. 6564.) 4to. [Mimeographed.] Pp. 7. 1932. Washington, D.C.: Bureau of Mines.
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XX.—BOOK REVIEWS

(Continued from pp. 652-656.)

[All books reviewed are contained in the Library of the Institute.]

Die technischen Werkstoffe; ihre Eigenschaften, Fehler, und Prüfung. Von Otto Schwarz. (Erweiterter Sonderdruck aus dem "Handbuch der physikalischen und technischen Mechanik." Herausgegeben von F. Auerbach

und W. Hort. Band IV, 2 Hälfte.) Sup. Roy. 8vo. Pp. viii + 222, with 337 illustrations in the text. 1932. Leipzig: J. A. Barth. (Geh., R.M. 23; geb., R.M. 24.50.)

This book has been compiled to give a summary of modern conceptions of metallurgical and engineering practice. It has been found that information which is normally required in the laboratory and in the shops tends to be disseminated through a number of volumes, and this is an attempt to gather all such information together. The result is that although the matter is regularly classified it tends to assume a dictionary or encyclopædia arrangement. There is this advantage, however, that definitions and fundamental principles are clearly given and discussed. It is possible, therefore, to arrive at an understanding of many terms used in the German language which have no exact counterpart in English and yet are essential in the correct reading of current metallurgical literature.

The work is divided into three main sections. The first deals with general ideas on the properties of manufacturing materials, and the three subsections treat respectively of the mechanical, magnetic and electrical, and technological aspects of such materials. The last of these subsections includes discussions on such diverse subjects as structure, occluded gases, non-metallic inclusions, equilibrium diagrams, segregation, recrystallization, and corrosion. The second section deals with the principal metallic and non-metallic materials, their constitution, manufacture, intermediate treatment, properties, and uses. So far as information on non-ferrous metals and alloys is concerned, this is confined to nickel, copper, aluminium, and magnesium, and their alloys and white metals. In the last main division, which is devoted to methods of testing, the following are the chief factors dealt with—static testing machines, which covers all the usual appliances and discussions on their underlying principles; fatigue machines; dynamic testing instruments such as the various pendulum machines; measuring instruments for all purposes; standardization of machines, technological testing, as, for instance, bending, swaging, drifting, and the Erichsen test; machines for testing building materials; structural examination by microscopical and X-ray methods.

The reading of the book leaves one with the feeling that it is an extremely useful compendium of information which should be available to all metallurgists.—W. A. C. NEWMAN.

Métaux et Alliages. Par C. Grard et J. Cournot. Roy. 8vo. Tome I.—**Métallurgie générale et expérimentale.** Pp. vii + 321, with 131 illustrations in the text. Tome II.—**Produits sidérurgiques.** Pp. vii + 291, with 124 illustrations in the text and 22 plates. Tome III.—**Métaux non-ferreux et alliages dérivés.** Pp. vii + 317, with 57 illustrations in the text and 3 plates. 1930. Paris: Berger-Levrault. (40 francs per volume.)

The three volumes into which this work is divided deal respectively with the following general considerations—(1) theoretical aspects of the metallurgy of metals and alloys; (2) the various iron alloys; and (3) the non-ferrous metals and their alloys. They have been compiled during the tenure by the authors of responsible metallurgical positions, and include summaries of a great many of their own investigations.

In the first volume there are four sections. The first is devoted to a discussion on structure and the process of solidification. The physico-chemical laws, such as those of Gibbs, Le Chatelier, Van 't Hoff, and also the phase rule, are considered in their relationship to metallic systems. There follow descriptions of the different types of alloy systems and their representation on equilibrium diagrams. The second section embraces the physical and chemical properties of alloys and the methods adopted for their standardization and determination. The individual chapters are devoted to corrosion testing, the various types of pyrometers and their application, calorimetry, dilatometry, microscopy, macroscopy, and mechanical testing. The third section is devoted to the different kinds of treatment to which materials are subjected during manufacture—casting and mechanical, thermal, and chemical preparation of diverse natures. After a preliminary discussion of the general treatment of minerals and the usual definitions, the second volume is devoted to iron and steel—their manufacture, structure, thermal, chemical, and mechanical treatment, and special steels. The third volume is reserved for consideration of the non-ferrous metals and their alloys—copper, tin, zinc, nickel, aluminium, cobalt, cadmium, antifriction metals, magnesium, and the precious metals. Additional chapters deal with special alloys of iron and tungsten, chromium, molybdenum, vanadium, titanium, &c., and with the rarer carths and metals.

Whilst the information contained in the volumes under review does not extend much beyond what may be found elsewhere, there is the definite advantage that the authors' own researches are reviewed and placed in proper relationship to the subjects with which they deal. The general discussions are arranged in orderly and clear fashion and are well worthy of perusal. Appendices are given which deal with specific points such as methods of analysis and specifications. The inclusion of a full index would be a very valuable addition.—W. A. C. NEWMAN.