METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

1933 MARCH Part 3

I.—PROPERTIES OF METALS

(Continued from pp. 65–68.)

On the Recrystallization of Aluminium and of Some Age-Hardening Aluminium Alloys. H. Hanemann and R. Vogel (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1932, 4, 3–23).—Recrystallization diagrams have been prepared for hot-working aluminium and some aluminium alloys with copper 4–6, silicon 0·2–2, iron 0·2–0·4, and manganese 0–0·7%. All the alloying elements raise the recrystallization temperature of aluminium; small quantities of manganese tend to restrain, and increasing silicon content accelerates, recrystallization. With a low rate of hot-deformation a coarse grain structure develops during working, and this persists even after a high degree of deformation. Grain-growth is restrained in the direction of application of the deformation force, and the development of the unrestrained recrystallization structure depends on the destruction of the material surrounding the original grains; rolling being more efficient in this respect than pressing. The intergranular material is less effective in strongly worked metal than in cast metal. In forging age-hardenable aluminium alloys the following points should be borne in mind if coarse grain-growth is to be avoided: (1) the critical range of reduction is 5–20%, hence the forging temperature should be as high as possible, so that the minimum work is required to obtain the maximum deformation; (2) the forging should be done with the smallest number of powerful blows; (3) lapping of the surface must be avoided. In extrusion a low rate should not be used.—B. Bl.

Beryllium and Its Alloys (Collection of Translations of Foreign Articles). A. M. Botchvar and A. K. Grazianov (*Zhurnal Prikladnoi Chimii* (*Journal of Applied Chemistry*, 1932, 5, (2), 285).—[In Russian.] A brief review, edited by B. and G., of a collection of translated articles on beryllium: the "beryllium problem" is stated to have become an important one in the U.S.S.R., and requires solution.—M. Z.

The Anomaly of the Electric Resistance of Pure Bismuth. C. Drucker (*Z. physikal. Chem.*, 1932, [A], 162, 305–317).—The temperature coeff. of electrical resistance of extruded bismuth wires containing as impurity only 0·001% of copper and silver (measured with an accuracy of 0·2–1%) shows anomalies not only with respect to its absolute magnitude and sign, but also with respect to the temperature. The magnitude of the anomalies decreases with increasing extrusion temperature. Wires prepared at 100° C. or lower show a sharp jump in the negative coeff. to more negative values above this temperature; this jump disappears after heating at 130° C. In wires prepared at 100° or 225° C. the anomaly almost disappears when they are tempered above their extrusion temperature. Which assumptions are also necessary to explain the complex phenomena remains to be decided.—B. Bl.

Diamagnetism of Thin Films of Bismuth. C. T. Lane (*Nature*, 1932, 130, 999).—No variation could be found in the magnetic susceptibility of thin films of bismuth ranging from 0·2 to 15·0 μ, prepared by an evaporation process.—E. S. H.

New Revision of the Atomic Weight of Chromium. I.—Preparation and Analysis of Chromyl Chloride. F. González Núnez (*Anal. Soc. españ. Fis. Quim.*, 1932, 28, 579–586).—From the ratio $CrO_2Cl_2 : 2Ag$ the atomic weight of chromium is calculated as 52·012 and 52·019 (volumetric), and, from the ratio $CrO_2Cl_2 : 2AgCl$, as 52·022 and 52·029 (gravimetric).—A. R. P.

On the Transformation of Cobalt. G. Wassermann (*Mitt. Material., Sonderheft* **21**, 1933, 33–38).—See this *J.*, 1932, **50**, 338.—J. W.

Enrichment of Copper with Cuprous Oxide during Heating. M. I. Sacharowa (*Zvetnye Metally* (*The Non-Ferrous Metals*), 1931, 949–964; *Chem. Zentr.*, 1932, **103**, II, 3614).—[In Russian.] Variations in the casting temperature of copper between 1090° and 1240° C. and of the mould between 0° and 400° C. have practically no effect on the distribution of the cuprous oxide eutectic in the ingot, but affect only the crystal structure, which, however, apart from the effect of the eutectic, can cause trouble during rolling if it is too coarsely crystalline. A fine crystalline structure, on the other hand, facilitates a homogeneous distribution of the eutectic. On heating, the cuprous oxide coagulates into a coarse network. The scale which forms on the metal on heating in an oxidizing atmosphere is almost exclusively cuprous oxide, and under favourable conditions (at 700°–800° C.) may penetrate to 1/10 the thickness of the ingot.—A. R. P.

An Egyptian Axe-Head of Great Antiquity. (Sir) H. C. H. Carpenter (*Nature*, 1932, **130**, 625–626).—An Egyptian axe-head, estimated to be about 6000 years old, was found to be coated with a thick patina of malachite and azurite; under this coating was a layer of cuprite, beneath which was the copper-coloured metal. The metal gave the following analysis: copper 97·35, nickel 1·28, arsenic 0·49, lead 0·17, iron 0·15, manganese 0·06%. Traces of tin and antimony were detected; the remaining 0·5% consisted of oxygen combined in the form of cuprite. It does not appear that the small quantities of metals were added for hardening purposes, but that they were present in the raw materials. Metallographic examination leads to the conclusion that the axe was cast roughly to shape, and then either cold-hammered and annealed or hammered when hot; afterwards, the axe was severely cold-hammered near the edge. Brinell hardness tests gave a value of 73 on the flat and a maximum of 85 on the cutting edge, confirming previous views on the permanence of cold-working (cf. this *J.*, 1931, **47**, 375).—E. S. H.

The Influence of Impurities on the Properties of Lead. R. S. Russell and J. Neill Greenwood (*Proc. Australian Inst. Min. Met.*, 1932, **87**, 135–166). —Three samples of lead were used in the tests: (*A*) commercial refined lead containing copper 0·0002, bismuth 0·0023, cadmium 0·0002, antimony 0·0040, iron 0·0007, zinc 0·0005, and silver 0·0003%; (*B*) specially purified (by fire-refining) lead containing copper 0·0002, bismuth 0·0009, cadmium 0·0001, antimony 0·00041, iron 0·00020, zinc 0·00023, and silver 0·00055%; and (*C*) electrolytically-refined lead obtained by electrolysis of (*A*) in an acid solution of lead perchlorate and containing copper 0·0001, bismuth 0·0004, antimony 0·00011, iron 0·00036, and zinc 0·00023%. The specimens were rolled to 2·5–20% reduction in thickness and annealed at 18°–175° C.; the grain-size was then examined after etching with a 7·5% solution of ammonium molybdate in 3*N*-nitric acid for 10 seconds. The results showed that *C* was much more susceptible to the effects of deformation and annealing than *A* and *B*; thus *C* recrystallized completely in 1·5 hrs. at 18° C. after a reduction in thickness of 5%, whereas *A* and *B* only partly recrystallized in 24 hrs. at 18° C. after a 20% reduction. These differences in behaviour are ascribed to differences in the composition, which, however, are extremely small, the total impurities in the samples amounting to only 0·008, 0·003, and 0·002%, respectively.—A. R. P.

Characteristics of Lead. G. W. Thompson (*Dutch Boy Quarterly*, 1931, **9**, (2), 13–14).—A summary of the properties of refined, common, and chemical lead, and the effect of adding antimony, tin, or alkali metals.—E. S. H.

Changes in the Tensile Properties of Magnetostrictive Metals [Nickel] Caused by Longitudinal, Circular, and Screw-Shaped Magnetization. Tullio Gnesotto (*Atti R. Istituto Veneto Sci., Venezia*, 1932, **91**, II, 615–632; *Chem. Zentr.*, 1932, **103**, II, 3843).—Cf. this *J.*, 1932, **50**, 340. Longitudinal and screw-shaped magnetization of nickel facilitates torsion. The change in strength of nickel wires produced by longitudinal magnetization decreases with increasing previous torsion.—A. R. P.

Changes in the Longitudinal and Circular Magnetization in Twisted Nickel and Iron Wires Produced by a Superimposed Constant Alternating Field. Angelo Drigo (*Atti R. Istituto Veneto Sci., Venezia*, 1932, **91**, II, 681–696, 933–974; *Chem. Zentr.*, 1932, **103**, II, 3843–3844).—Deformation by torsion of nickel that is subjected to a longitudinal alternating field of constant width causes changes in the longitudinal magnetization, the course of which at low Θ values depends on whether the torsion has been effected in a longitudinal field. Changes in the longitudinal magnetization produce magnetization changes of different sign in nickel and iron wires twisted in the same direction; this confirms the assumption that the electromagnetic effects which are associated with the torsion of ferromagnetic metals are derived from magnetization changes which are produced by a kind of magnetic anisotropy due to the torsion.—A. R. P.

Changes in the Electrical Resistance of Magnetostrictive Metals in Magnetic Fields. Tullio Gnesotto (*Atti R. Istituto Veneto Sci., Venezia*, 1932, **91**, II, 697–727; *Chem. Zentr.*, 1932, **103**, II, 3844).—At room temperature the electrical resistance of carefully demagnetized iron increases in a transverse magnetic field whereas that of nickel decreases, but in a longitudinal field it increases in both cases. If the specimens retain some residual magnetism, however, the electrical resistance falls both in transverse and longitudinal magnetic fields. These electromagnetic effects are ascribed to changes in the crystal lattice.—A. R. P.

The Effects of Changes in the State of Tension of Magnetostrictive Cylinders [of Nickel] in Magnetic Fields. Tullio Gnesotto (*Atti R. Istituto Veneto Sci., Venezia*, 1932, **91**, II, 905–916; *Chem. Zentr.*, 1932, **103**, II, 3844).—The magnetization cycles of nickel are more strongly affected by tensile stress than is the case with iron. With nickel wires the changes of longitudinal and circular magnetization are smaller with increasing tension up to 15 kg. the greater the constant field. The longitudinal effect of alternating field is appreciably greater with nickel than with iron.—A. R. P.

Changes in the Longitudinal Magnetization of Twisted Nickel Wires Produced by a Circulating Alternating Field Acting in a Constant Longitudinal Field. Giulia Alocco (*Atti R. Istituto Veneto Sci., Venezia*, 1932, **91**, II, 1101–1124; *Chem. Zentr.*, 1932, **103**, II, 3844).—The sudden changes in magnetization suffered by nickel wire in a circulating alternating field can be restrained by the simultaneous application of a constant longitudinal field of suitable strength. The dependence of this effect on the tension and torsion of the wire and on the frequency of the circulating alternating field has been investigated and correlated with the magnetostrictive properties of the metal. —A. R. P.

Tin and Its Alloys. Anon. (*Tin*, **1932**, Dec., 5–7).—An account is given of the principal properties of tin and its more important alloys, particularly the copper–tin alloys and white metals.—J. H. W.

Fault-Like Translation of Zinc Crystals. E. Schmid and M. A. Valouch (*Mitt. Material., Sonderheft* 21, 1933, 60–64).—See this *J.*, 1932, **50**, 342.—J. W.

Researches on the Hydrogen Content of Zinc with Especial Reference to Electrolytic Zinc. P. Röntgen and F. Möller (*Metallwirtschaft*, 1932, **11**, 685–687, 697–699).—The hydrogen content of zinc cannot be satisfactorily determined by heating or melting the metal in a vacuum, by dissolution in sulphuric acid or in copper sulphate solution, or by amalgamation with mercury.—v. G.

Report of Joint Research Committee [of A.S.T.M. and A.S.M.E.] on Effect of Temperature on the Properties of Metals. H. J. French and N. L. Mochel (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 148–152; and *Amer. Soc. Mech. Eng. Preprint*, **1932**).—See this *J.*, 1932, **50**, 531.—S. G.

Factors Affecting Choice of Working Stresses for High-Temperature Service. P. G. McVetty (*Amer. Soc. Mech. Eng. Preprint*, 1932, Dec. 1–4).—Discusses the various methods proposed to determine safe working loads for high-temperature service. The structural stability of the alloys during tests is of importance, as the metal in the final stages of the test may have become different from what it was when the test is commenced. Published creep test data will therefore contain limits of extrapolation, and in using such data it is necessary to bear in mind the possibility of a large effect of even slight overheating during service. The effects of vibration and impact on the creep properties have not been investigated, but may prove to be of extreme importance.—W. P. R.

Rate of Creep of Metals. P. H. (*Rev. gén. Sci.*, 1932, 43, 418–419).—A short article on the theory of the flow of metals at elevated temperatures. Two methods of investigation are used: (1) determination of the elongation as a function of time at constant temperature and constant stress; (2) determination of the time-temperature function giving a constant elongation under constant load. The first method supplies data useful to the engineer for design purposes, but the latter method is more likely to give results which will explain the true mechanism of creep.—W. P. R.

The Fracture of Machine Parts by Fatigue. L. Persoz ([illegible], 1932, 7, 359–373).—The various types of failure due to fatigue to which machine parts are liable to be subjected are discussed, and the mechanical properties of a number of straight carbon and alloy steels and of copper-aluminium alloys are tabulated. The results of alternate torsion tests are given, and the variation in the endurance limit with temperature is discussed.—J. H. W.

Recent American Researches on "Fatigue of Metals."—I. Anon. (*Metallurgia Suppl. to Engineer*, 1932, 8, 157–158).—A review and discussion of papers contributed to the Annual Meeting of the American Society for Testing Materials, 1932.—J. C.

Strength of Notches. W. Kuntze (*Mitt. deut. Materialprüf., Sonderheft* 20, 1932, 1–62).—The paper contains 10 sections some of which have already been published, on the theory, the properties determined experimentally in steel and different non-ferrous alloys, and the practical application of tensile tests on cylindrical test-pieces having a triangular notch turned out right round the specimens. The value of this work in carrying out a systematic investigation of triaxial tensile stresses is discussed, and the present state of our knowledge of this subject reviewed. (1) *Elastic transverse tension and spatial stresses* (pp. 7–9). Measurements of the elastic transverse tension in the apex of the notch show that the specific transverse tension is a linear function of the relative notch area f and notch angle α, so that in the limiting case when $f = 0$ and $\alpha = 0$ equal elastic tensions and tensile stresses prevail. If the elasticity values are known, the state of stress of [illegible] can, with a suitable shape of test-piece, be determined from the elastic tension in the direction of the smaller principal stress. (2) *Plasticity and tenacity* (pp. 9–17). See this J., 1932, 50, 174. (3) *Influence of stress arrangements on the tenacity* (pp. 18–21). The "undisturbed" tenacity values can be determined by graphical means of the maximum load conditions in notched tensile tests. In contrast with the elastic tension, the tenacity rises linearly with increasing notch angle and with decreasing notch area. (4) *Effect of deformation inhomogeneity on the effective tenacity* (pp. 21–25).—As the angle and area of the notch increase in notched-bar tensile tests the deformation which occurs up to the maximum load and up to fracture steadily decreases. The uneven stress distribution in the notch section magnifies the maximum load [illegible] and reduces the dimensions at fracture. The effective tenacity calculated from the maximum load and the deformation produced by it can thus be corrected, and is then, in the case of cylindrical notched test-pieces, a hyperbolic function of the relative magnitude of the cross-section of the notch.

(5) *Cohesion and shear resistance law under spatial tensile stress* (pp. 25–30). The regularities of the resistance to flow in the notch and in the constricted area are represented by the Mohr stress circle method, and from this the maximum load, shear strength at the beginning of flow, and the mechanism of slip planes are discussed. (6) *Practice of the notched tensile test* (pp. 31–37). See this *J.*, 1932, **50**, 368. (7) *Method for the technical determination of cohesion* (pp. 37–41). See this *J.*, 1932, **50**, 754. (8) *Evaluation of a material according to the appearance of the fracture of notched specimens* (pp. 41–43).—From the appearance of the fracture of aluminium, Duralumin, magnesium, and copper the deformation, cause of failure, and influence of inhomogeneities are discussed. (9) *Problem of fatigue in metals* (pp. 43–45). See this *J.*, 1932, **50**, 149. (10) *Importance and application of the notched tensile test* (pp. 45–60). The influence of recent investigations on the cohesion strength as a material constant on the opinions of the cause of fracture, on the testing of materials, and on a more sensible calculation of the dimensions of constructional parts, is reviewed.—J. W.

Strength of Cohesion. W. Kuntze (*Z.V.d.I.*, 1933, **77**, 49–50).—To be able to judge the stresses which a material will bear without failure not only must the maximum stress be known (which up to the present has been sufficient), but also the spatial state of stress which depends on the shape of the body and on the forces acting on it. The behaviour of a material is thus conditional on the juxtaposition, partly in the same and partly in different grains, of the slip planes which are formed during working and on shear and cleavage processes. Static and alternating stresses are not to be distinguished qualitatively from one another; under static stresses slip, and under alternating stresses shear processes, predominate.—v. G.

Wear of Metals Due to Abrasion. C. R. Weiss (*Mech. World*, 1932, **92**, 28–29).—In order to classify the abrasion-resisting properties of various metals and alloys used in industrial machinery, particularly such as are used for handling powdered materials or for working in a dust-laden atmosphere, more than 1400 tests were made with apparatus which is here described and illustrated. A few of the results are given, and it is claimed that these should be valuable as guides in the selection of materials to suit a specific purpose. —F. J.

Impurities in Metallurgical Products. Their Influence on Structure and Properties. Léon Guillet (*Génie civil*, 1932, **101**, 137–140).—The importance of impurities—intentional and unintentional—in metals has been recognized of late, and their influence on the properties of metals has been carefully studied. If the impurity is soluble in the solid state, it may affect the rate at which recrystallization proceeds, or it may have a profound influence on the temperature of recrystallization. Thus 0·05% of iron causes silver to recrystallize at room temperatures, whilst the addition of 0·1% of copper will mask the effect of the iron. If the impurity is insoluble in the metal, its effect will vary according to the manner in which the constituent impurity occurs. An important effect of insoluble impurities is illustrated in the case of cadmium in zinc, which represses the macroscopic columnar type of crystallization and confers on the zinc a structure consisting of equiaxed grains. The effect of impurities on the corrosion-resisting properties requires further study; in certain cases—for example copper in iron—the impurity has a beneficial effect; copper in aluminium, on the other hand, decreases the resistance of the metal to corrosion.—W. P. R.

On Melting under Pressure.—II. Ernst Jänecke (*Z. physikal. Chem.*, 1932, [A], **162**, 286–288).—Since van Laar has formulated an expression for the melting curves of a substance which, contrary to his earlier work, does not lead to a maximum melting point under infinitely high pressure, the interpolation expressions given in the earlier paper (cf. this *J.*, 1932, **50**, 343) no longer give an approximately correct impression of the conditions of equilibrium between the solid and liquid states of a substance at high pressures.—B. Bl.

Viscosity of Metals at High Temperature. G. Ranque and P. Henry (*Usine*, 1931, 40, (51), 29).—Abstract of a paper presented to the Académie des Sciences. See this *J.*, 1932, 50, 149.—H. W. G. H.

Gases in Metals. L. L. Bircumshaw (*Metallurgist* (Suppt. to *Engineer*), 1932, 8, 185–187).—A review of the results of recent work on the subject.—R. G.

On the Dependence of Wettability of Solid Substances on the Duration of Contact. Agnes Pockels (*Kolloid-Z.*, 1933, 62, 1–2).—Surfaces of silver, tin, and platinum, which are not usually wetted by water, are wetted after contact with water for several days. This property is lost when the metals are subsequently exposed to the air for an equal time. It is probable that an adsorption layer, which is formed at the surface of the metal in air, is removed slowly by the water.—E. S. H.

A Photographic Method of Deriving the Optical Constants of Metals. S. E. Williams (*Proc. Phys. Soc.* (*Lond.*), 1933, 45, 49–69).—A diffraction grating comprising alternate strips of glass and metal of known dimensions is used to obtain reflected diffraction spectra the relative intensities of which depend on the optical properties of the strips. With gratings cut from sputtered platinum films, the values of the optical constants k and n of platinum for radiation given by the doublet of the mercury arc were found to be $k = 1{\cdot}40$, $n = 1{\cdot}67$.—J. S. G. T.

Report of the Atomic Weights Commission of the International Union of Chemistry. G. P. Baxter, Mme. M. Curie, O. Hönigschmid, P. Lebeau, R. J. Meyer (*Ber. deut. chem. Ges.*, 1932, [A], 65, 33–42).—The Commission accepts revised values for the atomic weights of krypton and xenon. A table of atomic weights, related to that of oxygen as 16, is given, and investigations recently completed, are summarized. The metals dealt with are silver, lithium, cæsium, germanium, selenium, tellurium, tungsten, rhenium, ruthenium, and osmium.—P. M. C. R.

Electric Supra-Conduction in Metals. J. C. McLennan (*Nature*, 1932, 130, 879–886).—A general review of the work done on superconductive metals and alloys, the action of magnetic and alternating electrical fields, absorption of β-particles, experiments with simultaneous d.c. and a.c., &c.—E. S. H.

Theory of Super-Conductivity. R. de L. Kronig (*Z. Physik*, 1932, 78, 744–750).—The more important qualitative features of the phenomenon of super-conduction are derived from the consideration of a lattice distribution of the electrons in a uniformly charged positive medium, the conducting electrons exerting Coulomb forces on one another.—J. S. G. T.

Interpretation of Certain Experiments Relating to Super-Conduction. M. v. Laue (*Physikal. Z.*, 1932, 33, 793–796).—Read before the VIII Deutsche Physikertag, September, 1932. v. L. discusses mathematically the results obtained by Haas and Voogd indicating the effect of a magnetic field on the critical temperature of super-conduction, and results obtained by Sizoo.—J. T.

Theory of Diamagnetism of Conducting Electrons. R. Peierls (*Physikal. Z.*, 1932, 33, 864).—Read before the VIII Deutsche Physikertag, September, 1932. Landau's theory of the diamagnetism of free electrons is amplified (see *Z. Physik*, 1930, 64, 629, 637; this *J.*, 1930, 44, 476) and the anomalous behaviour of bismuth is considered to be attributable to the electrons not being perfectly free.—J. S. G. T.

Effect of Elastic Stresses Upon the Form of the Magnetization Curve. N. Akulov, A. Helfenbein, and N. Byczkov (*Z. Physik*, 1932, 78, 808–814).—The magnetic susceptibility of ferromagnetic materials in weak magnetic fields is shown, theoretically and practically, to be altered by longitudinal stress. The initial susceptibility, α, increases or decreases with the traction, F, according as the magnetostriction effect in weak fields is positive or negative. The value of $d^2(1/\alpha)/dF^2$ is always positive.—J. S. G. T.

Ferromagnetic Single Crystals. Richard Gans (*Physikal. Z.*, 1932, **33**, 924–928).—Magnetic saturation, the magnetic characteristics of isotropic ferromagnetic materials, the change of electrical resistance due to magnetization and magnetostriction are discussed practically and theoretically.—J. S. G. T.

A Magneto-Mechanical Effect. N. Akulov and E. Kondorsky (*Z. Physik*, 1932, **78**, 801–807).—A mathematical theory enabling the magnetostriction effect in an elastically-strained single crystal to be determined for any direction of the stress and of the magnetic field is developed. One consequence of the theory is that Hook's law, *i.e.* the law of proportionality of longitudinal strain to stress, is not necessarily valid in the case of ferromagnetic materials. The phenomenon of the increase of Young's modulus with magnetization (*Z. Physik*, 1902, **3**, 380) referred to by Honda, Shimizu, and Kuskabe is explained along these lines.—J. S. G. T.

Propagation of Large Barkhausen Discontinuities.—II. K. J. Sixtus and L. Tonks (*Phys. Rev.*, 1932, [ii], **42**, 419–435).—The propagation of large Barkhausen discontinuities (cf. Sixtus and Tonks, *Phys. Rev.*, 1931, [ii], **37**, 930–958; this *J.*, 1931, **47**, 371) in nickel–iron alloy (containing 14·75% nickel, 0·11% maganese and traces of carbon, phosphorus, sulphur, and silicon) has been studied. Both wires and strips were used, and experiments were carried out under different conditions of tension, torsion, impressed field, variation of jump magnitude, and temperature. The effects of annealing, and of etching the wire were also studied. The results are very complicated, but show that uniform crystal orientation is not necessary for the occurrence of the jump, since complete reversal of the whole wire is observed when only a small fraction of the wire contains uniform orientation produced in the process of manufacture. If λ is the length of the discontinuity, and v the velocity of propagation, a preliminary theory requires λ/v to be proportional to a^2, where a is the radius of the wire, but experiment shows that it is proportional to a rather than to a^2, the missing power of a being replaced by the empirical constant 0·035 cm., which applies to both torsion and tension experiments. The value 0·035 cm. is roughly the radius above which propagation does not occur. Propagation was observed up to 350° C., the slope of the v–H curves increasing with temperature (H is the longitudinal main field impressed on the wire). Propagation was affected by etching the surface of the wire; experiment showed that this was not due to absorption of hydrogen, but possibly to the release of surface strains, since cracks appeared in the surface.—W. H.-R.

Photo-Electric Emission from Different Metals. H. C. Rentschler, D. E. Henry, and K. O. Smith (*Rev. Sci. Instruments*, 1932, **3**, 794–802).—A method for preparing photo-electric cells of any metal which can be made in wire form is described. The method appears to give metal surfaces characterized by their true photo-electric effect. Results obtained with thorium, uranium, zirconium, calcium, tungsten, tantalum, and barium are discussed. Results obtained with barium cells suggest that activated oxide-coated cathodes contain something which has a lower work-function than that of pure barium.
—J. S. G. T.

Theory of the Thermoelectric Effect at Low Temperatures. Wolfgang Kroll (*Z. Physik*, 1933, **80**, 50–56).—An expression for the thermo-e.m.f. in a circuit at low temperatures is derived in accordance with a theory due to Bloch and Nordheim.—J. S. G. T.

Oblique Initial Emission of Thermo-Electrons from Rough Crystalline Metal Surfaces. H. Seemann (*Z. Physik*, 1932, **79**, 742–752).—The emission of electrons from heated tungsten wire in directions other than normal to the axis of the wire, owing to the crystalline structure of the surface of the wire (approximating in character to the surface of a round file) is investigated experimentally.—J. S. G. T.

Reflection of Ultra-Violet Rays. A. Furniss (*Brit. J. Physical Medicine*, 1932, 7, (2), 29–30; and (abstract) *Aluminium Broadcast*, 1932, 3, (32), 19).—Discusses the reflection of ultra-violet rays by metals.—J. C. C.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 69–75.)

On the Influence of Cadmium and Lead on the Properties of Aluminium. B. Blumenthal and M. Hansen (*Metallwirtschaft*, 1932, **11**, 671–674; and *Mitt. Material., Sonderheft* 21, 1933, 87–93).—In melting aluminium alloys with up to 7·4% cadmium or 1·5% lead, thorough stirring is necessary to obtain an even distribution of the cadmium or lead, and the alloys must be rapidly cast and cooled to prevent segregation. Both types of alloy can be readily rolled, drawn, and forged both hot and cold. The tensile strength, elongation, and hardness of aluminium–cadmium alloys are only slightly affected by the cadmium content. These alloys can, however, be appreciably hardened by quenching and ageing; their electrical conductivity is, even with 7% cadmium, only 3% less than that of pure aluminium. Up to 1·5% lead has no effect on the mechanical properties of aluminium or on its corrodibility in sea-water or in the air, but improves considerably its ease of working on the lathe or with the drill.—v. G.

[Contribution] to the Knowledge of the Binary Systems of Aluminium with Cadmium, Lead, and Bismuth. M. Hansen and B. Blumenthal (*Mitt. Material., Sonderheft* **21**, 1933, 19–20).—See this *J.*, 1932, **50**, 151.—J. W.

The Normal and Inverse Segregation of Aluminium–Copper Alloys in Relation to the Rate of Solidification. H. Bohner (*Hauszeit. V.A.W. u.d. Erftwerk A.G. Aluminium*, 1932, **4**, 27–30).—Alloys of aluminium with 5–6% copper show normal segregation at low rates of cooling; as the rate is increased the extent of segregation becomes greater, until with a certain definite rate normal segregation is suddenly replaced by inverse segregation, the extent of which is decreased by further increase in the rate of cooling.—M. H.

Equilibrium Relations in Aluminium–Copper–Magnesium and Aluminium–Copper–Magnesium Silicide Alloys of High Purity. E. H. Dix, jr., G. F. Sager, and B. P. Sager (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 119–129; discussion, 130–131).—For abstract of the paper, see this *J.*, 1932, **50**, 222. The discussion in which *M. L. V. Gayler*, *R. S. Archer*, and *E. H. Dix, jr.*, took part, ranges round the question as to whether Mg_2Si can be considered as an unalterable component in aluminium alloys containing magnesium and silicon. Recent evidence suggests that this is not the case.—A. R. P.

The Physical Properties of Aluminium-Base Die-Casting Alloys. A. J. Field (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 285–291).—Appendix to Report of Committee B-6 [of A.S.T.M.] on Die-Cast Metals and Alloys (see this *J.*, 1932, **50**, 581). The tensile strength and percentage elongation for both flat and round test-pieces, the Rockwell "E" hardness and Charpy impact values are tabulated with the analyses of 12 aluminium-base alloys of the following nominal compositions: (*a*) copper 4%; (*b*) copper 10%; (*c*) copper 14%; (*d*) silicon 5%; (*e*) silicon 12%; (*f*) copper 2, silicon 3%; (*g*) copper 4, silicon 5%; (*h*) copper, 1·5, silicon 1, nickel 2·25%; (*j*) copper 4, silicon 1·75, nickel 4%; (*k*) silicon 2, nickel 5%; (*l*) copper 2, silicon 8%; (*m*) copper 8, silicon 1·5%. Specimens from different sources show wider variations in properties than the analyses would suggest; such variations must be ascribed to divergent foundry methods. Round test-pieces, possessing the greater soundness, give more closely representative results than flat ones. Graphs are given illustrating the relation between: (*a*) tensile strength and hardness; (*b*) impact strength and hardness.—P. M. C. R.

Experiments with Magnalium Sheets (Tensile Tests). K. Schraivogel (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1931, 21*).—Magnalium (aluminium alloy) sheets 0·5–2 mm. thick had in the annealed state a tensile strength of 30–36 kg./mm.^{2} with an elongation of 15–22%, and in the polished state a tensile strength of 38–42 kg./mm.^{2}, an elongation of 8–11%, and a modulus of elasticity of 7300 kg./mm.^{2}. The yield-point (0·2% elongation) was 50% of the tensile strength in the first case, and 75–80% in the second case.—B. Bl.

D.2. A New Non-Heat-Treatable Alloy. Anon. (*Light Metals Research*, 1933, 2, (19), 2 pp.).—This aluminium alloy is not so strong as Duralumin or as corrosion-resistant as "MG 7," but is more ductile and readily worked. It is not susceptible to intercrystalline corrosion. Typical tensile properties are:

	Annealed.	Hard-Rolled.	Extruded.
Maximum stress, tons/in.^{2} . .	12·5	19·5	13·5
Proof stress, tons/in.^{2} . . .	6·6	18·5	7–8
Elongation, per cent. . . .	24	5	20

—J. C. C.

Special Light Alloys for Aircraft. W. C. Devereux (*Aircraft Eng.*, 1933, 5, (47), 6–12).—Typical castings in the "R.R." alloys are described, with particular reference to aircraft engine parts. The short range of solidification and low linear contraction of the alloys constitute distinct advantages. Hot-shortness tests on a number of aluminium castings are described. Diagrams are given indicating the properties of the alloys at elevated temperatures. Reference is made to frictional properties, and tests are described. The results of Wöhler fatigue tests, short endurance deflection-fatigue tests, and impact-fatigue tests in the Amsler machine are given. Troubles arising with the wrought alloys from the use of a dummy of too large a size for stamping, and from overheating are described, and attention is directed to the possibility of producing extruded sections having non-uniform structure, particularly in the portion last leaving the die.—H. S.

On the Reducibility of Beryllium Oxide. Wilhelm Kroll (*Wiss. Veröff. Siemens-Konzern*, 1932, 11, (2), 88–92; and (translation in full) *Light Metals Research*, 1932, 2, (17), 15–20).—Attempts to obtain beryllium alloys by the "Thermit" reduction of mixtures of beryllia with copper, nickel, or iron or their oxides, using calcium, magnesium, aluminium, silicon, lithium, or cerium as reducing agents, proved abortive.—A. R. P.

The Ternary System Cobalt–Chromium–Tungsten. W. Köster (*Z. Metallkunde*, 1933, 25, 22–27).—The constitution of the ternary system cobalt–chromium–tungsten up to 80% chromium and 50% tungsten was investigated by means of the thermal investigation of sections through the ternary model and microscopical observations of alloys in the cast and slowly-cooled states. The Brinell hardness and age-hardening of the cobalt-rich alloys were determined. The age-hardened alloys (maximum hardness about 600 kg./mm.^{2}) with 20–50% tungsten and up to 20% chromium possess good cutting properties, even at high temperatures.—M. H.

Joule Magnetostrictive Effect in a Group of Cobalt–Iron Alloys. S. R. Williams (*Rev. Sci. Instruments*, 1932, 3, 675–683).—Full report of a paper read before the American Physical Society on February 25, 1932, of which only an abstract was published in *Phys. Rev.*, 1932, [ii], 40, 120. Cf. this *J.*, 1932, 50, 729.—J. S. G. T.

Aluminium-Bronze. Freeman Horn (*Met. Ind.* (*Lond.*), 1932, **41**, 618).—Short note on an aluminium alloy containing copper 10–12%, referred to by C. J. Elliott in *Met. Ind.* (*Lond.*), 1932, **41**, 511, as "Aluminium-Bronze," remarking that this term applies to a copper alloy containing aluminium 10–12% and having a tensile strength of up to 35 tons/in.^{2}.—J. H. W.

Copper-Beryllium Bronzes. J. Kent Smith (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 65–76; discussion, 76–77).—For abstract of the paper, see this *J.*, 1932, **50**, 224. In the discussion *C. H. Greenall* states that it is possible to measure the hardness of sheet metal by means of a Rockwell tester using a 150-kg. load and a $\frac{1}{16}$-in. ball penetrator and taking the reading on the B scale. *O. W. Ellis* stresses the importance of determining the heat conductivity of alloys to be used in electrical machinery.—A. R. P.

The Equilibrium Diagram of the Copper-Rich Copper-Silver Alloys. Cyril Stanley Smith and W. Earl Lindlief (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 101–114; discussion, 114–118).—For abstract of the paper, see this *J.*, 1931, **47**, 651. In the discussion, *R. F. Mehl, D. Stockdale, N. W. Ageew, K. R. Van Horn*, and *C. S. Smith* discuss the mechanism of the age-hardening effect in copper alloys with a low silver content. C. S. S. states that quenched alloys are stable at room temperature for an indefinite period and no sign of hardening occurs on tempering below 200° C. After 4 hrs. at 200°–250° C. a slight hardening effect is observed, but the main increase in hardness does not occur until visible pearlitic precipitation commences at 300° C.; maximum hardness is reached at 400°–500° C. when visible precipitation is complete, and above 550° C. the hardness rapidly decreases to the value for the quenched alloy.—A. R. P.

Tin-Bronzes. F. C. Thompson (*Tin*, 1932, Nov., 12–14).—The failures in producing tin-bronze castings are usually due to neglect to diminish the oxidation of the tin by the use of a suitable flux or the addition of a little zinc, to lack of control of the pouring temperature, and to failure to allow for the shrinkage on solidification. The alteration in the properties of these alloys as the tin content is increased is discussed. With higher percentages of tin, the cold-working properties disappear and the hardness increases. Compared with other non-ferrous alloys, bronzes retain their hardness much better at the higher temperatures. The addition of up to 0·5% of lead greatly improves the machinability of pure copper-tin alloys. For higher resistance to wear, as in bearing bronzes, the tin content lies between 7% and 14%. In these alloys, even small quantities of zinc are definitely detrimental, but lead up to 5–10% is permissible.—J. H. W.

Effect of Antimony on the Mechanical Properties of a Bearing Bronze. C. E. Eggenschwiler (*Mech. World*, 1932, **92**, 384).—Abstract from *U.S. Bur. Stand. J. Research.*, 1932, **8**, 625. See this *J.*, 1932, **50**, 537.—F. J.

Bronzes Used in Railway Work. R. Loiseau (*Usine*, 1931, **40**, (34), 31–35).—See this *J.*, 1932, **50**, 52.—H. W. G. H.

Age-Hardening Copper-Titanium Alloys. F. R. Hensel and E. I. Larsen (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 55–62; discussion, 62–64).—For abstract of the paper, see this *J.*, 1931, **47**, 652. In the discussion *P. G. McVetty* discusses the effect of age-hardening on the creep of alloys at high temperature and the embrittling effect of hardening in some alloys. *E. E. Schumacher* and *W. C. Ellis* point out the necessity for excluding air during the melting of titanium-copper alloys to prevent the formation of "slushy" metal. *F. R. Hensel* compares, in a table, the mechanical properties of titanium-copper alloys with those of Corson alloys (copper hardened with Ni_2Si). The tensile properties of the titanium alloys are much superior to those of the Corson alloys, but their electrical resistivity is 3 times as great.—A. R. P.

On the Transformations in Copper-Zinc and Silver-Zinc β-Alloys. M. Straumanis and J. Weerts (*Mitt. Material., Sonderheft* 21, 1933, 23–26).—See this *J.*, 1932, **50**, 158.—J. W.

The Separation of the α-Phase in β-Brass. M. Straumanis and J. Weerts (*Mitt. Material., Sonderheft* 21, 1933, 26–33).—See *J.*, this volume, p. 12.—J. W.

The Influence of Third Metals on the Constitution of Brass Alloys. IV.—The Influence of Aluminium. A Contribution to the Knowledge of the Ternary System Copper–Zinc–Aluminium. O. Bauer and M. Hansen (*Mitt. Material., Sonderheft* 21, 1933, 3–18).—See this *J.*, 1932, **50**, 225, 426–427.—J. W.

The Influence of Third Metals on the Constitution of Brass Alloys. V.—The Influence of Manganese. A Contribution to the Knowledge of the Ternary System Copper–Zinc–Manganese. O. Bauer and M. Hansen (*Z. Metallkunde*, 1933, **25**, 17–22).—Cf. this *J.*, 1929, **42**, 451; 1930, **43**, 469; 1931, **47**, 12–13, 140–141; 1932, **50**, 225, 426, 427. Earlier investigations on the constitution of the ternary system are critically reviewed. The constitution of the copper–zinc–manganese alloys with copper 70–50, and manganese 0–6%, has been studied by thermal and micrographical investigation of sections through the ternary model for a constant manganese content of 0·53, 1·26, 2·24, 4·20, and 5·78%, respectively. (1) The solidification is quite analogous to that of the binary copper–zinc series of alloys. Within a certain range of concentration the peritectic reaction $\alpha + \text{melt} \rightleftharpoons \beta$ takes place over a very narrow temperature interval. The temperature of the peritectic reaction in the copper–zinc system (905° C.) is decreased as the manganese content increases; the lowering is 45° C. for 5·5–7% manganese, according to the copper content. (2) The influence of manganese on the structure of the brasses is characterized by the fact that the limiting curves of the $(\alpha + \beta)$ region are displaced to lower copper concentrations, and that in alloys which contain the β solid solution, with manganese contents above 4–4·7% and at temperatures below about 375° C., a manganese-rich phase makes its appearance, owing to the decrease in solid solubility of manganese in β-brass.—M. H.

The Beta to Alpha Transformation in Hot-Forged Brass. Robert S. Baker (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 159–162; discussion, 162–164).—For abstract of the paper, see this *J.*, 1932, **50**, 730. In the discussion, the following took part: *R. F. Mehl, A. J. Phillips,* and *R. S. Baker.* The β–α change under the conditions described in the paper is a suppressed constitutional change similar to the austenite–ferrite change in quenched iron–carbon alloys. The Widmanstätten structure obtained by direct conversion of β-brass into α-brass is extremely complex, and it is often possible to find as many as seven crystal orientations of α within a single β-grain. Greater ductility is obtained by extrusion above 825° C. followed by rapid cooling and subsequent annealing, than by cold extrusion. The transformed areas of the 60·3% copper, 1·75% lead brass used in the tests had a Rockwell B hardness (100-kg. load, $\frac{1}{16}$-in. ball) of 52–54, which fell to 0–2 after 1 hr. at 450° C., whilst the untransformed areas $(\alpha + \beta$ before annealing) gave corresponding values of 57–60 and 19.—A. R. P.

On the Alloys of Gallium with Zinc, Cadmium, Mercury, Tin, Lead, Bismuth, and Aluminium. N. A. Puschin, S. Stepanović, and V. Stajić (*Z. anorg. Chem.*, 1932, **209**, 329–334).—These binary gallium systems have been studied by thermal analysis. Zinc and tin are completely miscible with liquid gallium; the eutectic points are about 5% zinc and 25° C. and about 8% tin and 20° C. Mercury and gallium are completely immiscible in one another just above the melting points of the metals. Lead, cadmium, and bismuth, have only a limited range of miscibility with gallium in the liquid state; the melting point of lead is lowered by 5% gallium to 317° C., that of cadmium by 12–13% gallium to 258° C., and that of bismuth by 11% gallium to 225° C. No determinations were made of the composition of the gallium-rich melts in any of these systems. The freezing point of gallium (29·9° C.) is not appreciably lowered by additions of lead, cadmium, and bismuth. Gallium and aluminium form 3 compounds, with melting points as follow: Ga_2Al (290° C.), GaAl (376° C.), and $GaAl_2$ (464°).—M. H.

On the System Gold–Manganese. H. Moser, E. Raub, and E. Vincke (*Z. anorg. Chem.*, 1933, **210**, 67–76).—A study of the constitution of the binary system gold–manganese (97% manganese) by means of thermal and microscopic methods gave an equilibrium diagram similar to that obtained by Parravano and Perret (cf. this *J.*, 1915, **14**, 236). Between 0 and 40% manganese a series of solid solutions (γ) exists above 700° C., the liquidus and solidus curves have a minimum at 12% manganese and 977° C., and a maximum at the composition corresponding with the formula AuMn (21·8% manganese) and 1237° C. Between 5% and 15% manganese the gold-rich γ-solid solutions transform below 700° C. to form a hard intermediate phase (δ). At 1130° C. the monotectic reaction: melt with 55% $\rightleftharpoons$ melt with 50% + β-manganese solid solution with about 75% Mn takes place, and at 1073° C. a eutectic (44%) crystallizes which consists of the γ-solid solution (40%) and the β-manganese solid solution (about 74%). The β-manganese solid solution with 83% manganese decomposes at about 570° C. into γ (35%) and α-manganese.—M. H.

The Heat of Formation of Lanthanum and Magnesium, and Lanthanum and Aluminium Compounds. G. Canneri and A. Rossi (*Gaz. Chim. Ital.*, 1932, **62**, (3), 202–211).—The heats of formation of LaMg, $LaMg_2$, $LaAl_2$, and $LaAl_4$ have been determined.—G. G.

Arsenic in Lead Bearing Metals. Ch. Ackermann (*Z. Metallkunde*, 1932, **24**, 306–308).—An improvement takes place in the mechanical properties of 80 : 11 : 9 and 80 : 15 : 5 lead–antimony–tin alloys, and of more complex lead-rich bearing metals with the addition of arsenic if the arsenic content is less than about 0·8%. A higher arsenic content results in a further increase in the hardness and compression strength and also in a considerable decrease in the specific shock strength.—M. H.

Hardenable Lead Alloys. B. Garre and F. Vollmert (*Z. anorg. Chem.*, 1933, **210**, 77–80).—Additions of the compounds Ag_3Sn (up to 7%), $AgCd_4$ (up to 5%), and Ag_2Cd_3 (up to 2%) to lead result in a lowering of its freezing point and in a considerable increase in its Brinell hardness (being determined for additions up to 2%), especially after quenching. All alloys consist of solid solutions. The Brinell hardness of quenched alloys with 0·5% $AgCd_4$, Ag_3Sn, and Ag_2Cd_3 is respectively about 20%, 57%, and 70% higher than that of the slowly-cooled state. A new method of etching lead-rich alloys is described.—M. H.

Intermetallic Compounds Formed in Mercury. I.—The Tin–Copper System. Alexander Smith Russell, Peter Victor Ferdinand Cazalet, and Nevill Maxsted Irvin (*J. Chem. Soc.*, **1932**, (1), 841–851).—Stable compounds of tin and copper with or without mercury are formed in mercury at room temperature. All the compounds have valency electrons equal to 6, 9, or 12, or some simple multiple of these numbers, and to this extent are similar to the compounds in the tin–copper, zinc–copper, and aluminium–copper systems round the β-phase range.—S. V. W.

Intermetallic Compounds Formed in Mercury. II.—The Zinc–Copper System. Alexander Smith Russell, Peter Victor Ferdinand Cazalet, and Nevill Maxsted Irvin (*J. Chem. Soc.*, **1932**, (1), 852–857).—The methods of formation and decomposition of ZnCu, $ZnCu_3Hg_2$, Zn_2Cu_5, Zn_2Cu_6Hg, and CuHg, compounds formed in mercury at ordinary temperatures or at 100° C. have been studied. The relations of these to each other and to similar compounds of tin, copper, and mercury are briefly described.—S. V. W.

Intermetallic Compounds Formed in Mercury. III.—The Zn–Fe System and Part of the Sn–Fe System. Alexander Smith Russell and Henry Anthony Montague Lyons (*J. Chem. Soc.*, 1932, (1), 857–866).—Five new compounds of Fe and Zn and two of Sn and Fe are formed in mercury at ordinary temperature. General conclusions regarding the valency electrons of compounds of the Sn–Cu, Zn–Cu, Zn–Fe, and Sn–Fe systems are drawn.—S. V. W.

Intermetallic Compounds formed in Mercury. IV.—Summary of Work on the Sn–Cu, Sn–Fe, Zn–Cu, Zn–Fe, Cd–Cu, Hg–Cu, Mn–Cu, and Zn–Mn Systems. Alexander S. Russell, T. R. Kennedy, J. Howitt, and H. A. M. Lyons (*J. Chem. Soc.*, 1932, (II), 2340–2342).—The title indicates the scope of this paper.—S. V. W.

The Solubilities of Copper, Manganese, and some Sparingly Soluble Metals in Mercury. Nevill Maxsted Irvin and Alexander Smith Russell (*J. Chem. Soc.*, 1932, (1), 891–898).—Of the metals of atomic numbers 22–29 and of molybdenum, tungsten, and uranium, copper and manganese alone have solubilities in mercury greater than 1 in 10^7, their values being 0·0020% and 0·0010%, respectively.—S. V. W.

A New Metal [Illium] for Instruments. W. D. Staley (*Instruments*, 1932, 5, 65, A22).—Illium is a corrosion-resisting alloy containing nickel, chromium, copper, molybdenum, and tungsten as principal constituents. It has a tensile strength of 60,000 lb./in.², and is slightly harder to machine than cast steel. It has been used for calorimeter bombs, crucibles, and pyrometer tubes.
—J. C. C.

Some Developments in High-Temperature Alloys in the Nickel–Cobalt–Iron System. C. R. Austin and G. P. Halliwell (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, 99, (Inst. Metals Div.), 78–96; discussion, 97–100).—For abstract of the paper, see this *J.*, 1932, 50, 18. In the discussion, in reply to questions, G. P. Halliwell stated that alloys with 46–49% nickel, 29–24% cobalt, 6–8% iron, 10–18% chromium, and 2·2–2·4% titanium developing only a thin oxide film after 4000 hrs. at 600° C. Alloys with less than 10% iron and a relatively low titanium content forge readily, and once the cast structure is broken down the alloys can be readily drawn into fine wire. Most of the hardened alloys retain their hardness for many thousands of hours at high temperature, and could be used for oil-cracking machinery. C. R. Austin suggests that marked age-hardening properties are obtained only when both nickel and cobalt are present, little hardening being obtained in the absence of cobalt. Cobalt, at high temperatures, confers on nickel a strength independent of ageing. The hardening constituent in the ageing would appear to be Fe_3Ti.—A. R. P.

The Properties of Monel Metal and Similar Copper–Nickel Alloys. O. Bauer, J. Weerts, and O. Vollenbruck (*Metallwirtschaft*, 1932, 11, 629–633, 643–649).—Metallographic, mechanical, and chemical tests have been made on natural Monel metal (*A*), and on two synthetic so-called "Nicorros" alloys, (*C*) containing, like (*A*), 0·12% carbon in solid solution and (*B*) containing 0·3% carbon, most of which was present as precipitated graphite. In all cases the small contents of iron, cobalt, and manganese were in solid solution. In the form of rolled sheet 6·5 mm. thick (*A*) has the highest tensile strength and yield-point; after annealing for 30 minutes at 1050° C. no appreciable difference could be found between the three alloys in the direction of rolling, but perpendicular thereto (*B*) showed a smaller elongation and reduction in area. (*B*) also showed an irregular behaviour in tensile tests on rolled specimens, and the impact values of notched bars of rolled or annealed specimens were only half those of the other two alloys; its hardness after annealing as well as after quenching and tempering was greater than that of the other alloys in a similar state. The density of (*A*) was 8·87, of (*B*) 8·86, and of (*C*) 8·82; stretching reduced these values by 0·008, 0·015, and 0·003, respectively. (*A*) and (*C*) after annealing could be readily drawn and rolled, whereas (*B*) was much less easily worked after annealing in air and somewhat less easily worked after annealing in a vacuum. Cold-rolling reduced the rate of chemical attack in all cases, (*B*) in all cases being more readily attacked then (*A*) or (*C*). Artificial is thus equivalent to natural Monel metal only when the carbon content is kept so low that it is also retained in solid solution.—V. G.

Technical Properties of Copper–Nickel Alloys Containing Beryllium. Georg Masing and Waldemar Pocher (*Wiss. Veröff. Siemens-Konzern*, 1932, 11, (2), 93–98).—The hardness and mechanical properties of various nickel–copper alloys containing beryllium have been determined after various heat-treatments. The best quenching temperatures are 800° C. for alloys with 0–30% nickel, 900° C. with 50% nickel, 950° C. with 70% nickel, and 1050° C. with 90% nickel; the ageing temperature rises from 350° to 550° C. with increasing proportions of nickel. A hardness of 321 Brinell units with a tensile strength of 115 kg./mm.^{2} and an elongation of 13% is readily obtained with the 1 : 39 : 60 beryllium–copper–nickel alloy after ageing at 500° C. for 10 hrs.; the corresponding values for the 1 : 19 : 80 alloy aged at 500° C. for 21 hrs. are 288, 100 kg./mm.^{2}, and 4%. No deterioration in these properties occurs after prolonged heating at 400°–450° C.—A. R. P.

The Alloys of Palladium with Iron. A. T. Grigoriev (*Z. anorg. Chem.*, 1932, 209, 295–307).—The liquidus curve falls to a very flat minimum at about 1300° C. and 55 atomic-% palladium; it corresponds with the crystallization of an uninterrupted series of solid solutions of γ-iron and palladium. Two transformations occur in the solid state, *viz.*, the $\gamma \longrightarrow \alpha$ iron transformation in alloys containing up to about 25 atomic-% palladium (the temperature of which falls with increasing palladium content), and the formation of the compound $FePd_3$ at 810° C. The microstructure of slowly-cooled alloys and of alloys quenched from 1000° C. consists of homogeneous solid solutions despite the occurrence of transformations. The existence of a series of solid solutions at high temperatures and of the compound $FePd_3$ at lower temperatures has been confirmed by measurements of the Brinell hardness and temperature coeff. of electrical resistance of quenched and slowly-cooled alloys.—M. H.

On Alloys of Platinum with Nickel. N. S. Kurnakow and W. A. Nemilow (*Z. anorg. Chem.*, 1933, 210, 13–20, and (in Russian) *Izvestia Platinago Instituta* (*Ann. Inst. Platine*), 1932, 8, 17–21).—The constitution of the system nickel–platinum was studied by means of thermal analysis (for the liquidus curve between 0 and 77·5% platinum by weight), microscopic investigation, and measurements of the Brinell hardness and temperature coeff. of electrical resistance after annealing at 1100° C. with subsequent slow cooling. Results indicate that nickel and platinum form a continuous series of solid solutions which are stable down to room temperature, *i.e.*, no compound or solid solution with a regular arrangement of the atoms is formed.—M. H.

On Alloys of Platinum with Copper. N. S. Kurnakow and W. A. Nemilow (*Z. anorg. Chem.*, 1933, 210, 1–12, and (in Russian) *Izvestia Platinago Instituta* (*Ann. Inst. Platine*), 1932, 8, 5–16).—The investigation of the constitution by means of thermal analysis, microscopic investigation, and measurements of Brinell hardness and electrical properties both after quenching at 800°–900° C. and annealing at 650°–750° C. with subsequent slow cooling, has shown that, in accordance with Johansson and Linde (cf. this *J.*, 1928, 39, 539), a continuous series of solid solutions exists above 800° C. and that 2 transformations take place with fall in temperature, *viz.*: (1) the formation of the compound CuPt (which forms solid solutions with copper and platinum) in alloys between 40 and 60 atomic-% platinum near 800° C.; and (2) a transformation near 500° C. in alloys with about 20–25 atomic-% platinum, which seems to be characterized by the formation of another compound (Cu_4Pt or Cu_3Pt) or a solid solution with regular distribution of the atoms. The latter transformation could not be observed by thermal analysis and microscopic examination.
—M. H.

The System Silver–Copper–Cadmium. M. Keinert (*Z. physikal. Chem.*, 1932, [A], **162**, 289–304).—This ternary system has been investigated by micrographic methods. Since the systems silver–cadmium and copper–cadmium are similar to one another in almost every respect solid solutions are formed in the ternary system between the binary γ-phases, and between the binary ε-phases. [$\gamma = Ag_5Cd_8$–Cu_5Cd_8.] Again the four components in the quasi-quaternary system Ag_5Cd_8–Cu_5Cd_8–Ag_5Zn_8–Cu_5Zn_8 appear to be isomorphous. Complicated reactions occur between the β and β' phases the nature of which could not be completely elucidated. The course of the eutectic curves is briefly outlined. Precipitation-hardening tests on supersaturated ternary solid solutions at the silver corner of the system have confirmed the results of Fraenkel and Nowack (*Z. Metallkunde*, 1928, **20**, 243; cf. this *J.*, 1928, **40**, 625).—B. Bl.

Relation of Crystal Orientation to Bending Qualities of a Rolled Zinc Alloy. Gerald Edmunds and M. L. Fuller (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 175–185; discussion, 185–189).—For abstract of the paper, see this *J.*, 1932, **50**, 735. In the discussion, the following took part: *E. M. Wise, W. P. Davey, W. H. Finkeldey, A. J. Phillips, H. O'Neill, G. Edmunds, F. Wever,* and *E. Schmid* and *G. Wassermann*. Sheet zinc obtained by breaking down slabs to 0·056 in. in the roughing mill and then completing the reduction to 0·040 in. in the finishing rolls frequently shows good bending properties on one side of the strip and complete failure on the other, but this defect may be eliminated by stopping the first stage at 0·075 in. and completing the rolling in the finishing rolls using fairly moderate reductions. In the production of large zinc crystals by annealing near the melting point the large crystals are often coated with a layer of fine crystals which is thicker on one side than on the other. Electronic diffraction is suggested as a method for determining the orientation of the metal from the surface to the centre of the rolled strip. The results of E. and F. on strip agree with those previously found by E. S. and G. W. on drawn zinc wire.—A. R. P.

Average Strength Data for Non-Ferrous Alloys. Anon. (*Machinery* (*N.Y.*), 1933, **39**, 312A).—Average tensile properties of standard aluminium alloys and brasses are tabulated.—J. C. C.

On Internal Stresses. Otto Mies (*Schmelzschweissung*, 1931, **10**, 213–215).—The importance of internal stresses in technical construction is illustrated by simple examples, *e.g.*, the season-cracking of brass rods and the bending of a rod and of a strip of sheet.—B. Bl.

Immiscible Metals. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 178–179).—A brief review, pointing out the lack of knowledge concerning the nature of immiscibility between some metals. The behaviour of two metals in this respect does not appear to be related to their similarity in physical characteristics, and the effect of the addition of a third metal cannot be predicted. The subject is a promising one for fundamental research.—R. G.

Investigation on the Shape and Arrangement of Ferromagnetic Segregates by Means of the Magnetic Balance. E. Gerold (*Z. Metallkunde*, 1932, **24**, 255–257).—The shape and arrangement of ferromagnetic segregates in a non-magnetic ground-mass can be determined by means of magnetization curves obtained with the aid of a magnetic balance. The shape of the curve depends on the position of the specimen in the magnetic field; if the curves for transverse and longitudinal positions coincide, the ferromagnetic phase occurs in separate particles completely surrounded by non-magnetic material, *e.g.*, in the case of copper containing 2% iron. If the two curves do not coincide, the ferromagnetic phase is present as a tenuous film surrounding grains of the non-magnetic substance. From the characteristic irregularities of the curves of cold-worked specimens conclusions can be reached as to the structural changes produced by the rolling or drawing process.—B. Bl.

On the Theory of Formation of Segregate Structures in Alloys. C. H. Mathewson and D. W. Smith (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, 99, (Inst. Metals Div.), 264–271; discussion, 271–273).—For abstract of the paper, see this *J.*, 1932, 50, 479. In the discussion, *C. S. Barrett, R. F. Mehl, O. T. Marzke*, and *C. H. Mathewson* took part. Additional evidence is cited against the theory of Hanemann and Schröder as to the shape and orientation of segregates in alloys; this evidence implies that perfusion, diffusion, lattice strains, and concentration gradients are of no importance in determining either the principal surfaces between matrix and segregate in alloys or the orientation of the segregate lattice with respect to the matrix.—A. R. P.

Contribution to the Thermodynamics of Concentrated Solutions.—II. Communication: Calculation of the Complete Curves of Crystallization in Binary Eutectic Systems. Ernst Kordes (*Z. physikal. Chem.*, 1932, [A], 162, 103–127).—Cf. this *J.*, 1932, 50, 353. An equation is given by the aid of which the complete crystallization diagram of a binary eutectic system can be calculated. Two constants in the equation are derived from the latent heats of fusion and the melting points of the two components, and the third refers to the heat developed in mixing the components in the liquid state. This third constant may be determined for any system by measuring the temperature of crystallization of a highly concentrated mixture. The validity of the equation is independent of the nature of the components—whether they are metals, salts, molecular compounds, or aqueous solutions. The calculations can be extended to include systems with a miscibility gap in the liquid state. —B. Bl.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 75–76.)

Metallography. —— Muhr (*Draht-Welt Export-Ausgabe*, 1932, (8), 77–81). —[In German, English, and French.] A brief but comprehensive statement of the essential factors governing the choice, preparation, and examination of metal sections, as well as the necessary apparatus.—A. B. W.

The Importance of the Structure for the Permanent Deformation of Crystals. E. Seidl (*Mitt. Material., Sonderheft* 21, 1933, 46–49; and (abstract) *Fortschritte Min. Krist. u. Petr.*, 1931, 26, (1)).—Macroscopic observations on the deformation and fracture of coarsely crystalline metal specimens are described.—J. W.

On the Recrystallization and Recovery after Cold-Working of Pure Aluminium and Some Age-Hardening Aluminium Alloys of Al–Cu Base. H. Bohner and R. Vogel (*Z. Metallkunde*, 1932, 24, 169–175).—The recrystallized structure of aluminium and its alloys is, even after repeated recrystallization, strongly dependent on the previous thermal and mechanical treatment, *e.g.*, nature, rate, degree, and temperature of deformation, as well as on small changes in the chemical composition and on the size and orientation of the original structure. The surface of stretched metal behaves somewhat differently from the core, and the time required to produce a coarse secondary grain structure on annealing is appreciably greater than that necessary to produce a fine-grained recrystallization structure. The critical deformation range is greater with pure aluminium than with age-hardenable copper–aluminium alloys. The recrystallization temperature and critical deformation range of the latter are lowered by increasing the silicon content, but remain unaffected by replacement of part of the silicon with magnesium. Manganese increases the critical deformation range. When Silumin or copper–aluminium alloys containing small quantities of silicon, magnesium, manganese, chromium, or titanium are quenched from 500° C., stretched, and again annealed to produce secondary recrystallization, an oriented chequered structure is formed under certain conditions between the Lüders slip lines developed by the deformation. On annealing a deformed alloy the mechanical and electrical properties characteristic of the selected annealing temperature are obtained by crystal recovery before recrystallization commences, and the time required for this recovery to take place is also dependent on numerous factors, hence in constructing recrystallization diagrams the previous history of the metal must be taken into account.—B. Bl.

Studies upon the Widmanstätten Structure. III.—The Aluminium-Rich Alloys of Aluminium with Copper, and of Aluminium with Magnesium and Silicon. Robert F. Mehl, Charles S. Barrett, and Frederick N. Rhines (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 207–229; discussion, 229–233).—For abstract of the paper, see this *J.*, 1932, **50**, 485. In the discussion, *J. W. Greig*, *E. Posnjak* and *H. E. Merwin*, *G. Doan*, *R. F. Mehl*, and *F. N. Rhines* took part. G., P., and M. illustrate similar types of Widmanstätten structure observed on oxidized natural magnetite and in decomposed solid solutions derived from synthetic mixtures of ferric and ferrosoferric oxides. D. states that from considerations based on the principle of Guertler's "Klärkreuz" method, and from the fact that the existence of the quasi-binary system Mg_2Si–aluminium has been proved to be a real one, the compound Al_3Mg_2 cannot coexist in equilibrium with Mg_2Si in any of the alloys on the line joining the aluminium corner of the ternary diagram with the Mg_2Si point. In reply, R. argues as follows in support of the possible formation of Al_2Mg_3: when a saturated solid solution of Mg_2Si in aluminium is kept just below the melting point for some time, then cooled somewhat, the solute atoms will aggregate into particles of whatever second phase is most readily formed, and this appears to be Al_2Mg_3; subsequently, however, the silicon atoms in solution react with this compound to form stable Mg_2Si with the rejection of aluminium into the matrix. If this explanation is correct, the separation of Al_2Mg_3 from an alloy of aluminium and Mg_2Si is a case of metastable equilibrium.—A. R. P.

An X-Ray Study of the Nature of Solid Solutions [Aluminium–Silver]. Robert T. Phelps and Wheeler P. Davey (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 234–245; discussion, 245–263).—For abstract of the paper, see this *J.*, 1932, **50**, 164. In the discussion, *J. S. Marsh*; *C. S. Barrett*; *T. D. Yensen*; *R. S. Dean* and *J. Koster*; *F. N. Rhines*; *A. Stansfield*; *H. E. Stauss*; *Yap, Chu-Phay*; and *W. P. Davey* took part. With reference to the theory put forward as to the nature of metallic solid solutions J. S. M. points out that copper–palladium solid solutions after rapid cooling have a perfectly random distribution of atoms in the face-centred cubic lattice, but after annealing at 400° C. the equiatomic alloy develops a regularly oriented CsCl type of lattice. C. S. B. shows that the authors' observed values for the density of aluminium–silver alloys and the calculated values of Westgren and Bradley lie on the same straight line. R. S. D. and J. K. in a lengthy contribution give tables showing that the percentage difference between atomic radii for pairs of metals known to form unbroken series of solid solutions never exceeds 15%, but that the converse of this statement is not true; tables are also given showing the diffusion constants for various metals in lead at 140°–315° C., and the mechanism of the diffusion of thallium in lead is explained. Calculations show that considerable movement must take place at room temperature, and D. and K. therefore postulate that the state of affairs in a true solid solution is essentially kinetic; this would account for Tammann's reaction limits. Although the solute atoms migrate slowly from place to place at room temperature, this movement is sufficient to prevent their detection by the usual X-ray methods; hence the chief difference between a solid solution and a compound is that the migrating atoms may shift from one crystallographic position to another in the solution, whereas in the compound shifts can take place only between like atoms; in the solid solution the distribution of the solute will be uniform, and the influence of such a statistical arrangement on the formation of intermetallic compounds is discussed with special reference to Ag_3Al. The remainder of the discussion is concerned with the interpretation of the low density of silver alloys with 2–5% aluminium and with the authors' reply to the points raised.—A. R. P.

Comparison of the Intermetallic Compound $AuCd_3$ Crystallized from Molten Alloys with that Precipitated from Solution. P. A. Thiessen and J. Heumann (*Z. anorg. Chem.*, 1932, **209**, 325–327).—The crystal structure of the precipitated $AuCd_3$ formed by immersing cadmium in auric chloride solution is identical with that of the same compound produced from molten alloys of the two metals.—M. H.

The Transformations in the System Gold–Copper and Their Fundamental Importance for the Transformations in Solid Metallic Phases. L. Graf (*Z. Metallkunde*, 1932, **24**, 248–253; discussion, 253–254).—The mechanism and kinetics of the transformation: cubic face-centred lattice with irregular distribution of the atoms $\rightleftarrows$ tetragonal lattice with regular distribution of the atoms which occurs in the gold–copper alloy with 50 atomic-%, was studied by X-ray analysis. With fall in temperature the transformation occurs in 2 steps, *viz.*: (1) change of the lattice symmetry from cubic to tetragonal; and (2) transition from an irregular distribution of the atoms to a regular distribution. The first step takes place completely and with great velocity, the second, however, occurs rather slowly and incompletely. Thus a so-called " intermediate state " is formed which is characterized by a tetragonal lattice with inhomogeneously-distributed areas of regularly-arranged atoms within a coherent grain. The " intermediate state " has a special X-ray diagram and is characterized by an electric resistance and a tensile strength which are considerably higher than those of the final state. The thermodynamic conditions of the transformation and the coupling between the change of the lattice symmetry and the rearrangement of the atoms are discussed.—M. H.

Remarks on the Rolling Texture of Zinc. M. A. Valouch (*Mitt. Material., Sonderheft* 21, 1933, 64–65).—See this *J.*, 1932, **50**, 363.—J. W.

The Rolling Texture of Zinc and Magnesium. V. Caglioti and G. Sachs (*Mitt. Material., Sonderheft* 21, 1933, 42–46).—See this *J.*, 1932, **50**, 363.—J. W.

Changes in Structure and Crystal Orientation Produced by Cold-Rolling. K. L. Dreyer (*Kalt-Walz-Welt* (Suppt. to *Draht-Welt*), 1932, (1), 5–8).—A description of Tammann's work on the relations between distribution of grain orientation and progressive cold-rolling for copper (cf. this *J.*, 1927, **37**, 379), aluminium (cf. this *J.*, 1927, **38**, 367), and for iron.—A. B. W.

Precision Measurements of Crystal Parameters. E. A. Owen and E. L. Yates (*Phil. Mag.*, 1933, [vii], **15**, 472–488).—The following respective values of the lattice parameters (A), and densities (grm./c.c.) at 0° C. and 20° C. of 10 elements, each possessing cubic symmetry, have been determined from precision X-ray measurements: gold, $4{\cdot}0699 \pm 0{\cdot}0003$, $19{\cdot}30_9$, $19{\cdot}29_4$; platinum, $3{\cdot}9158 \pm 0{\cdot}0003$, $21{\cdot}45_9$, $21{\cdot}44_7$; palladium, $3{\cdot}8824 \pm 0{\cdot}0003$, $12{\cdot}03_6$, $12{\cdot}02_7$; rhodium, $3{\cdot}7957 \pm 0{\cdot}0003$, $12{\cdot}42_0$, $12{\cdot}41_4$; lead, $4{\cdot}9396 \pm 0{\cdot}0003$, $11{\cdot}35_7$, $11{\cdot}33_9$; iridium, $3{\cdot}8312 \pm 0{\cdot}0005_5$, $22{\cdot}65_6$, $22{\cdot}65_0$; iron, $2{\cdot}8607_5 \pm 0{\cdot}0002$, $7{\cdot}87_1$, $7{\cdot}86_8$; aluminium, $4{\cdot}0406_5 \pm 0{\cdot}0002$, $2{\cdot}70_0$, $2{\cdot}69_7$; copper, $3{\cdot}6077_5 \pm 0{\cdot}0002$, $8{\cdot}93_9$, $8{\cdot}92_9$; silver, $4{\cdot}0772_4 \pm 0{\cdot}0002$, $10{\cdot}51_1$, $10{\cdot}49_8$.—J. S. G. T.

Precision X-Ray Method in Alloy Research. J. Weerts (*Mitt. Material., Sonderheft* 21, 1933, 75–79).—See this *J.*, 1932, **50**, 486.—J. W.

On the Importance of X-Ray Interference Lines in the Study of Metals. E. Schmid (*Mitt. Material., Sonderheft* 21, 1933, 70–74).—See *J.*, this volume, p. 18.—J. W.

IV.—CORROSION

(Continued from pp. 77–81.)

The Corrosion of Aluminium and Its Alloys. —— v. Zeerleder (*Technique moderne*, 1930, 22, 731).—Abstract of a paper read before the 6e. Congrès International des Mines, de la Métallurgie et de la Géologie Appliquée, June, 1930. Methods are enumerated for determining general corrosion and local corrosion.—H. W. G. H.

Comparative Experiments with [Two] Duralumin Sheets of Different Origin (Examination of the Resistance to [Sea-Water] Corrosion). E. K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1931, 19*).—B. Bl.

Improving Plant Performance by Condenser Maintenance. Anon. (*Power Plant Eng.*, 1932, 36, 201–202; and (abstract) *Mech. World*, 1932, 91, 292).—Methods of fitting condenser tubes with or without the use of ferrules are described and illustrated.—P. M. C. R.

Corrosion of Chemical Lead. P. F. Thompson (*Proc. Australian Inst. Min. Met.*, 1932, (87), 193–206).—From potential measurements in 63% sulphuric acid of 3 samples of lead containing less than 0·01% of impurities it appears that iron derived from the casting moulds or tools used in working the metal may be the cause of corrosion when the metal is used for lining sulphuric acid chambers.—A. R. P.

Eighth Report of the Corrosion Committee of the Société Suisse de l'Industrie du Gas et des Eaux; the Union d'Entreprises Suisses de Transport; the Direction Générales des Télégraphes, and the Association Suisse des Electriciens. Anon. (*Bull. Assoc. Suisse Élect.*, 1932, 23, 275–277).—An account of investigations undertaken in 1931 covering the corrosion of live rails, the influence of welded joints, attack on electric cables, the distribution and leakage of current, soil resistance, and underground corrosion of pipe materials (cast iron, wrought iron, steel, lead).—P. M. C. R.

Electrolysis. Anon. (*Indust. Australian*, 1932, 38, 370).—A survey of the causes and prevention of electrolytic corrosion on underground structures, especially on lead and iron piping. Jointed pipes composed of several short lengths are practically unaffected, probably on account of the high electrical resistance introduced by the joints. Humidity and composition of soil are of great importance, another factor being electrical leakage from neighbouring conductor systems. Methods of combating this type of corrosion must balance the expense involved against the cost of damage; some protective measures are outlined.—P. M. C. R.

Fogging on Polished Nickel. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1932, 53, 519–520).—A brief review of the investigations and conclusions of W. H. J. Vernon on behalf of the Atmospheric Corrosion Committee of the British Non-Ferrous Metals Research Association. See full account of this work, this *J.*, 1932, 48, 121–136.—J. H. W.

Potential Measurements and Dissolution Tests with Tin–Copper and Zinc–Copper Alloys. O. Bauer, O. Vollenbruck, and G. Schikorr (*Korrosion. Bericht über die I. Korrosionstagung, Berlin*, 1931, 73–81; discussion, 81–82).—For abstract of the paper see this *J.*, 1932, 50, 544. In the discussion *M. Werner* quotes figures obtained for the rate of corrosion of copper in *N*-hydrochloric acid and in *N*-acetic acid with and without the addition of copper chloride and acetate; the results entirely confirm the conclusions of B., V., and S.—A. R. P.

On the Effect of Anions on the Rate of Solution of Zinc in Acids. Erich Müller and Johannes Förster (*Z. Elektrochem.*, 1932, 38, 901–906).—By measuring the volume of hydrogen evolved after periods of 1–10 minutes in contact with acids of strength of 1–30*N*, the rate of solution of zinc in the following has been observed and plotted as smooth curves: sulphuric, hydrochloric, hydrobromic, perchloric, chloric, and orthophosphoric acids. —J. H. W.

Oxidation of Zinc. I.—Influence of Nickel on the Oxidation of Zinc. A. Oliviero and O. Belfiori (*Annali Chim. Applicata*, 1932, **22**, 484–493).—Minute quantities of nickel in zinc promote the corrosion of the latter in water, especially warm water, with evolution of hydrogen.—G. G.

Progress Report on Exposure Tests of Plated Coatings. P. C. Strausser (*Monthly Rev. Amer. Electroplaters' Soc.*, 1932, **19**, (2), 15–18; discussion, 18–27; and (summary) *Met. Ind.* (*N.Y.*), 1932, **30**, 150–152).—An outline of the programme of work involving exposure of 7000 plates at many localities in the United States. The plates being tested comprise nickel, copper, chromium, zinc, and cadmium, and combinations of two or more of these of varying thicknesses and produced from different baths.—A. R. P.

The Effect of Elementary Iodine on Metals. N. Floresco (*Bul. Fac. Stiinte Cernauti*, 1929, **3**, 24–30; *C. Abs.*, 1932, **26**, 4002).—Qualitative investigation of the effect of iodine on the metals antimony, aluminium, magnesium, zinc, iron, and a description of the resulting phenomena.—S. G.

What Metals are Suitable for Mayonnaise Plants? Anon. (*Canning Age*, 1932, **13**, 566, 568, 582–583).—Data are given for the rate of corrosion of chromium–nickel–iron alloys, Monel metal, nickel, silver, and tin in hot and cold vinegar and in salad dressing. For mayonnaise plant Inco chrome-nickel and 18 : 8 chromium–nickel–iron alloy are recommended; nickel and Monel metal are less suitable; pure silver and tin are resistant to corrosion but are subject to tarnish.—E. S. H.

Seasonal Variation in Rate of Impingement Corrosion. Alan Morris (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 274–280; discussion, 280–281).—For abstract of the paper, see this *J.*, 1932, **50**, 28. In the discussion by *J. R. Freeman, jr.*, *E. M. Wise*, and *A. Morris* it is stated that mechanical abrasion by suspended matter in estuarine water is only a minor factor in impingement corrosion of condenser tubes.—A. R. P.

Influence of Stress on Corrosion. D. J. McAdam, jr. (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 282–318; discussion, 319, 322). —For abstract of the paper, see this *J.*, 1931, **47**, 344. In the discussion by *B. P. Haigh*, *T. M. Jasper*, *T. S. Fuller*, *E. M. Wise*, and *D. J. McAdam, jr.*, stress corrosion of steel alone is dealt with.—A. R. P.

The Theories of Passivity and Corrosion. Ernest S. Hedges (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 188–190).—A review, summarizing the available knowledge on the subject and discussing its practical utility.—R. G.

The Passivity of Metals. VII.—The Specific Function of Chromates. T. P. Hoar and U. R. Evans (*J. Chem. Soc.*, **1932**, (II), 2476–2481).—The power possessed by chromates of inhibiting corrosion by potassium chloride has been studied by immersing samples of mild steel in various corroding media. —S. V. W.

Mechanism of Rusting in Drops of Water. Erich Baisch and Max Werner (*Korrosion. Bericht über die I. Korrosionstagung, Berlin*, **1931**, 83–98; discussion, 98–101).—Corrosion tests on iron and copper alloys by the drop method have confirmed the validity of Evans' theory of the mechanism of corrosion and disproved that of Maass and Liebreich.—A. R. P.

Corrosion as a Physico-Chemical Problem. H. Mark (*Korrosion. Bericht über die I. Korrosionstagung, Berlin*, **1931**, 1–3; discussion, 3–4).—Corrosion, adsorption, and catalysis are related branches of physical chemistry in that the phenomena in all cases are dependent on the nature of the surface; in the first case the surface is kept to a minimum to reduce the rate of attack, whereas in the other two cases the maximum surface is desirable to obtain the greatest effect. Polished platinum has a real surface of 2–3 times, and etched silver a real surface of 5 times, the apparent surface owing to the presence of minute irregularities and cracks; in the case of corrodible metals these defects generally behave as the seats of corrosion.—A. R. P.

From Empirical to Basic Principles in Particular Cases of Corrosion. G. Masing (*Korrosion. Bericht über die I. Korrosionstagung, Berlin,* 1931, 16–18).—The behaviour of copper, nickel, and iron under corrosive conditions in alkaline and acid media is compared from the point of view of the formation of protective films and potential differences.—A. R. P.

Corrosion in Its Technological Relations. E. H. Schulz (*Korrosion. Bericht über die I. Korrosionstagung, Berlin,* 1931, 6–15).—A discussion of corrosion and protection problems with especial reference to iron and steel. —A. R. P.

Electrochemical Corrosion of Metallic Structures. O. Scarpa (*Atti Soc. per il Progresso Scienze XX Riunione,* 1932, 1, (1), 595–632).—Corrosion of underground tubes, lines, and structures by stray currents and by chemical reactions is discussed.—G. G.

Remarks on the Problem of Corrosion Testing from the Point of View of the Constructor. P. Brenner (*Korrosion. Bericht über die I. Korrosionstagung, Berlin,* 1931, 61–71; discussion, 71–72).—The value of a light metal alloy to the constructional engineer depends on the effect of corrosion on the various mechanical properties. Curves are given showing the reproducibility of laboratory tests designed to ascertain the effect of accelerated corrosion on the tensile strength, elongation, and bending strength of aluminium alloys. The effect of the construction of various joints on their resistance to sea-water corrosion is briefly discussed.—A. R. P.

Progress in the Methods of Preventing Corrosion. Ulick R. Evans (*Met. Ind.* (*Lond.*), 1933, 42, 77–79).—A review of recent research on the prevention of the corrosion of copper–nickel alloys, aluminium–bronze, light alloys, the fogging of nickel, nickel plating, tin plating, and aluminium and selenium coatings.—J. H. W.

Increasing the Resistance [of Metals] to Corrosion by Alloying. A. Fry (*Korrosion. Bericht über die I. Korrosionstagung, Berlin,* 1931, 110–124).—A review of the development and properties of corrosion-resistant alloys with especial reference to non-rusting and non-scaling alloys. A bibliography of 24 references is appended.—A. R. P.

How Soil Corrosiveness can be Measured. William Thompson Smith (*Gas Age-Record,* 1932, 70, 131–134, 143).—Methods, including ground moisture determinations, hydrogen evolution method, total acidity measurements, loss of weight determinations, the geological method, chemical analysis, and various electrical methods of investigating the corrosiveness of soils are briefly reviewed.—J. S. G. T.

Methods of Corrosion Testing. Erich K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt,* 1932, 495–504).—An abbreviated account appears in *Z. Metallkunde,* 1930, 22, 328–333, 334–336. Cf. this *J.*, 1931, 47, 21.—B. Bl.

New Corrosion-Testing Device being Developed. Anon. (*Gas Age-Record,* 1932, 70, 143).—Apparatus in which the sample of corrodible material is alternately immersed for a definite time in corroding liquid and then exposed to air, is briefly described.—J. S. G. T.

Alloys for Chemical Plant Construction. Anon. (*Mech. World,* 1932, 92, 312–314).—Silicon–iron and chromium–nickel–iron alloys are suitable for plant-handling corrosive liquors. The varying resistance to corrosion of these alloys with varying composition is discussed.—F. J.

The Corrosion of Metals. P. F. Thompson (*Proc. Australian Inst. Min. Met.,* 1932, (87), 175–191).—A short review of the electrochemical theory of corrosion with especial reference to the mechanism of the corrosion of iron. —A. R. P.

V.—PROTECTION

(Other than Electrodeposition.)

(Continued from pp. 84–86.)

Study of Corrosion. Recent Progress in the Protection of Metals and Alloys. J. Cournot (*Usine*, 1931, **40**, (53), 29–31).—A brief review of factors operating to produce corrosion and rapid tests for investigating them, is followed by notes on the various methods adopted to resist corrosion. The use of such materials as stainless steel, electrolytic protection, and various coatings, metallic and non-metallic, is discussed.—H. W. G. H.

Modern Processes for Protection of Metals. Anon. (*Technique moderne*, 1931, **23**, 319–320).—Reviews the latest development in paints, varnishes, and enamels, sprayed metallic coatings, and chemically and electrolytically produced protective deposits.—H. W. G. H.

Comparison of the Protective Effect of Various Methods of Pickling Elektron Sheets. E. K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, **1931**, 25*).—The English pickling method is superior to the German one.—B. Bl.

Electrolytic Oxidation of Aluminium and Its Applications. Shoji Setoh (*J. Soc. Mech. Eng. Japan* (*Foreign Edn.*), 1931, **34**, 12–13).—[In English.] Abridged from the Home Edition, 1931, **34**, 973–985. The conditions of electrolysis to obtain thick films, taking into account the tendency of the film to dissolve in the electrolyte when the temperature of the bath is high, are discussed. An aluminium plate of not less than 0·5 mm. thickness was entirely oxidized using as an electrolyte a dilute aqueous solution of oxalic acid and keeping the temperature below 30° C. The chemical composition of the film is given as Al_2O_3,H_2O, and among the physical properties cited are sp. gr. (20° C.) 2·76; hardness (Marten's scratch hardness scale) 10; high resistance to abrasion; high dielectric strength; high resistance to thermal decomposition or deterioration, and high resistance to the corroding action of acids and salts. Practical applications of the film are made in heat-resisting electric insulators and windings of electric machines; in the protection of household utensils and parts of machines and apparatus in chemical factories against corrosion; and the protection of aluminium articles against abrasion. It is also stated that various permanent colours can be given to the film by means of suitable dye-stuffs.—J. W. D.

The Protection of Iron and Steel from Corrosion. I.—The Principles of Protection. II.—Practical Methods of Protection. Ernest S. Hedges (*Metallurgia*, 1932, **6**, 87–89; 1933, **7**, 89–92).—(I.—) The direct action of oxygen on iron in producing surface films over the surface of the metal and the protective qualities and other properties of such films, as well as the indirect action of oxygen on iron, are discussed in detail. Consideration is also given to the action of oxidizing solutions such as concentrated nitric acid, potassium chromate, hydrogen peroxide, &c., in producing passivity, and to the behaviour of iron anodes in producing the peculiar anodic state known as electro-chemical passivity. It is also stated that no fundamental difference can be found between film formation and passivity. (II.—) Practical methods of protection described and discussed are protection by oxide and other films, protection by metal coatings, hot-dipping, electroplating, metal spraying, and cementation. Methods of applying zinc, tin, lead, nickel, copper, chromium, and aluminium coatings are considered in detail, and special reference is made to the chemical and physical properties of the various coatings and to their resistance to various forms of corroding media, and also to their application in various industrial processes.—J. W. D.

Metallic Coatings as a Protection against Corrosion. W. H. Creutzfeldt (*Korrosion. Bericht über die I. Korrosionstagung, Berlin*, **1931**, 125–136).—Methods of coating iron and steel with zinc, tin, lead, aluminium, cadmium, nickel, and chromium are described and the protective values of the coatings so obtained are compared.—A. R. P.

Lead-Coated Wires. Herbert Kurrein (*Draht-Welt*, 1932, 25, 691–693).—Lead has a number of advantages as a protective coating against atmospheric attack, but it has not as yet been widely applied. This is probably partly due to the coatings not realizing all expectations in the electrical and cable industries. K. advocates a phenol sulphonic acid bath as the best for electrodeposition of lead coatings.—A. B. W.

Ancient Lock Preserved with Lead. Anon. (*Dutch Boy Quarterly*, 1930, 8, (4), 29).—A lock (composition not given), dipped in acid and coated with a thin film of lead in 1750, shows no corrosion at the present day.—E. S. H.

Investigations on the Mechanism of the Process of Galvanizing Iron. Heribert Grubitsch (*Monatsh.*, 1932, 60, 165–180).—The rate of dissolution of steels with 0·011–0·87% carbon in molten zinc at various temperatures has been investigated. Solubility curves of pearlitic steels with not more than 0·6% carbon are similar to one another and all pass through a maximum within the range 480°–520° C. The magnitude of this maximum varies with the steel, but is not a function of the carbon content. The structure of the deposits varies considerably with the temperature of dipping, and in some cases is very characteristic. A relation between the solubility of the iron in zinc at the various temperatures and the structure of the zinc layer has been established.—A. R. P.

On the Use of the Preece Test Especially for Electrolytic Galvanizing. Jürgen Feiser (*Chem.-Zeit.*, 1932, 56, 831–832).—The Preece test for evaluating zinc coatings on iron and steel consists in immersing the specimen repeatedly for periods of 1 minute in 20% copper sulphate solution until the original loose black coating is replaced by an adherent red film of copper showing that all the zinc has been removed. The test is shown to be of value only for examining the homogeneity of the coatings, and gives no indication of the thickness of the coatings, as the loss in weight during each immersion is greater the higher the iron content of the coating. Wide variations in the results are obtained in the test with homogeneous electrolytic deposits. As thin films of electrolytic zinc are more protective than much thicker films produced by hot-dipping, the test is of little value in comparing the value of films produced by the two processes.
—A. R. P.

Metal Sprayer. Anon. (*Chem. and Met. Eng.*, 1932, 39, 625–626).—A new metal spraying gun capable of applying coatings of any metal that can be drawn into wire or rod, is illustrated.—F. J.

Spotting of Lacquered Metal Articles. —— Freitag (*Oberflächentechnik*, 1931, 8, 217).—Addition of 15–20% of "Stabilisol A," a yellow viscous oil, to nitrocellulose lacquers prevents the metal attacking the lacquer with the formation of brown spots. The best solvents or diluents for these lacquers are butyl alcohol, butyl acetate, and cyclohexanone.—A. R. P.

Investigation of Paint Films for the Surface Protection of Duralumin Sheets. E. K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1932, 17).—Red lead paint is unsuitable as a priming coat for protection against sea-water and ferric oxide paint is little better. Aluminium paint will protect Duralumin against atmospheric corrosion, but not against corrosion by sea-water. Of the 64 paints tested, only 5 were found suitable for the protection of the under-water parts of seaplanes, and only 15 for the parts above the water-line and for land aeroplanes.—B. Bl.

Examination of Two Paints for the Surface Protection of Elektron. E. K. O. Schmidt (*Jahrb. deut. Versuchsanst. Luftfahrt*, 1932, 17).—B. Bl.

Metallic Zinc Paint Finds Great Favour Abroad. Anon. (*Daily Metal Reporter*, 1932, 32, (223), 5).—A brief account of the continental use of metallic zinc paint, which is now also being made in the U.S.A. in increasing amounts.
—P. M. C. R.

Particular Purpose Paints. Edwin Gunn (*Architect*, 1932, **130**, 255–256).—A dull grey paint for metal protection is claimed to be applicable after merely wire-brushing the metallic surface, with which the pigment interlocks. One coat is said to give effective protection. It is stated that the paint can be applied to hot or wet surfaces, and that it possesses good covering power and high resistance to corrosion and vibration.—P. M. C. R.

A Useful Colour-Changing Paint. James Scott (*Eng. Rev.*, 1933, **46**, 493–494).—A bright red enamel or paint is described, which undergoes a sharp change in colour at or near 140° F. (60° C.), becoming a deep brown. The change is reversed on cooling, and the paint is recommended as an indicator of overheating in bearings.—P. M. C. R.

The Art of Painting. James M. Jardine (*Indian Engineering*, 1932, **92**, 154–156).—Practical instructions for the selection, application, and drying of paint, enamel, and varnish products for a variety of purposes.—P. M. C. R.

VI.—ELECTRODEPOSITION

(Continued from pp. 87–92.)

Anodic Phenomena in Cadmium Plating Solutions. Gustaf Soderberg (*Monthly Rev. Amer. Electroplaters' Soc.*, 1932, **19**, (2), 9–15).—Cadmium anodes polarize in cadmium cyanide baths at 20–30 amp./ft.^{2} with increase in the free cyanide content from 2 to 10 oz./gall.; at these current densities the time required for the attainment of potential equilibrium decreases with increase in current density. With a steel anode potential equilibrium is rapidly attained, and is independent of the cyanide content. There is no formation of carbonate at a cadmium anode, but some is formed when a steel anode alone is used. To plate the inside and outside of long hollow articles simultaneously, an external soluble cadmium anode and an internal insoluble steel anode give the best results.—A. R. P.

Modern Plants for Chromium Plating. W. Birett (*Z. Metallkunde*, 1932, **24**, 289–295).—A review of the general features and modern practice of chromium plating is given, particularly with regard to the construction of baths (tanks, heating), the influence of the composition of the electrolyte, bath control, and working conditions.—M. H.

Cold Baths for the Electrodeposition of Chromium. Anon. (*Industrie chimique*, 1932, **19**, 891–892).—A review of recently published work, showing that the most brilliant deposits and the highest current efficiencies are obtained by the use of cold baths.—E. S. H.

Factors Affecting the Bright Chromium-Plating Range. R. J. Piersol (*Metal Cleaning and Finishing*, 1932, **4**, 547–550, 562; *C. Abs.*, 1933, **27**, 28).—Cf. this *J.*, 1932, **50**, 371. A discussion of the effects of temperature, CrO_3 concentration, sulphate ratio, trivalent chromium, and the iron content on the bright plating range of chromium-plating baths.—S. G.

Characteristics of a Bath for Hard Chromium Plating. Edmond de Winiwarter and Jean Orban (*Technique moderne*, 1930, **22**, 731).—Abstract of a paper read before the 6e. Congrès International des Mines, de la Métallurgie et de la Géologie Appliquée, June, 1930. Increasing the acidity of the bath by sulphuric acid makes it possible to use higher current densities with the consequent production of harder and denser deposits.—H. W. G. H.

The Influence of the Acidity of the Electrolyte on the Structure and Hardness of Electrodeposited Nickel. D. J. Macnaughtan and R. A. F. Hammond (*J. Electrodepositors' Tech. Soc.*, 1931–1932, **7**, 1–19; discussion, 170–171).—Reprinted from *Trans. Faraday Soc.*, 1931, **27**, 633–648. See this *J.*, 1931, **47**, 590.—S. G.

Cadmium Plating Instead of Galvanizing. Anon. (*Apparatebau*, 1932, **44**, 177).—Describes the properties and advantages of cadmium coatings.—M. H.

Electrochemistry. Chromium Plating. H. T. S. Britton (*Times Trade and Eng. Suppt.* (*Electrical Section*), 1932, 31, (750), 32).—A general review of recent advances in the electrochemical industry. In particular, extended reference is made to chromium plating and its importance, not only because of its corrosion resistance, but also because of extreme hardness.—S. V. W.

Ultra-Rapid Nickel Plating in France. Marcel Ballay (*Met. Ind.* (*Lond.*), 1932, 41, 499–500).—Abstract of a paper read before the Electrochemical Society. See this *J.*, 1932, 50, 493.—J. H. W.

A Year's Progress in Electrodeposition. H. Sutton (*Met. Ind.* (*Lond.*), 1933, 42, 74–76, 82).—A review of the progress effected in the electrodeposition of metals during the past year, including improved cleaning, throwing into deeply recessed parts, the deposition of cadmium, nickel, and chromium, and standardization. A short bibliography is appended.—J. H. W.

Throwing Power in Electroplating. L. C. Pan (*Metal Cleaning and Finishing*, 1932, 4, 441–444, 497–500, 559–560; *C. Abs.*, 1933, 27, 29).—The use of the circular and tubular cavity scales to determine the throwing power in electroplating and the advantages of these determinations are discussed. The effects of electrode spacing, hydrogen evolution, and current density on the throwing power are outlined. A bibliography is given.—S. G.

Electroplating Solution Control. Lawrence E. Stout (*Metal Cleaning and Finishing*, 1932, 4, 269–272, 343–344, 354, 411–414, 463–466, 511–514; *C. Abs.*, 1933, 27, 29).—The operating characteristics of acid copper, cyanide copper, and sulphate nickel-plating baths are described. Methods of analysis for determining copper, iron, and free sulphuric acid in acid copper baths, and nickel, chlorine, and acidity in nickel baths are outlined.—S. G.

Micro-Organisms in Plating Solutions. E. A. Ollard (*Met. Ind.* (*Lond.*), 1933, 42, 17–18).—A description is given of fibrous "weeds" that sometimes grow in both acid copper and nickel-plating solutions. Sodium fluorite and phenol are said to check the growth, but hydrogen peroxide and formaldehyde do not seem to have much effect.—J. H. W.

Electroplating Wire. A. Wogrinz (*Draht-Welt*, 1932, 25, 259–260).—The relationships between wire velocity, immersed length, and current, in the continuous plating of wire are derived. If G is weight of wire plated per hour in kg.; d the diameter in m.m.; s the density; L the length immersed in metres; v the velocity in metres per second; N the weight of metal plated per kg. of wire; M the electrochemical equivalent of the metal deposited; f the current efficiency (fractional); i the current in ampères; c the current density in amp./dm.^{2}; then $v = G/0{\cdot}9d^2 . \pi . s$; $L = N . G/0{\cdot}1d . \pi . f . M . c$; and $i = N . G/f . M$.—A. B. W.

Metal Surface Finishes for Electrodeposition of Protective Metallic Coatings. W. J. Merten (*Metal Cleaning and Finishing*, 1932, 4, 537–540, 546; *C. Abs.*, 1933, 27, 29).—Experiments which demonstrate the improved cohesive bond obtained between electrodeposits and base metal through the use of the more perfect surface finishes are described and illustrated.—S. G.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-Refining.)

(Continued from p. 92.)

Aqueous Electrolysis in Metallurgy. Georg Eger (*Z. Elektrochem.*, 1932, 38, 942–964).—The commercial and industrial electrolysis of copper, zinc, cadmium, the noble metals, silver, bismuth, tin, antimony, iron, nickel, cobalt, and chromium is described and that of various other metals is mentioned. More than 100 references to current literature are made.—J. H. W.

An Electric Furnace Method for Separating Manganese from Manganese Sulphate. A. L. Ducournau (*Proc. Louisiana Acad. Sci.*, 1932, 1, 18–21

C. Abs., 1933, 27, 27).—The furnace was charged with a mixture of manganese sulphate and $\frac{1}{16}$-in.-mesh carbon. The quantity of carbon used was equal to twice the theoretical weight needed to reduce the Mn_3O_4 equivalent to the manganese sulphate. The charge was allowed to fuse at 1800°–2000° C. Manganese was separated. Analysis of 15 samples gave the following averages: manganese, 90·01; sulphur, 5·02; residue, 2·00%. The presence of manganese carbide in some of the samples is due to the reaction between manganese and carbon at high temperatures. The presence of sulphur in the samples is attributed to the reduction of the sulphates by carbon. The amount of carbon used did not affect the purity of the manganese obtained. If manganese is to be used in the manufacture of steel, a low percentage of sulphur is necessary.—S. G.

The Production of Ferro-Alloys. S. S. Steinberg and P. S. Kusakin (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1930**, 1471–1480; *C. Abs.*, 1933, **27**, 484).—[In Russian.] Molybdenite, containing 87·51% MoS_2, was smelted together with iron filings, coke, and lime in an experimental arc furnace. Iron alloys containing molybdenum 80, carbon 5–6, and sulphur $>$ 0·10% were easily obtained. The recovery of molybdenum from the ore reached 80–90%. In the preparation of pure iron–chromium alloy, crude iron–chromium, containing chromium 64·37–65 and carbon 4·5–6%, was mixed with magnetite in one case and with chromite ore in other cases and refined in the same furnace at temperatures up to 2050° C. In this way iron–chromium alloys containing as low as 0·5% or less carbon can easily be produced. Iron–vanadium alloys were prepared from iron–vanadium ore containing V_2O_5 48·44, and Fe_2O_3 26·38%, and $(NH_4)_3VO_4$ in an arc and a kryptol furnace. Charcoal, soot, and iron–silicon alloy were used as reducing agents. First, iron was melted in a magnesite crucible. To this were added vanadium ore, iron–silicon alloys, or other reducing agents, and lime. The temperature was kept as low as possible. In this way an iron alloy containing vanadium 36·93–44, silicon 1·18–1·23, and carbon 0·48–1·80% was obtained.—S. G.

Cadmium–Nickel and Iron–Nickel Accumulators. W. Dinser (*Bull. Assoc. Suisse Elect.*, **1932**, 234–235).—Among the advantages of the "alkaline" accumulator is its freedom from any reaction between electrodes and electrolyte, the latter serving simply as conductor. The batteries may therefore safely be left, either charged or not, without deterioration, and no changes analogous with the "sulphating" of a lead accumulator can take place. The construction, working, and applications of the cadmium–nickel and nickel–iron cells are described; considerable economies in time and cost of upkeep compensate for the initial outlay.—P. M. C. R.

On the Use of Antimony and Manganese Electrodes for Determining Hydrogen-Ion Concentration. I. I. Zhukov and J. A. Boltunov (*Zhurnal Obschtchey Khimii* (*Journal of General Chemistry*), 1932, 2(64), (4/5), 407–414).—[In Russian.] The influence of various substances on the efficiency of antimony and manganese electrodes in buffer solutions has been investigated to determine their suitability for practical applications. The antimony electrode is affected by a considerable number of substances, notably organic acids, so that in this respect it offers no advantages over the hydrogen electrode. On the other hand, it enables continuous observations of p_H values to be made without disturbing gas equilibrium, bubbling of hydrogen through the solution, or adding such substances as quinhydrone; it can also be used for the direct determination of the p_H of gels. The manganese electrode has no practical value, since it is strongly affected by a wide variety of substances and does not give constant readings over a period. In certain cases, *e.g.* when the ions S'', SO_3'', NO_2', and CN' are present, the only possible method appears to be the use of a glass electrode.—M. Z.

VIII.—REFINING

(Including Electro-Refining.)

(Continued from pp. 92–94.)

[Abstract of Papers Read at] the Pan-Union Conference on Electrochemistry and Chlorine [October 26, November 1, 1931]. B. I. Rimer (*Zhurnal Prikladnoi Khimii* (*Journal of Applied Chemistry*), 1932, [B], 5, (3/4), 485–494).—[In Russian.] —— *Billiter* reviewed the world progress in the electrolytic refining of copper, nickel, tin, zinc, lead, sodium, aluminium, and magnesium. *A. F. Alabyshev* described the production of metallic sodium and its use in industry. Electrolysis of fused sodium chloride containing 18% sodium fluoride, 10% potassium chloride and fluoride, is recommended. *N. A. Tzelikov* dealt with the same method, and —— *Rudnitzky* with the electrolysis of fused caustic soda. —— *Pletnev* described the production of metallic lithium by electrolysis of a mixture of lithium and potassium chlorides at 400° C. and the special precautions necessary for casting and packing the metal. *M. S. Maximenko* reviewed the prospective developments of the electrothermal industry in U.S.S.R. *M. W. Borodulin* discussed the resistance of materials suitable for chemical plant. Nickel, chromium-plated iron, and lead are considered suitable. Chlorine attacks nickel above 500° C. and the others at 400° C. *W. Skortcheletti* described the work of the (Russian) Institute of Metals on the chemical resistance of alloys. *W. J. Kurbatov* discussed the influence of non-ferrous metals on the corrosion of steel.—M. Z.

Resistance Limits [in the] Parting of [Silver–]Gold [Alloys]. Heinz Borchers (*Metall u. Erz*, 1932, 29, 392–398).—The effect of thermal and mechanical treatment, the rate of dissolution, and the presence of impurities in the acid on the parting of gold–silver alloys in sulphuric and nitric acids has been determined, and the results are discussed from theoretical considerations based on Tammann's rule of resistance limits. Alloys with a gold–silver ratio of 1 : 1·42–1 : 300 can be parted in sulphuric acid (*d* 1·84) in 15 minutes and alloys with a ratio of 1 : 1·75–1·3 in nitric acid (*d* 1·3) in 15 minutes, leaving a compact residue of gold.—A. R. P.

Removal of Copper from Ridder Crude Lead. M. P. Verkhovtzev (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1930**, 90–101; *C. Abs.*, 1933, 27, 481).—[In Russian.] The lead was heated with sulphur or metal sulphides, such as PbS and pyrites, in pots of a capacity of 280 kg. of lead. The amount of copper in the lead was thus reduced from 3·11–6·52 to 0·054–0·070%, whilst 92% of the gold and 90% of the silver were retained in the lead. The best results were obtained with lead sulphide ore as reagent.—S. G.

A Study of Electrolytes for Zinc. I.—Purification from Nickel. L. Cambi and V. Toja (*Giorn. chim. ind. appl.*, 1932, **14**, 125–129).—The removal of nickel and cobalt from zinc sulphate solutions obtained in the production of electrolytic zinc from its ores by hydrometallurgical methods is discussed.—G. G.

Experiments on Smelting Precipitated Fine Tin Dust. V. A. Vanyukov, N. N. Murach, and A. N. Genvarskii (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1931**, 204–210; *C. Abs.*, 1933, 27, 483).—[In Russian.] The ordinary method of compressing zinc dust into briquets and smelting the briquets under a layer of powdered coal in closed crucibles is wasteful, since a good deal of the powder oxidizes and escapes in the form of a white smoke. The method used in these experiments was as follows. Cause the tin dust to react with chlorine to get $SnCl_4$, reduce this to $SnCl_2$ with tin scrap, and precipitate the tin with zinc. Press the precipitate into briquets which have the composition: tin 79·38, $SnCl_2$ 6·7, $FeCl_2$ 2·3, $ZnCl_2$ 2·04, H_2O 5·95, other impurities 4·63%. Place these briquets in crucibles under a protecting cover of various salts such as KCN, $ZnCl_2$, $CaCl_2$, Na_2CO_3, $CaCl_2 + Na_2CO_3$, $ZnCl_2 + CaCl_2$, $Na_2CO_3 + K_2CO_3 + NaCl$, and $Na_2SO_4 + NaCl$. This method gave good results.—S. G.

IX.—ANALYSIS

(Continued from pp. 91–96.)

The Service of Analytical Chemistry to Research. B. L. Clarke (*Bell Laboratories Record*, 1932, 10, 327–333).—Cf. this *J.*, 1932, 50, 364. The organization of the analytical chemistry division of the Bell Telephone Laboratories is outlined. Examples of standard forms and analytical procedures are illustrated.—J. C. C.

The Case for the Standardization of Analytical Methods. A. R. Williams (*Chem. Eng. Min. Rev.*, 1932, 24, 431–433).—Abstract of a paper read before the Analytical Group of the Victorian Branch of the Australian Chemical Institute. The advantages of standardization are pointed out and the necessity for periodic revision and improvement of methods is emphasized. —J. H. W.

Development and Position of Quantitative Spectrum Analysis. I.—Physical Principles and Methods. F. Waibel (*Z. Metallkunde*, 1933, 25, 6–12). —A review under the following headings: (1) physical principles: spectra of the elements; excitation of spectra by temperature, electrons, and light; (2) methods of quantitative spectrum analysis: observation of the spectra; flame analysis; spark analysis with solutions and solid electrodes; valuation of the spectrum photographs; (3) sensitiveness and accuracy of measurement. —M. H.

Authorized Tentative Methods of Sampling and Analysis for Copper. R. H. Walton, C. Blazey, V. S. Rawson, and V. Barker (*Chem. Eng. Min. Rev.*, 1932, 25, 18–30).—Recommended methods of sampling molten and ingot copper are given. Cu is determined by electrolysis. As, Sb, and Sn are separated, As being then determined either by titration with standard I solution or with standard KCNS (by NH_4CNS) using $Fe(NH_4)_2(SO_4)_2$ solution as an indicator, or by precipitation as $Mg_2As_2O_7$; Sb, in the absence of Sn by titration with $KMnO_4$ or by weighing as Sb_2O_4, and in the presence of Sn, similarly after removing the tin with $(NH_4CO_2)_2$; Sn by weighing as SnO_2 or by electrolysis. Pb is separated and weighed as $PbSO_4$; Fe is weighed as Fe_2O_3 or titrated; Zn is weighed as $ZnSO_4$ or as ZnO; Co is weighed as Co_3O_4, and Ni is determined by dimethylglyoxime. Se and Te are precipitated and weighed as such. Bi is determined colorimetrically or by precipitation as BiOCl. O_2 is determined by loss in weight after heating the Cu in a current of H_2; S by weighing as $BaSO_4$. Au and Ag are determined by fire assay or by the mercury–sulphuric acid method; Ag can also be determined independently by precipitation with NaCl or HCl.—J. H. W.

A Distillation Method for the Rapid Determination of the Volatile Constituents in Small Samples of Copper–Zinc Alloys. Lily I. Weinstein and A. A. Benedetti-Pichler (*Mikrochemie*, 1932, 11, 301–310).—By heating Cu–Zn alloys in H_2 at 1150° C. all the Zn, Pb, and Bi volatilize, and hence the sum of these constituents present may be determined by weighing the alloy before and after heating for 10 minutes in a current of H_2 if 1–3 mg. are taken for analysis. The results are about 0·5% too high. Errors are introduced by the reduction of any oxides or sulphides that may be present, by incomplete removal of Zn if Ag or Mg is present, and by partial loss of As if the alloy contains this element.—A. R. P.

On Methods of Testing the Purity of High-Grade Lead. R. S. Russell (*Proc. Australian Inst. Min. Met.*, 1932, (87), 167–174).—Spectrographic analysis is satisfactory when the lead contains less than about 0·01% of impurities. Bi may be determined colorimetrically with KI and Sb turbidimetrically as Sb_2S_3. There do not appear to be satisfactory methods for estimating Fe and Zn in amounts less than 0·001%.—A. R. P.

Microchemistry in the Science of Metals. M. Niessner (*Forschungen u. Fortschritte*, 1932, 8, (31), 396).—Cf. this *J.*, 1932, 50, 365. In many cases the nature and distribution of small quantities of impurities in metals and alloys can be determined by the use of modern sensitive methods of detection, *e.g.* impression prints of various kinds.—J. W.

On a New Micro-Analytical, Gravimetric Procedure. Julius Donau (*Monatsh.*, 1932, 60, 129–140).—An improved type of filtering cup for microchemical analysis is described and some examples are given of its utility.—A. R. P.

Potassium Iodide as a Spot Reagent for Some Heavy Metals. E. Grünsteidl (*Mikrochemie*, 1932, 12, 169–173).—Details are given of the application of the colour reactions of Cu, Pt, Pd, and Au with KI for the detection of these metals.—A. R. P.

Macro-Electrolytic Analysis and Rapid Separation of Copper and Nickel. J. Guzmán (*Anal. Soc. españ. Fis. Quim.*, 1932, 30, 433–440).—The method described is suitable for separating large quantities of Ni and Cu. The cathode consists of 400 cm.^{2} of Cu wire mesh mounted on a rectangular frame and the anode of Fe or Cr–steel wire passivated by immersion in HNO_3. Current is obtained from an 18-v. accumulator, and is regulated by the use of a graphite powder resistance; with 4–5 amp. 1–2 grm. of the metals can be separated in 30–40 minutes. Both metals can be rapidly deposited from an ammoniacal solution of their nitrates to which $(NH_4)_2SO_4$ has been added; if both metals are present together, the Cu is first deposited from HNO_3 solution containing $(NH_4)_2SO_4$ by the use of a Pt anode, NH_4OH is added to the electrolyte, and the Ni deposited with the aid of a Pt or passive Fe anode. Other metals can be determined in a similar way.—A. R. P.

Improved Method for the Analysis of Gaseous Elements in Metals. N. A. Ziegler (*Met. Ind.* (*Lond.*), 1932, 41, 637–638).—Read before the Electrochemical Society. Cf. this *J.*, 1932, 50, 674.—J. H. W.

Electrolytic Determination of Bismuth in Alloys with Lead. L. Lucchi and A. Bartocci (*Annali chim. appl.*, 1932, 22, 509–511; *Chem. Zentr.*, 1932, 103, II, 3126).—A sample containing less than 0·1–0·2 grm. of Bi is dissolved in HNO_3, the solution evaporated to 2–3 c.c., and diluted to 30 c.c., and the Pb precipitated with 3 c.c. of H_2SO_4. The filtrate is evaporated to dryness, the residue treated with 20 c.c. of H_2O, and $Ba(OH)_2$ added until the liquid is alkaline. After addition of 1–2 c.c. of HNO_3, the solution is electrolyzed without previous filtration, using 0·1 amp. at 1·8–1·9 v. Deposition of Bi compounds on the anode is avoided by adding $H_2C_2O_4$ after some hours. The deposited Bi is washed with C_2H_5OH and dried at 100° C. for weighing.
—A. R. P.

Contribution to the Quantitative Determination of Calcium by the Filtration Method. H. Th. Bucherer and F. W. Meier (*Z. anal. Chem.*, 1932, 89, 171–173).—Instead of $H_2C_2O_4$ for the precipitation of Ca, a 0·1*N*-$Na_2C_2O_4$ solution may be used and C_2H_5OH added to increase the sensitivity of the nephelometric determination of the end-point.—A. R. P.

On the Determination of Cobalt with Permanganate. J. Ledrut and L. Hauss (*Bull. Soc. chim. Belg.*, 1932, 43, 104–113).—The method depends on the precipitation of CoC_2O_4 from a solution containing 25% HCOOH. Nitrates and NH_4 salts interfere. The error is less than 0·5% of the Co.
—A. R. P.

The Spot Method of Approximately Estimating Gold. N. A. Tananaev and E. W. Vassilieva (*Ukrainskii Khemichnii Zhurnal* (*J. Chim. Ukraine, Scientific Part*), 1932, 7, (1), 50–57).—[In Ukrainian, with German summary.] A method of estimating Au by comparing the intensity of colour developed when a drop of the solution is placed on a filter-paper saturated with benzidine solution, with the colour produced by a standard Au solution. It is stated that as little as 0·00002 grm. Au can be estimated in 15–20 minutes with an accuracy of 2–20%.—M. Z.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

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

(Continued from p. 96.)

For Metallographers. Anon. (*Eng. and Min. J.*, 1933, 134, (1), 39).—Announces the new (Eastman Kodak) Wratten metallographic plate. Its characteristics are high resolving power; availability of a very high photographic contrast; availability of lower contrasts; high green and blue sensitivity; and absence of sensitivity to red light—R. Gr.

Dark Field Illumination Adds Contrast and Resolving Power. W. Zieler (*Metal Progress*, 1933, 33, (1), 19–23).—The factors influencing the resolving power of a lens system are considered. Modification of the wave-length of the light used requires high technical skill, and is expensive and somewhat cumbrous; the angle of the cone of light entering the objective cannot be increased beyond a certain limit. Where reflected light is used, as in the examination of metallic samples, both prismatic and plane reflectors have certain disadvantages. A system is described in which the illuminating rays enter past a central stop, are reflected from a plane glass illuminator, to two spherical reflecting surfaces, so arranged that light reaching the sample does not previously pass through the objective. The latter has not, as in most microscopes, to serve both as condensing and as observing system; this renders more definite focussing possible, whilst the increased aperture of the illumination greatly enhances resolving power. The image appears bright on a dark ground, and a comparison of bright and dark-field images may reveal characteristics not easily observed by either method singly. The definition of particles in slight relief is performed with considerable success by the dark-field method. Illustrative photomicrographs and diagrams of the condenser systems reviewed are given.—P. M. C. R.

The Spectroscope in the Works. Anon. (*Metallurgist* (Suppt. to *Engineer*), 1932, 8, 184–185).—A description of spectroscopes which are now available for works' use in the identification of alloys. Little skill is required in the use of the instruments, which are of the visual type, and offer considerable advantages for such purposes as the sorting of alloys and the control of scrap.—R. G.

A Self-Rectifying Demountable X-Ray Tube of High Power. C. E. Eddy (*J. Sci. Instruments*, 1932, 9, 354–358).—The requirements of a demountable X-ray tube for spectroscopy and crystal analysis are discussed. Full details are given of the construction of a tube of the thermionic type with detachable electrodes mounted on metal ground joints. The tube can pass 40 m.amp. at 50 kv. for long periods, and has taken 10 m.amp. at 95 kv. for a few minutes. —W. H.-R.

An Automatic Safety Device for Water-Cooled X-Ray Tubes. Graham W. Marks and J. Grebmeier (*Rev. Sci. Instruments*, 1932, 3, 294–296).—There is inserted in the electric circuit an automatic switch comprising contacts made between two conducting rods and mercury contained in two narrow tubes dipping into a pool of mercury, the mercury level in the tubes being determined by the pressure of the water supply.—J. S. G. T.

Apparatus for the Control of Drying Chambers. Anon. (*Tonind. Zeit.*, 1932, 56, 156–157).—The apparatus comprises a balance to one arm of which is attached by means of a wire the test-piece which is suspended in the drying oven. The loss in weight is continuously recorded by the balance.—B. Bl.

Construction of an Air-Cooled Electromagnet. I. Walerstein and A. I. May (*Rev. Sci. Instruments*, 1932, 3, 136–144).—Describes an air-cooled electromagnet of the Boas type, in which the current is carried by 2000 turns of flat bare copper ribbon wound in 24 pancake coils cooled by a forced air draught. Using ferro-cobalt pole caps, a field of 48,500 gauss is attainable.—J. S. G. T.

A Small Experimental Electromagnet. S. R. Williams, W. W. Stifler, and T. Soller (*Rev. Sci. Instruments*, 1932, 3, 423–426).—Describes a simple and cheap form of electromagnet, giving field strengths up to about 18,000 gauss. —J. S. G. T.

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

(Continued from p. 97.)

Etching Aluminium Alloy Airscrew Blades. H. E. F. (*Aircraft Eng., Workshop and Production Section*, 1932, 4, (46), 4).—Etching of aluminium alloy airscrew blades after about every 300–350 hrs. of flying is recommended in order to show up any cracks which may have developed. The treatment consists in swabbing the airscrews with 10–20% solution of caustic soda in water, rinsing, and then swabbing with a 20% aqueous solution of nitric acid. These operations are repeated until the desired depth of etch is obtained.—H. S.

Static and Dynamic Testing of Some Light Metals. Kurt Matthaes (*Jahrb. deut. Versuchsanst. Luftfahrt*, **1931**, 439–484).—A fuller report of *Z. Metallkunde*, 1932, 24, 176–180; cf. this *J.*, 1932, **50**, 600. The paper gives numerous results of the mechanical testing of light metals. The original should be consulted for detailed data.—B. Bl.

Metals at High Temperature—Test Procedure and Analysis of Test Data. Ernest L. Robinson (*Amer. Soc. Mech. Eng. Preprint*, **1932**, Dec., 1–4).—A definite relation between short and long-life tests at elevated temperatures has not yet been established. The flow of metals under low stresses, such that the resulting distortion is less than 0·1%, show, after a long lapse of time, a continued decrease in the rate of extension. In presenting data on the results of creep tests at high temperatures, it is important to include a record of the distortion—*i.e.*, extensions—and preferably a complete extension–time diagram of the test.—W. P. R.

Accelerated Method for Determining Creep Limit. A. Pomp and Walter Enders (*Instruments*, 1932, 5, 166–168).—A description is given of a creep-testing machine equipped to provide, by the action of a beam of light on sensitized paper, a continuous record of elongation. Automatic recording enables transitory elongations (due to temperature fluctuations, &c.) to be recognized, and thus avoids errors which may occur in a series of spaced instantaneous readings. The importance of precise temperature control is emphasized. With this equipment, elongation-time curves were determined over periods of up to 2400 hrs. on carbon steels, and indicated that values of elongation higher than 0·001% per hr. (as previously proposed by Pomp and Dahmen, see this *J.*, 1931, **47**, 71) can take place between the fourth and eighth hours with loads which are yet not high enough to cause continuous creep. It is now proposed that the greatest load which does not cause more elongation than 0·003% per hr. between the fifth and tenth hours shall be taken as the creep limit.—J. C. C.

New Portable Sheet Metal Tester. Anon. (*Instruments*, 1932, 5, 179).—A cupping test is carried out by using a vice to force the plunger of this machine into a sample of sheet. The pressure at rupture is shown on a hydraulic gauge, and the depth of the cup measured subsequently.—J. C. C.

Impact Values of Some Metals as Determined on the New Tentative Standard Test-Piece Proposed at the Zürich Congress. A. Bertella (*Ricerca scientifica*, 1932, 2, (5/6), 157–185).—The results of 1340 impact tests made on Mesnager bars of steels, cast irons, brasses, and copper with notches of 2 mm. or 3 mm. indicate that the 3-mm. notch gives more uniform values than the 2-mm. notch. The values obtained with the 3-mm. notch are 0·875 times those obtained with the 2-mm. notch. The fractures obtained in the tests are discussed, and the numerical results are shown diagrammatically.—G. G.

On the Bending and Torsion Vibrations of a Thin Cylindrical Crystal Rod of any Desired Crystallographic Orientation. E. Goens (*Ann. Physik*, 1932, [v], **15**, 455–484; errata, *ibid.*, 902).—The theory of bending and torsion vibration, which is of importance for the determination of the moduli of elasticity and torsion by dynamic methods, is discussed.—v. G.

The Scratch Extensometer. Anon. (*Instruments*, 1932, **5**, 253).—Cf. *J.*, this volume, p. 97. Extension is recorded by the scratch of a diamond on a steel target, and measurements are made by means of a microscope.—J. C. C.

Stress–Strain Recorder. Anon. (*Instruments*, 1932, **5**, 225).—A brief notice of the Southark–Emery stress–strain recorder. All moving parts are operated from a small motor. Extension of the specimen breaks an electric circuit, and the retreating contact is followed up automatically by a contact on the recorder.—J. C. C.

Portable Brinell Hardness Tester. Anon. (*Instruments*, 1932, **5**, 26).—Cf. this *J.*, 1932, **50**, 312. A 5-mm. ball is mounted on one side of a heavy two-pronged spring, so that when the instrument is forced by means of a vice against the specimen under test, a load of 750 kg. is applied.—J. C. C.

"Superior" Brinell Hardness Testing Machine. Anon. (*Instruments*, 1932, **5**, 269).—A brief notice.—J. C. C.

New Self-Indicating Unit for Screw-Power Universal Testing Machines. Anon. (*Instruments*, 1932, **5**, 252).—A large dial indicator can be fitted to beam-type testing machines.—J. C. C.

New Gigantic Testing Machine. Richard Rimbach (*Instruments*, 1932, **5**, 44–46).—An illustrated description of a testing machine at the University of California accommodating columns up to 33½ ft. long and capable of exerting up to 4,000,000 lb. in compression and up to 3,000,000 lb. in tension.—J. C. C.

RADIOLOGY.

On the Development of the X-Ray Method for Testing Materials. P. Wiest (*V.D.I.-Nachrichten*, 1932, **12**, (52), 2).—A short review.—J. W.

The Use of X-Rays for Testing Locomotive Details: German State Railways. Anon. (*Locomotive*, 1932, **38**, 398–400).—The portable X-ray plant and van used by the German State Railways for the inspection of rolling-stock, permanent-way material, constructional work, &c., is described and illustrated. It provides for careful inspection at points most liable to stress, and has been found especially useful in connection with the construction of the inner fire-box. Specimen skiagraphs are appended.—P. M. C. R.

X-Ray Testing Steel Structures. —— Kantner (*Elektroschweissung*, 1932, **3**, 21–25).—Describes the "shockless" apparatus and illustrates some applications.—H. W. G. H.

Recent Radiological Methods with Special Reference to Boilers and Built-In Apparatus. A. Herr (*Schmelzschweissung*, 1931, **10**, 258–262).—The accuracy, economy, and reliability of the X-ray method of examining the macrostructure of materials are illustrated by examples.—B. Bl.

X-Ray Inspection Outfit. Anon. (*Power Plant Eng.*, 1932, **36**, 354).—A travelling generator and inspection apparatus for the workshop examination of joints, seams, and welds is described and illustrated.—P. M. C. R.

Detecting Faulty Welds. —— (*Electrician*, 1932, **108**, 451; and *Elect. Rev.*, 1932, **110**, 557).—Cf. this *J.*, 1932, **50**, 560. Brief description of the portable "Metalix" self-protected X-ray outfit used by Messrs. Babcock and Wilcox for examining steel welds.—S. V. W.

Some Factors in the Design of Hot Cathode X-Ray Tubes for Steady Running. W. R. Harper (*Proc. Cambridge Phil. Soc.*, 1932, **28**, 497–508).—General considerations regarding the design of hot cathode X-ray tubes are discussed and a description is given of a tube constructed on these lines. If the electrical input of the tube is controlled satisfactorily, the quality of the vacuum in the tube has little influence on the steadiness of the beam.—E. S. H.

XII.—PYROMETRY

(Continued from p. 98.)

Measuring the Temperature of Zinc Baths. Gustaf Borlinghause (*Draht-Welt Export-Ausgabe*, 1932, (7), 67–70).—[In English, French, and Spanish.] A survey of available pyrometric devices leads to the choice of the thermo-electric pyrometer as providing the best combination of sensitivity, reliability, and durability for this type of service. To be really useful the pyrometer must give a close indication of the bath temperature, and is therefore best immersed directly in the bath or in a pocket filled with lead at the corner of the bath. The thermocouple outer sheaths are best made of steel, which is cheap, but must of course be frequently replaced.—A. B. W.

Pyrometry in the Brass Foundry. Chas. E. Foster. J. Arnott (*Met. Ind.* (*Lond.*), 1932, 41, 495).—Two letters disputing the advantages of using a Nichrome sheath for pyrometers in brass melting, as claimed by F. A. Livermore, and recommending the use of a bare thermo-couple.—J. H. W.

Infra-Red Pyrometer with Photo-Electric Cell. Anon. (*Technique moderne*, 1931, 23, 508).—The instrument is claimed to give accurate readings of temperatures between 400° and 3500° C. The infra-red radiation, of about 1 micron wave-length, emitted by the hot body, is compared with that from a filament lamp by means of the photo-electric cell. The voltage applied to the filament is then a measure of the temperature.—H. W. G. H.

Instruments as an Aid to the Production Engineer. A. Eric Smith (*J. Inst. Production Eng.*, 1932, 11, 258–271).—Includes brief descriptions of various types of indicating and recording pyrometers.—J. C. C.

On New Precious Metal Thermocouples for High Temperatures. Alfred Schulze (*Helios*, 1932, 38, 329–330).—An abstract of the work of W. Goedecke in the *Festschrift zum 50-jährigen Bestehen der Platinumschmelze G. Siebert G.m.b.H., Hanau*, 1931, 72–99. See this *J.*, 1932, 50, 94.—v. G.

Investigations of the Cooling Down of White-Hot Silit Rods by Means of Photographic Pyrometry. R. Hase (*Z. tech. Physik*, 1932, 13, 410–415).—In temperature measurements by the photographic method without using prismatic resolution of the light it is necessary to determine by the colour sensitivity and smoked glass absorption method the "effective wave-length" for the range of temperature investigated. By interpolation with different degrees of blackness and the use of the photo-electric photometer, it is possible even with rapid changing radiation to obtain an accuracy of $\pm$ 3° C. at 1400° C., but for intervals of more than 100° C. monochromatic light must be used. The calculations have been confirmed by observations on Silit rods, the heat constants of which have been determined by separate methods.—J. W.

On Micropyrometry, Especially on an Objective Micropyrometer. G. Lewin, W.-W. Loebe, and C. Samson (*Z. tech. Physik*, 1932, 13, 415–420).—A micro-pyrometer is described in which comparison of light intensities is replaced by comparison of light currents by means of photo-electric cells. In this way the temperature of individual portions of the hot surface having a diameter of less than 1 μ can be measured accurately. Examples of the use of the instrument for measuring the temperature of electric lamp filaments and complete technical details are given.—J. W.

Temperature Controller Uses Photo-Electric Cell. R. H. Newton and C. C. Furnas (*Chem. and Met. Eng.*, 1932, 39, 455).—A sensitive form of temperature controller as constructed and used by the Department of Chemical

Engineering at Yale University, U.S.A., is illustrated and described. A light reflected from the mirror of a galvanometer which is used in a potentiometer circuit connected to the detecting device is caused to play over the surface of a Weston Photronic cell. The cell, in turn, actuates relays, which control the heat supply—either fuel or electricity. The detecting device may be a single- or multiple-junction thermometer or a resistance thermometer, and it is probable that the circuit can be adapted to the use of a radiation pyrometer or other apparatus which employs a potentiometer. The controller is inexpensive, and simple to set up and keep in adjustment.—F. J.

Temperature Regulators in Metallurgy. Anon. (*J. Four élect.*, 1932, **41**, 420–423).—A description is given of several types of temperature regulators for use in metallurgical operations and their methods of use.—J. H. W.

Self-Acting Temperature Regulator. Anon. (*Chem. and Met. Eng.*, 1932, **39**, 460).—A new "Tycos" self-acting temperature regulator, suitable for use in plating tanks, &c., is illustrated.—F. J.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from p. 98.)

Some Special Alloys for Non-Ferrous Metal Mixers. Wesley Lambert (*Met. Ind.* (*Lond.*), 1933, **42**, 47).—A description of the preparation and use of various types of "hardeners," such as phosphorus, manganese, manganese–copper, silicon, aluminium, nickel, boron, beryllium and magnesium, sodium, barium, lithium and ferrous alloys, and sulphur and galena.—J. H. W.

Economical Melting in the Foundry. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, **53**, 499–500).—Precautions to be taken to prevent waste in the foundry are given, and an economical form of coke furnace is described.
—J. H. W.

Heat-Cracks and Casting Strains as Causes of Waste. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, **53**, 351–352).—The effects of defective moulding and casting are discussed.—J. H. W.

The Aluminium Foundry ; Methods and Results. C. Panseri (*Atti Sindacato Ingegneri Milano*, 1932, **10**, (1), 17–26).—A review of modern practice in the light metal foundry.—G. G.

Treatment of Aluminium Turnings with Salt Fluxes. (Some [Information] on the Systems KCl–NaF, KCl–NaCl–NaF, KCl–CaF_2, and NaCl–CaF_2). W. Leitgebel (*Metallwirtschaft*, 1932, **11**, 699–700).—Melting tests with aluminium turnings under various salt fluxes have afforded information on the system sodium chloride–potassium chloride–sodium fluoride. The two last-named constituents form a eutectic at 19% sodium fluoride and 653° C. In the ternary system the lowest melting point (607° C.) occurs with 12% sodium fluoride and 35–45% sodium chloride.—v. G.

Casting Temperature and Mechanical Properties of Aluminium Alloys. —— Thews (*Metallbörse*, 1932, **22**, 834–835, 866–867).—Over-heating of aluminium and its alloys, especially if the melt is held at a high temperature for a long time, causes porosity due to gas absorption, introduces oxide inclusions into the bath, and produces a coarse-grained structure; a low casting temperature does not ameliorate these faults.—A. R. P.

The Melting and Casting of Aluminium Alloys. W. Fröhlich (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, **53**, 206–207, 224–225).—Cf. this *J.*, 1932, **50**, 124. The melting and casting of aluminium alloys containing aluminium 81–100, copper 0–12·0, zinc 0·2–13·5, iron 0–1·7, and silicon 0–10%, and the properties of the resulting castings are described.—J. H. W.

Moulding Practice with Heat-Treated Aluminium Alloys. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, **53**, 459–460).—Copper-containing aluminium alloys exhibit as a rule severe piping and brittleness. These troubles can be reduced by the use of silicon and by suitable heat-treatment. Excessive temperatures must be avoided during melting, and pouring should be at about 705° C. In England heat-treatment is carried out in a carefully-regulated electric furnace, and consists of annealing for 18–24 hrs. at 515° C. and quickly quenching in water.—J. H. W.

A New Aluminium Alloy for Casting [M.V.C.]. Anon. (*Engineering J.*, 1931, **52**, 432).—A note of the principal properties, and method of "modification" of "M.V.C." alloy.—H. F. G.

Investigation of a Cracked [Aluminium] Motor Piston. K. Matthaes (*Jahrb. deut. Versuchsanst. Luftfahrt*, **1932**, 18).—The fracture was attributed to the pressure at the high working temperature exceeding the tensile strength of the aluminium piston alloy at that temperature.—B. Bl.

Bearing Cover of Aluminium in Chill-Casting. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, **53**, 479–480).—For casting aluminium and Silumin bearing covers, the mould is made of nickel–steel or nickel–cast iron, the effect of the nickel (added as a nickel alloy containing 6% of silicon) being to prolong the life of the mould. The mould is preheated to 120°–160° C. An example is given of the melting of an alloy of 85% of aluminium and 15% of 50 : 50 copper–aluminium in a crucible furnace, the casting temperature being 720°–760° C. (760°–800° C. for Silumin). Zinc chloride is used for deoxidizing.
—J. H. W.

On the Preparation of "Aluminium–Bronze." Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, **53**, 480).—Composition alone is not a sufficient criterion for "aluminium–bronzes," and the other factors which determine its quality and applicability are discussed.—J. H. W.

Froth Formation of "Aluminium–Bronze" and Special Brasses, Its Causes and Remedy. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, **53**, 331–333).—The strong froth-formation that occurs in many alloys, especially in "aluminium–bronzes," is due to the oxidation of certain constituents and, in the case of aluminium alloys, to atmospheric oxidation. The manner in which these causes result in froth-formation and the precautions required to obviate it are described.—J. H. W.

Experiments on the Use of Calcium Carbide as a Deoxidizer for Bronze. I. I. Mokienko (*Metallurg* (*The Metallurgist*), 1932, **7**, (2), 71–79).—[In Russian.] Owing to the lack of phosphorus at the Marty works at Nikolaev, attempts were made to use calcium carbide for deoxidizing bronze. Satisfactory results were obtained, the carbide acting as a deoxidizer without contaminating the alloy or causing any marked difference in its microstructure. The mechanical properties are improved : tensile strength increases by 4·5%, and elongation by 13·2%. It is concluded, however, that a small addition of phosphorus is still desirable (about $\frac{1}{5}$ of that formerly added) to improve the fluidity of the molten alloy.—M. Z.

The Bronze Founding Industry in 1932. Francis W. Rowe (*Met. Ind.* (*Lond.*), 1933, **42**, 43–46).—An account of the progress in bronze founding that has taken place during the past year.—J. H. W.

Cause and Effect in Bronze Founding. Francis W. Rowe (*Met. Ind.* (*Lond.*), 1932, **41**, 413–416; and *Found. Trade J.*, 1932, **47**, 282–283, 292).—Abstracts of a paper read before the East Midlands Branch of the Institute of British Foundrymen on the subject of the melting and founding of bronze castings.
—J. H. W.

Sound Non-Ferrous Castings. C. W. Bigg. — Peace. P. A. Russell. — Lucas. — Hillman. — Blandy. — Speirs. — Blades. F. W. Rowe (*Found. Trade J.*, 1932, **47**, 330).—Abstract of a discussion of a paper by F. W. Rowe. See preceding abstract.—J. H. W.

The Manufacture of a Drum in Acid-Resisting Bronze. A. Führer (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, 53, 517–518).—A description is given of the casting of a drum in acid-resisting bronze of the following composition: copper 75, lead 9, nickel 5, antimony 5, tin 4, and phosphor-copper 2%. The copper and nickel are first melted, under a suitable cover, in a crucible furnace, and the antimony, lead, and tin are then added in that order. Finally, the phosphor-copper is added and the whole poured at 1120° C.—J. H. W.

The Casting of a Bronze Cupola in Green-Sand. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, 53, 518–519).—The mould preparation and coring and the casting of a cupola in 90 : 10 bronze in a green-sand mould are described.—J. H. W.

Roll-Bearings and Their Manufacture. Erich Becker (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, 53, 439–440, 458–459).—The manufacture of non-ferrous roll-bearings is described, and the composition and applications of a number of alloys containing copper 73–88, tin 5–13, zinc 0–8, lead 0·5–12, nickel 0–4·8, manganese 0–1, phosphorus 0–0·3, and antimony 0–3% are tabulated. According to Weinlig, the average life of a red brass bearing is 14,645 days, but this can be increased to 33,273 days with an alloy consisting of copper 85·5, tin 9·5, lead 0·5, nickel 3·5, and manganese 1%. Segregation in the lead-containing alloys can be minimized by small additions of zinc, nickel, sulphur, or sodium.—J. H. W.

Protection and Refining Slags for the Preparation of Brass Alloys. Edmund Richard Thews (*Metallbörse*, 1932, 22, 1166–1167).—The value of various fluxes in melting brass is discussed at some length with special reference to patented mixtures.—A. R. P.

On the Deoxidation of Red Brass with Phosphorus. Edmund Richard Thews (*Metallbörse*, 1932, 22, 1037–1038).—Cf. this *J.*, 1932, 50, 773. The effect of phosphorus in red brass is discussed and a brief account given of recent work on the deoxidation with phosphorus of an alloy of 81·5% copper, 3% tin, 7% lead, and 8·5% zinc. The beneficial action of phosphorus on this alloy is more likely to be due to the formation of a fusible phosphate slag with the zinc and tin oxides rather than to reduction of these oxides to the metals.—A. R. P.

The Casting of Slide Valves and Oblique Valves in Red Brass. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, 53, 417–419).—Until recently the casting of red brass slide and oblique valves was considered a difficult operation requiring special precautions. A general method of making these valves has now been developed and is here described, together with the methods of mould and core preparation. If scrap metal is used, it must be of known composition. Scrap containing aluminium, iron, or manganese must not be used. The casting temperature should not exceed 1150° C.—J. H. W.

Phosphorus in Red Brass. James Brinn (*Met. Ind.* (*Lond.*), 1933, 42, 10). —A letter commenting on an article with the above title by R. Thews (cf. this *J.*, 1932, 50, 773); and on letters by others, and claiming that the action of the phosphorus is to take the place of a flux and to oxidize in preference to copper, &c. The oxide combines with the solid oxide film on the metal surface forming a liquid slag and permitting metal to metal contact.—J. H. W.

The Casting of Red Brass and Brass Receptacles. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, 53, 436–438).—The system of moulding, gating, and casting brass receptacles is described.—J. H. W.

Manganese-Bronzes. Edmund Richard Thews (*Metallurgist* (Suppt. to *Engineer*), 1932, 8, 139–141).—Compositions are given of commercial "manganese-bronzes," and of proprietory alloys of similar type. The separate effects of manganese, iron, aluminium, lead, and tin are described. Various methods of melting are discussed. The addition of phosphorus and preliminary casting and remelting are advocated.—R. G.

Art Moulding in Nickel–Brass. —— Dubercet (*Rev. Fonderie moderne*, 1932, **26**, 424–425).—Nickel–brass is manufactured under a large variety of names, but consists essentially of nickel 15–25, copper 60–65%, and the remainder zinc. For art moulding, the following composition is recommended: copper 62, nickel 15, zinc 25·5, cupro-manganese 0·4 parts, and 0·1 part of a 20 : 80 lead–tin alloy. The mixing, melting, and casting of this alloy and the precautions to diminish segregation and pin-holes are discussed.—J. H. W.

Casting Table Legs in Brass and Nickel–Brass. A. Heinz (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, **53**, 477–479).—The correct and incorrect gating procedure for casting columns in copper and nickel–brass are illustrated, and details of moulding and pouring are described.—J. H. W.

Whitemetalling Bearing Bushes. Anon. (*Machinery* (*Lond.*), 1932, **40**, 270; *correspondence*, 528, and **41**, 253).—A fixture for casting sound bearing shells, free from blowholes, is described and illustrated. The metal is poured into a hollow mandrel, whence it flows through a number of $\frac{3}{16}$-in. holes into the space between the mandrel and the outer walls of the mould. The mandrel is forced out later in a small screw press.—J. C. C.

Forming and Pouring Hard Lead Castings. Anon. (*Z. ges. Giesserei-Praxis : Das Metall*, 1932, **53**, 419).—Hard lead castings contain copper and, more especially, antimony, the latter up to 28%. A typical alloy is lead 85, antimony 14, copper 1%. The copper is first melted, then the antimony is added in small pieces, and finally the lead is added with vigorous stirring. 5% lead–tin is used as a deoxidizing agent. The pouring temperature is about 550° C.—J. H. W.

Magnesium : Melting, Casting, and Uses. R. de Fleury (*Rev. Mét.*, 1932, **29**, 341–347; and (short abstract) *Met. Ind.* (*Lond.*), 1932, **41**, 245).—It is imperative to use fluxes in melting magnesium for founding. There are two methods of using the fluxes; in the one method the amount of flux is large in relation to that of metal which it virtually envelops and isolates from the atmosphere. This method involves some risk of inclusions of flux in the castings. The second method employs a minimum amount of flux and provides measures for its removal from the metal; a deep, narrow crucible is used. Fluxes for use in melting magnesium should have low melting-point (below 680° C.), low density (below 1·70), fluidity at the working temperature sufficient to protect the melt completely, but viscosity sufficient to prevent the flux from passing with the metal into the mould. They should be chemically inert towards magnesium and stable at the temperatures of use (up to about 800° C.). No single substance possesses all these properties, hence attention is paid to mixtures containing minimum amounts of chlorides, and particularly of magnesium chloride, which should be present in amounts only sufficient to form oxy-chloride with any MgO present and thereby permit easy removal. The selection of suitable fluxes is discussed and formulæ are given, but de F. remarks that these are suitable only for 20 kg. crucibles as used in the experiments, and would require modification to suit other conditions. The preparation of sand moulds, the features of the various additions made to the sands used for magnesium alloy castings, and the general technique of casting magnesium alloys in sand moulds are discussed. A note by M. Messier on the advantages gained by the use of cast magnesium alloy wheels on aircraft is appended.—H. S.

Melting Magnesium : Casting in Green Sand. A. Caillon and R. de Fleury (*Compt. rend.*, 1932, **195**, 549–551).—Hitherto the affinity of magnesium for water vapour has rendered it necessary for magnesium castings to be made in dried sand. By the use of suitable additions, however, green sand can be used. The following is an example of such a mixture: clay sand (8% Al_2O_3 + 90% SiO_2) 10 kg., white sand (99% SiO_2) 30 kg., flowers of sulphur 400 grm., ammonium fluoride 400 grm. The sulphur remains as such, owing to the decomposition by the excess magnesium of any sulphur dioxide formed, and acts as a protection against the action of moisture. The ammonium fluoride acts in the same way, by the formation of hydrofluoric acid. Other substances can be used instead of the ammonium fluoride; the best and most economical is a mixture of ammonium sulphate and calcium fluoride.—J. H. W.

Fluidity and Castability of Ultra-Light Alloys. L. Losana (*Alluminio*, 1932, **1**, 237–243).—The fluidities (fluidity of tin at 300° C. = 1) of various alloys of magnesium with aluminium, zinc, &c., have been determined by casting the alloys from a bottom-pouring crucible, into a spiral mould. The "castability," expressed as the number of cm. of the mould filled by the alloy, is plotted against the casting temperature, mould temperature, and composition of the alloy. An "index of castability," and a "coefficient of equal castability" are also proposed and defined.—G. G.

Melting and Pouring White Bearing Metals. Edmund R. Thews (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 170–173).—The relative advantages of tin- and lead-base bearing metals are discussed. In melting, it is important that oxidation of tin and antimony be avoided, and suitable methods of melting are described in detail. The various considerations which govern the choice of pouring temperatures are dealt with. Tin-base alloys permit a wider range of pouring temperature than lead-base alloys. The Brinell hardness (10 mm. ball; 500 kg. load) should be 28–32 for tin-base and 20–24 for lead-base alloys. In casting, porosity due to shrinkage is avoided by locally heating the mould or by application of heat to the feeding head.—R. G.

Arrangements for Casting Bearings in White Metal. A. Schüle (*Z. ges. Giesserei-Praxis: Der Modellbau*, 1931, **52**, 29–30; and *Rev. Fonderie moderne*, 1932, **26**, 383–384).—The construction and setting up of a special mould for casting white metal bearings are described.—J. H. W.

Prevention of Liquation in White Anti-Friction Alloys by Addition of Nickel. A. M. Botchvar, F. P. Borin, and M. Yoselevich (*Zvetnye Metally* (*The Non-Ferrous Metals*), **1931**, (7), 850–854; *C. Abs.*, 1932, **26**, 5893).—[In Russian.] Nickel was found to prevent liquation and to ensure uniform distribution of hard crystals in tin–antimony alloys. Experiments showed that 1–2·5% of nickel entirely prevents liquation and creates a uniform distribution of hard crystals of β solid solution of tin and antimony. Nickel, which forms a compound Sn_3Ni_2 with tin, forms needles uniformly distributed throughout the alloy. Nickel also increases the hardness of the alloy. The mechanical properties of this alloy and the effect of other elements, such as cobalt, manganese, cadmium, chromium, magnesium, and aluminium on tin–antimony, lead–antimony, and tin–lead–antimony alloys are now being investigated and will be reported later.—S. G.

Report of Committee B-6 [of A.S.T.M.] on Die-Cast Metals and Alloys. H. A. Anderson and P. V. Faragher (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 264–284).—See this *J.*, 1932, **50**, 581.—S. G.

Widening the Field of Die-Castings. William J. During (*Amer. Machinist* (*Eur. Edn.*), 1932, **76**, 532–534E).—Of the three methods of producing die-castings, mechanical, pneumatic, and hydraulic, the last has the advantages of pressure build-up, less risk, and positive smooth and dependable action. The application of this method to all kinds of die-castings, particularly of zinc, is described. This process has largely overcome previous limitations of zinc-base die-castings, and several illustrations of its application to such castings are given.—J. H. W.

Metal Pressure Castings. Joh. Mehrtens (*Z. ges. Giesserei-Praxis: Das Metall*, 1932, **53**, 382–384).—The mechanism of metal flow in pressure castings and the advantages of this method of casting over sand-casting is discussed, and the machinery used in pressure-casting are briefly described.
—J. H. W.

Pressure Die-Casting. Anon. (*Fonderie moderne*, 1931, **25**, 273–274).—Abstract from *Z. ges. Giesserei-Praxis : Das Metall*, 1931, **52**, 26–26; see this *J.*, 1931, **47**, 305.—J. H. W.

Production of Gravity and Pressure Die-Castings in Aluminium.—I–II. C. Vaughan (*Amer. Machinist* (*Eur. Edn.*), 1932, **76**, 564–566E, 594–596E ; also *Machinery* (*Lond.*), 1932, **41**, 337–343, 373–376 ; and *Met. Ind.* (*Lond.*), 1932, **42**, 125–126, 150–153, 179–180).—A paper read and discussed before the London Section of the Institution of Production Engineers. The design of moulds and details of pouring for gravity castings of aluminium alloys are considered having particular regard to the high shrinkage of the alloys and the sluggishness and slow freezing of the alloys relatively rich in zinc or iron. Illustrations of such castings are given. The moulds are usually made of close-grained cast-iron or semi-steel castings containing a little chromium. Cores, &c., are made of ordinary tool steel or higher-grade alloy steels. The mould faces are protected from erosion by spraying them while warm with a solution containing, for example, sodium silicate and chalk. The process of pressure die-casting is described in some detail.—J. H. W.

Mould for Die-Casting Aluminium Pistons. Anon. (*Machinery* (*Lond.*), 1932, **41**, 253).—The production of cracked pistons during die-casting is attributed to an excessive difference between the temperatures of the molten metal and the die. The metal should be poured at as near 700° C. as possible and the mould kept within 50° of 400° C. Methods of maintaining the mould temperature are discussed.—J. C. C.

Modern Plastic Shaping of Copper Alloys by the Die-Casting Process. Anon. (*Metallbörse*, 1932, **22**, 737–738).—The use of the two types of die-casting machine for the preparation of castings of brass and other copper alloys is described and the tensile properties of some die-cast copper alloys are given. Bronzes with up to 15% tin have recently been successfully cast by this method.—A. R. P.

Pressure Casting Brass. Anon. (*Aciers spéciaux*, 1932, **7**, 347–354).—Examples of the machinery and accessories used for making pressure castings in brass and a description of the method and examples of such castings are given.—J. H. W.

The Casting of Brass Under Pressure. M. Belin (*Usine*, 1931, **40**, (53), 35–37).—The advantages of die-castings and the difficulties encountered in producing them in brass are explained. The short life of the moulds, due to the rapid attack by the molten brass, has been overcome to a large extent by using very high pressures and low casting temperature. Detailed cost figures are given to show that, by this means, die-castings can be produced at an economic figure in many cases. It is emphasized that discretion must be used in choosing suitable cases, in many of which slight modifications in design are necessary.—H. W. G. H.

Zinc Alloys for Die-Casting Recently Improved. J. B. Nealey (*Metal Progress*, 1932, **22**, (6), 43–46).—A discussion of the scope of the die-casting process is followed by a consideration of dies as regards design, life, material, and operating conditions. Comparative figures for ultimate tensile stress, elongation, and impact strength (0·25 in. square bar) are given for die-castings of aluminium and of zinc, as against malleable iron, sand-cast brass, and grey iron. The properties of certain zinc-base die-casting alloys made with zinc of special purity, are tabulated, together with their percentage compositions. The use of a high grade of zinc largely eliminates warping, although dimensional changes occur in two stages during some weeks after casting: the earlier is probably the result of the relief of casting strain, the second and slower stage being ascribed to phase changes in the alloys. Details of stabilizing treatments are given, with tabulated effects on tensile and impact strength. The results of steam exposure tests are discussed. Machining, where necessary, is easy; soldering and welding are possible but difficult, although nickel-plating provides a satisfactory base for solder. A wide range of decorative finishes may be applied to the castings.—P. M. C. R.

Die-Casting. A. H. Mundey (*Met. Ind.* (*Lond.*), 1933, **42**, 51–56).—A description of die-casting methods, and of the properties, testing, and applications of lead-base alloys (type metals), bearing metals, zinc-base alloys, and aluminium alloys for die-casting.—J. H. W.

Alloys for Pressure Die-Casting. P. Mabb (*Machinery* (*Lond.*), 1932, **39**, 781).—The composition and properties of the principal aluminium-, zinc-, tin-, and lead-base die-casting alloys are tabulated. The characteristics of the alloys and the effects of impurities are briefly discussed.—J. C. C.

Improved Methods and Alloys Aid Die-Casting Industry to Expand. Anon. (*Machinery* (*N.Y.*), 1932, **39**, 266–269).—An illustrated review.—J. C. C.

The Production of Centrifugal Castings from Non-Ferrous Metals. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1932, **8**, 10).—The process is briefly described; it is shown that its nature tends to eliminate blow-holes and inclusions, and to produce a closer structure than other methods of casting. Results of mechanical testing illustrate the improvement in tensile strength and in elongation obtained in the case of certain bronzes; the improved wearing qualities of centrifugally-cast material render it especially suitable for marine propellers.—P. M. C. R.

Largest Centrifugally-Cast Bronze Wheel Ever Made. Anon. (*Found. Trade J.*, 1932, **47**, 362).—A short note, giving the physical properties of a centrifugally-cast wheel, 57·5 in. outside diameter and 6·25 × 7 in. section, made of a bronze containing copper 86·8, tin 12·4, phosphorus 0·3, and nickel 0·35%.—J. H. W.

The Removal of Sand from Castings. E. Tourneur (*Rev. Fonderie moderne*, 1932, **26**, 149–159, 173–181).—Read before the Association Amicale et Mutuelle de Fonderie. The removal of sand is always desirable and frequently indispensable, in view of the finish of the pieces and of possible enamelling, plating, or painting. Castings are classified according to size and method of treatment, and their preparation for cleaning is described. Several grades of sand are considered, and their properties compared; suitable grain-sizes for aluminium, brass, bronze, cast iron, and steel are indicated, and the relative advantages of sand and steel grit are discussed. Compressed-air plant, gravity, aspiration, and pressure systems of projection, and the adaptation of existing methods to various classes of work are considered. Emphasis is laid on the necessity for removing dust from the atmosphere and for adequate protection for operators, and T. describes several types of dust-collecting and air-conditioning plant. Methods of cleaning by water-jet and by combined water and sand-blast are described and illustrated. A review of chemical methods of cleaning states that hydrochloric and sulphuric acids are now the most favoured media; their advantages and limitations are discussed and compared, and details as to concentration, temperature, and the use of "modifying" materials are given.—P. M. C. R.

Trimming, Fettling, and Sand-Blast Equipment. Fred Gentles (*Iron and Steel Ind.*, 1932, **6**, 105–109).—A description of trimming, fettling, and sand-blast equipment considers in detail tumbling barrels, various types of sand-blast apparatus, pneumatic-chipping hammers, portable grinders, and the latest developments which consist in washing castings under hydraulic pressure.
—J. W. D.

Foundry Core Binders. E. Perry (*Paint Varnish Production Manager*, 1931, **6**, (5), 8–10, 35–38; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1931, (24), 301).—The use, among other substances, of linseed oil and rosin as foundry core binders is discussed.—S. G.

Core and Mould Drying. W. Russell (*Iron and Steel Ind.*, 1932, **6**, 99–104).—Essential features such as proper drying, time of drying, control of temperature, and fuel and labour costs which must be considered in modern drying equipment are discussed. The various types of drying stoves available classed under headings such as bogie type for moulds, rack and transveyor type for cores, rack and bogie type for cores, drawer plate type for cores, continuous type for cores, and dryer unit for drying moulds in position are described and considered in detail.—J. W. D.

Hand-Moulding and Core-Making Equipment. Frank Whitehouse (*Iron and Steel Ind.*, 1932, **6**, 89–92).—A description of the equipment used in modern hand-moulding foundries deals in detail with sand preparation plant, the handling of materials, mould drying plant, and core-making equipment.
—J. W. D.

Electric Heat Solves a Foundry Problem. Wm. B. Ferguson (*Maintenance Eng.*, 1932, **90**, 12–13; *Ceram. Abs.*, 1932, **11**, 229).—Electric heating coils are used to heat patterns in a moulding machine to prevent the moulding sand from sticking to the patterns.—S. G.

The Preparation of Moulding Sand. J. North (*Iron and Steel Ind.*, 1932, **6**, 85–87, 109).—The best results in connection with the use of natural bonded moulding sands are obtained when tests such as (1) an elutriation test to obtain the percentage of fines and the amount of silt; (2) tests for strength, *i.e.*, bond by ramming, and breaking tests at definite moisture content and ramming density; (3) permeability tests; (4) a test for actual moisture by evaporation; and (5) occasional sieve tests for checking grain sizes are regularly made on both new supplies of sand and all mixtures used in the foundry as facing sands together with their backing sands. Suitable equipment for the preparation of sand is described.—J. W. D.

Study of Moulding Sands. L. Gasquard (*Rev. Fonderie moderne*, 1932, **26**, 436–443; discussion, 443–445).—Read before the Association Amicale et Mutuelle de Fonderie. Cf. this *J.*, 1932, **50**, 509. Gives the composition of a large number of sands for various purposes and also the composition arrived at by calculation from the qualities required; describes the properties and constitution of the sands and methods of testing them.—J. H. W.

Machine Moulding Equipment. W. J. Cooper (*Iron and Steel Ind.*, 1932, **6**, 93–97).—Descriptions of various types of moulding machines which are divided into, and dealt with, under the five main sections, hand-operated machines, power-driven jarring machines, power-driven squeezing machines, machines combining jarring and squeezing operations, and the sand-slinger moulding machine.—J. W. D.

Mould-Handling Methods in Foundries. William L. Hartley (*Trans. Amer. Soc. Mech. Eng.*, 1931, **53**, MH 5, 59–63).—Mould handling in a foundry comprises between 20% and 40% of the total materials handled, and methods of cutting down the handling costs are discussed.—W. P. R.

Rubber and Its Applications in the Foundry. Pierre Wolff (*Usine*, 1931, **40**, (49), 37).—Conveyor bands, belts, piping, and sand-blast tubes are discussed and the necessary properties of rubber used for each are explained.
—H. W. G. H.

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

(Continued from p. 99.)

Plumbers' Ashes and Drosses. Anon. (*Plumbing Trade J.*, 1932, **12**, 172).—An account of the recovery of pure lead from scrap.—E. S. H.

Standard Classification for Old Metals. Anon. (*Met. Ind.* (*N.Y.*), 1932, **30**, 239–240).—An account of a meeting of the National Association of Waste Material Dealers. This was also reported in the *Daily Metal Reporter*, 1932, **32**, (52), 9. See *J.*, this volume, p. 42.—I. M.

XV.—FURNACES AND FUELS

(Continued from p. 99.)

FURNACES

Fluctuating Flow of Heat in Furnaces. R. J. Sarjant (*Trans. Ceram. Soc.*, 1932, **31**, 83–128).—The flow of heat in industrial furnaces under fluctuating or discontinuous conditions of heating has been studied. An attempt is made to correlate experimental results with the mathematical treatment of the subject.—S. V. W.

Annealing and Hardening Furnaces. Anon. (*Maschinenkonstrukteur*, 1932, **65**, 132–136; 1933, **66**, 9).—A review of current furnace construction dealing with gas-fired, oil-fired, and electrically-heated furnaces. Many illustrations and diagrams of burner and heater construction are given, and approximate temperature ranges are usually indicated, as are the probable running costs. —P. M. C. R.

Redesigned Pot Improves Monotype Casting Efficiency. R. L. Davis (*Gas Age-Record*, 1932, **69**, 47–48, 50).—Improvements in a monotype casting-pot, including improved insulation with Sil–O–Cel and asbestos fibre, and improvement of the burner, has resulted in reducing the gas consumption for the same output by about 50%.—J. S. G. T.

Towns' Gas in the Tinplate Industry. Anon. (*Mech. World*, 1932, **92**, 239–240).—Cf. Jackson, this *J.*, 1932, **50**, 512. Interesting experimental work by Baldwins, Ltd., in conjunction with the Neath Gas Department on the use of towns' gas in the tinplate industry is described and illustrated. Tin-pot firing requires quick heating from cold, correct and uniform temperature in the tin-pot, and in the grease hopper. Quick heating obviates waste of time and fuel; maintenance of correct temperature minimizes scruff formation (oxidation of tin) and loss of grease; uniformity of temperature throughout the pot ensures an even coating of tin and minimizes the amount of tin necessary for an effective coating. Cost saved on these counts can be set against fuel costs. The experimental data given show that these economies are achieved by using towns' gas.—F. J.

Gas in the Wire-Drawing Industry. J. Bradbury (*Gas J.*, 1933, **201**, 199–201).—Applications of towns' gas as a fuel in the operations of the wire trade, *e.g.*, annealing, hardening, tempering, galvanizing, enamelling, are briefly discussed.—J. S. G. T.

New Principle Applied in Bright-Annealing Copper Wire. J. B. Nealey (*Wire and Wire Products*, 1932, **7**, 252–254, 270–272).—Describes the furnace construction and the method used in bright-annealing copper wire in a gas-fired unit in an atmosphere of steam which removes the difficulties of discoloration and objectionable oxidation. (Cf. this *J.*, 1932, **50**, 582, and this volume, p. 48.)—J. H. W.

Research on Noise Abatement in Industrial Gas Burners. Harry W. Smith, Jr. (*Gas Age-Record*, 1932, **70**, 643–648).—A study of the origins and possible reduction of noisiness in industrial gas burners is presented.—J. T.

Further Developments with the Luminous Flame Burner. Thomas E. Wood (*Gas Age-Record*, 1932, **69**, 573–574, 582).—Industrial applications of gas to normalizing, billet heating and metal melting (copper) using luminous flame burners are referred to.—J. S. G. T.

Combustible Losses in Flue Gases. J. D. Keller (*Blast Fur. and Steel Plant*, 1932, **20**, 723–726, 781–783, 786).—(I.) Discusses the basis and the value of the earlier graphical methods of representing the loss of heat in flue gases. Improved Ostwald charts are shown for certain fuels and examples given of the method of using them. (II.) Calculations of the chart for complete and incomplete combustion are dealt with. The estimation is also outlined of heat losses caused by the escape of unconsumed gases.—R. Gr.

Temperature Control by Oil Fuel. H. W. Ritchie (*Met. Ind.* (*Lond.*), 1932, **41**, 571–572).—Abstract of a paper read before the Glasgow University Engineering Society. Oil-firing for non-ferrous metal furnaces enables a high degree of temperature control to be attained, and this is further facilitated by the ease with which the air supply and preheating temperature can be regulated. Crucibles can frequently be dispensed with, thus saving a large item of expenditure. Oil-fired furnaces also have particular application for the casting of steel and cast iron.—J. H. W.

Electricity in Heating and Melting of Metals. A. G. Robiette (*Metallurgia*, 1933, **7**, 79–81).—Developments in metallurgical processes have shown the need for accuracy and control of heating and melting operations, and although electricity is a relatively costly fuel, furnaces of the Ajax–Wyatt type and the coreless induction furnace have a very high efficiency. It is stated that the Ajax–Wyatt furnace is now used to melt approximately 90% of the world's wrought brass requirements, and it is also being used for nickel–brass, zinc, cupro-nickel, and copper. Electric melting in resistance furnaces has done much to produce sounder aluminium ingots and castings. For heat-treatment furnaces an even distribution of temperature and accurate control are more readily obtained with electric heating, and there is a saving on the direct cost of fuel and electricity basis due to the very high efficiency obtained by the liberal use of heat-insulating material. Other advantages of electric heating are the question of furnace atmosphere and the life of refractory linings.
—J. W. D.

Contribution to the Knowledge of the Induction Crucible Furnace and Its Metallurgy. M. H. Kraemer (*Z. Metallkunde*, 1932, **24**, 281–284).—Cf. this *J.*, 1932, **50**, 776. Deals with the production of heat and its effect, the vortex motion and its variation by various factors, and the behaviour of slag in the high-frequency induction furnace. The experiments were carried out with 60 kg. steel melts.—M. H.

What Is to Be Considered in the Electrical Melting of Aluminium? E. Fr. Russ (*Metallwirtschaft*, 1932, **11**, 593–594).—The Russ furnace is described. The small crucible type holds 10 kg. of aluminium and operates with 4 kw. using 0·5 kw.-hr./kg. The hearth types hold 500 kg. (output 3500 kg./day) or 2000 kg. (output 14,000 kg./day) and the energy consumption is 0·4–0·45 kw.-hr./kg. Rules for operating the furnace are given.—v. G.

The Melting of Aluminium by Electricity. George Turner (*Met. Ind.* (*Lond.*), 1932, **41**, 583–584).—The Russ type of stationary and tilting crucible furnaces and hearth resistance furnaces are described. The furnace should never be completely emptied after pouring, and the melting temperature should not exceed 800° C. The proper use of these furnaces prevents undue oxidation, over-heating, and heavy loss of metal.—J. H. W.

Special Electric Furnaces for Annealing Copper Strip in Brass Works. Albert Reymond (*J. Four élect.*, 1932, **41**, 380–386).—Describes in detail a continuous strip-annealing furnace and its accessories for copper or brass.
—J. H. W.

Electrically-Heated Universal Furnaces for Continuous Heating Operations. C. Frick (*Chem.-Zeit.*, 1932, **56**, 215–217).—Illustrations and wiring diagrams are given of several types of electrically-heated tunnel furnaces suitable for annealing and heat-treating operations. Nickel–chromium alloy coils or spirals are used as resistors for temperatures up to 950° C. and Silit rods for higher temperatures.—A. R. P.

The Brown-Boveri–Grünewald Bright-Annealing Apparatus. H. Nathusius (*Z.V.d.I.*, 1932, **76**, 1221–1224).—For temperatures up to 550° C. iron annealing boxes can be used, but heat-resisting alloys must be used for higher temperatures. The temperature distribution in the boxes is discussed; circulation of the annealing atmosphere in the boxes by means of a pump does not provide a better equalization of the temperature. Suitable layering of the material in the boxes, *e.g.* by the interposition of rings, gives better results. If the material is oily, *e.g.* from the lubricant used in drawing or rolling, the oil provides a sufficiently protective atmosphere against oxidation when it is sufficiently volatile and has a low flash-point; hence tarry oils or rapeseed oil is unsuitable. In annealing copper, wood charcoal or water (to provide a steam atmosphere) can be mixed with the charge in the boxes.—v. G.

Fundamental Principles in Designing the Electric Furnace for Heat-Treatment. Mikio Mukoyama (*J. Electrochem. Soc.* (*Japan*), **1932**, 66–73; *C. Abs.* 1933, **27**, 27–28).—[In Japanese.] There is a limiting temperature of electric resistance wire furnaces. By determining this temperature with various furnaces an equation was derived for the minimum electric power, the required temperature, T, and inner capacity of the furnace. The fundamental formula for the design of a resistor wire furnace was found to be: $Y = ax^{0.41}$, $a = 0.0017 . S . K_x . T^{1.55}$, where Y is the input in watts; x the inner capacity of the furnace in c.c.; S a constant dependent on the shape of the furnace; K_x the ratio of heat loss of used materials.—S. G.

Electric Induction Furnace for Heat-Treating and Reheating. —— Boyer (*Arts et Métiers*, 1932, **85**, 437–443).—Based on a paper by *R. Perrin* and *V. Sorrell* presented to the Académie des Sciences and published in *Rev. Mét.*, 1931, **28**, 448–452. See this *J.*, 1932, **50**, 270. A full description of an electric induction furnace for heat-treating iron, nickel, and cobalt is given. The furnace consists of a primary circuit of copper wire, a magnetic core represented by the muffle containing the specimen, and a secondary circuit represented by a metallic envelope surrounding the muffle, and forming a short-circuited coil. A single-phase alternating current passes through the primary, and induces a variation of magnetic flux in the muffle which produces in the secondary a current of the same frequency as the original current, but of lower voltage and very high intensity. The various accessories to the furnace are also described. —J. H. W.

Annealing Furnace for Aluminium Articles. Anon. (*Z. ges. Giesserei-Praxis: Das Metall*, 1932, **53**, 500).—A brief description is given of an electric furnace with pyrometric control and the method of operating it.—J. H. W.

Developments in the Electrical Industry During 1932. —— (*Gen. Elect. Rev.*, 1933, **36**, (1), 7–71).—Reference is made to batch-type furnaces for bright-annealing copper wire and strip, and also to a continuous-type furnace for bright-annealing miscellaneous steel and non-ferrous parts. For producing protective atmospheres for use in furnaces, an ammonia dissociator has been developed. Another method is to use controlled mixtures of air and gas (towns' gas or natural gas).—S. V. W.

Furnaces and Kilns. E. P. Barfield (*Electrician*, 1933, **110**, 103).—A brief survey of progress during 1932.—S. V. W.

FUELS

Fuel Oil in Metallurgical Melting and Heating Practice. T. F. Unwin (*Metallurgia*, 1932, **7**, 49–51).—Factors which have led to the use of fuel oil are discussed, and the general advantages of fuel oil for furnace heating, such as high controllability of the fuel, flame control, residue from combustion, consistent calorific value, convenience of storage, continuous operation, and operating, labour, and maintenance costs, are discussed. The use of proper oil furnaces, specially designed to obtain the advantages from fuel oil, are stressed, and consumption figures are given as a guide to its economy in use for a wide range of metallurgical operations which include tube welding and annealing, melting of aluminium and copper alloys either in crucible or reverberatory furnaces, annealing of copper tubes and brass strip, and lead melting and refining.—J. W. D.

The Use of Fuel Oil in Furnaces. T. F. Unwin (*Met Ind.* (*Lond.*), 1932, **41**, 539–540, 568–570).—Cf. preceding abstract. Part of a paper read before the Institute of British Foundrymen. (For the remainder see *Iron and Steel Ind.*, 1932, **6**, —.) A similar paper by U. was also read before the Co-ordinated Societies, in Birmingham.—J. H. W.

Discussion on Oil-Fired Furnaces. — Sutton. — Molinaux. — Jude. — Hemms. — Crow. — Lavender. — Twigger. — Fallon. — Palmer. — Brazener. T. F. Unwin (*Met. Ind.* (*Lond.*), 1932, **41**, 586–587, 610).—Discussion of a paper read by T. F. Unwin before the Co-ordinated Societies and U.'s reply. (See preceding abstract.)—J. H. W.

The Use of Towns' Gas in the Melting and Heating of Metals. J. C. Walker (*Metallurgia*, 1932, **6**, 189–190).—Factors which have facilitated the use of towns' gas as an industrial fuel are (1) it requires no storage facilities; (2) the production of gas from coal is not only a thermally efficient operation, but the production of heat from gas is also thermally very efficient; and (3) it is always available. These factors enable heating operations to be effected with great precision, and accurate control can be maintained without the aid of specialized labour. The application of towns' gas for industrial purposes has also been developed with the gradual improvement in the design of furnaces and with progress in burner construction. Gas consumption figures are given for reheating furnaces for annealing brass and copper; and for melting furnaces for aluminium, brass, nickel, and type-metal.—J. W. D.

Using Gas in the Brass Industry. W. W. Young, Jr. (*Gas Age-Record*, 1932, **69**, 601–602 and 617).—Cf. this *J.*, 1932, **50**, 764, and this volume, p. 45. Results obtained in the bright-annealing of brass and copper, wire and strip, using various types of gas-fired furnaces are discussed. Equipment for forging, and preheating furnace linings are also discussed very briefly.—J. S. G. T.

The Use of Modern Gas-Heated Equipment for Various Industrial Drying Processes. W. Hind (*Gas World* (*Indust. Gas Suppt.*), 1932, **4**, (12), 12–18).—The use of towns' gas for various drying operations, including core, enamel, and cellulose drying is briefly referred to.—J. S. G. T.

Burning Gas with Preheated Air. Anon. (*American Gas J.*, 1932, **137**, (5), 30–31).—Formulæ are given for the possible percentage economy of gas used and probable increase of production associated with the use of preheated air in furnace heating. An economy exceeding 40% has been affected with preheated air at 1600° F. (871° C.), which is probably the economic limit of preheating attainable.—J. S. G. T.

Coke in Metallurgical Melting and Heating Practice. R. J. Sarjant (*Metallurgia*, 1932, **7**, 19–21).—The general characteristics of metallurgical cokes are considered and their chemical, physical, and combustible properties discussed. Reference is made to their metallurgical uses, and specifications are given for their application in various types of melting and for general heating.—J. W. D.

Disperse Fuel: Its Technical and Commercial Possibilities. John L. Stevens (*Fuel Economist*, 1932, **8**, (85), 70–72).—The method of preparation of colloidal fuel (coal-oil fuel), the use of coking and non-coking coals, and results obtained are briefly discussed.—J. S. G. T.

Tentative Method of Sampling Coke for Analysis (D 346–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 705–709; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 789–793).—S. G.

Tentative Method of Sampling Coal by Ball-Mill Method (D 271–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 710–712; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 794–796).—S. G.

XVI.—REFRACTORIES AND FURNACE MATERIALS

(Continued from p. 47).

Preparation and Shaping of Refractory Materials in Germany. Otto Philipp (*Feuerfest*, 1932, 8, 81–89, 101–104, 113–119).—Various machines, crushers, sieving machines, mixers and presses, used in Germany for manufacturing refractory bricks and shapes are described and illustrated.—v. G.

Refractories Produced by Melting. Friedrich Reinhart (*Tonind. Zeit.*, 1932, 56, 32–34).—A description of the different methods used in the production of refractories by fusion.—B. Bl.

Some Notes on Refractory Cements. Donald Andrews (*Indust. Chemist*, 1932, 8, 403).—Desirable properties of refractory cements are summarized. —E. S. H.

Modern Furnace Setting Cements [Quick-pach ; Sairset]. Anon. (*Eng. Rev.*, 1932, 46, 326).—An account of two high-alumina furnace cements, Quick-pach and Sairset.—P. M. C. R.

Chrome Brick. Anon. (*Brit. Clayworker*, 1931, 40, 246–247; *Ceram. Abs.*, 1932, 11, 112).—Chrome bricks probably have fluctuated in popularity more than any other refractory; the reasons being cost, inability to resist load at working temperatures, variation in quality of the raw ore from different localities, &c. The most valuable deposits are in Greece. The raw ore must be carefully sorted prior to exportation. The concentrate is ground to a fixed fineness and mixed with the bond. The bond may be clay, fire-clay, bauxite, magnesia, water, a mixture of calcium and aluminium sulphates, or some combination of any of the materials. The ore should contain not less than 6% silica. The physical conduct of the chrome bricks and bricks prepared from other refractory materials and coated with chromite is discussed. A table of typical compositions of chrome ore is included, and the use of either the ore or bricks in such typical applications as nickel and nickel–copper blast furnaces, smelting of antimony, lead, bismuth, and steel, buffer linings for furnaces, gas-fired furnaces, tap holes, spouts, &c., is described.—S. G.

Physico-Chemical Properties of Natural and Artificial Graphites. J. A. Chapiro and —— Vessolovski (*Mineral Suir'e*, 1931, 6, (3), 265–274; *Ceram. Abs.*, 1932, 11, 183).—The electrical conductivity and resistance to high temperatures of graphite have been studied. The electrical conductivity depends on the structure of the sample, and to compare the results obtained powdered graphite was used and made homogeneous by sifting. The resistance of the powders of the different kinds of graphite previously compressed was determined. It was found that for each kind, the electrical resistance is the same for the grain-sizes from 0·10 to 0·27 mm. if the pressure of compression is 90 kg./cm.^{2}, but increases with finer powders. The resistance of different graphites diminishes progressively according to their crystallization. The more crystalline they are, the less is their resistance. The minimum is reached in the artificial graphite (Siemens electrode). Measurements of the resistance to temperature were made on graphite powders in the presence of excess air. A slight decrease in weight can be observed at low temperatures; this decrease depends on the length of time of heating. The temperature at which a sample of powdered graphite loses 3% of its weight during 10 minutes of heating was called "the temperature of attack." It was found that for a crystalline graphite like that of Ceylon or Madagascar, the temperature of attack is about 730° C., whilst less crystalline graphite has a slightly lower temperature of attack, and finally, for amorphous graphite, this temperature decreases to 535° C. The losses increase with the temperature almost exponentially for the same graphites.—S. G.

Refractory Agglomerates and Fused Cement. Anon. (*Rev. mat. constr. trav. pub.*, 1931, (265), 423; *Ceram. Abs.*, 1932, **11**, 181).—Studies made by Kestner, Arnould, and Jaurrier in 1926 and by Giuseppe Ongars in 1923 have given knowledge of mixtures that can be used like ordinary cement but without disintegration at high temperatures. The application of this process is varied, and has been made with completely satisfactory results: (1) as refractory pieces of special kilns, pieces of high price, and slow delivery, (2) repair of parts of refractory facings exposed to continued changes of temperature, (3) as a mortar for joining ordinary refractories in all furnaces, (4) for stopping cracks and to act as a protection against the destructive action of gas, &c., and (5) for application between refractory and metal parts.—S. G.

Kestner Refractory Hydraulic Cements and Mortars.—I.–II. J. Arnould (*Rev. mat. constr. trav. pub.*, 1931, (264), 169–172B, (265), 419; *Ceram, Abs.*, 1932, **11**, 181).—(I.—) This product is a true hydraulic, basic, and aluminous cement used with water like ordinary Portland cement. It is slow setting and rapid hardening, gives practically no shrinkage on setting, and gives a maximum of 1% shrinkage on initial firing. (II.—) This cement combines the qualities of products of construction and refractories, and can be used in a manner analogous to that of refractory masonry in kilns, gas generators, chimneys, &c. There are two types, one for low temperatures (below 1200° C.), and the other for high temperatures (below 1400° C.). The thermal conductivity of Kestner cement is close to that of bauxite. The melting point is 1300° C. for the first type and 1400° C. for the second.—S. G.

Apparatus for Testing Resistance to Pressure of Refractories at High Temperatures. G. Chaudron, M. Garvin, and A. Villachon (*Chim. et Ind.*, 1930, 21, 2; and *Feuerfest*, 1931, 7, 148; *Ceram. Abs.*, 1932, **11**, 110–111).—A kiln for testing resistance to pressure of refractory materials at temperatures above 1600° C. is described. The lower part is made of graphite and the upper part of iron. A measuring instrument of high sensitivity shows the beginning of the decrease in resistance, whilst an optical pyrometer (Ribaud) shows the temperature. Magnesite materials prefired to 2000° C. with 1·6% silicic acid and more showed a decrease in resistance; pure magnesite showed only a viscous deformation. Other oxide additions, such as alumina, chromium oxide, and iron–lime oxide, seem to have no effect on the mechanical properties of magnesium oxide. Fe_2CaO_3 appears to affect viscosity slightly.—S. G.

A Rapid Method of Estimation of Alumina in Clays. R. W. Ellison (*J. Amer. Ceram. Soc.*, 1932, **15**, 188–190).—With the material analyzed in routine a definite relation was noted between the proportion of combined water and silica. The determination of combined water and of iron was all that was necessary to calculate the silica and alumina. The procedure is given, and also a curve showing the relation between combined water and silica in the particular material cited. This same "short cut" chemical analysis is applicable to other clays when the curve for the ratio of combined water to silica has been determined for each clay.—S. G.

Tentative Method of Test for Particle Size of Ground Refractory Materials (C 92–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 412–414; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 721–723).—This method of test is intended for determining particle size of ground refractory raw materials and finished products, such as fireclay mortars and high-temperature cements. The test data are of use in helping to maintain uniformity in manufacturing process and development work, and in the purchase or sale of certain finished products. The materials or aggregates to which water is added for their use, or those which are shipped in a plastic condition, are to be subjected to the wet method of sieve analysis. This group includes plastic clays, mixes containing plastic clays, fireclay mortars, and high-temperature cements.—S. G.

XVII.—HEAT-TREATMENT

(Continued from pp. 47–48.)

Heat-Treatment of Aluminium Alloys. Douglas B. Hobbs (*Machinery (N.Y.)*, 1933, **39**, 319–320).—The effects produced by the operations of annealing, "solution heat-treatment," and "precipitation heat-treatment" (ageing) on aluminium alloys are described on conventional lines, and typical tensile properties of some common alloys tabulated.—J. C. C.

Annealing Box for Cold-Rolling Mills and Wire-Drawing Works. Georg Weiss (*Draht-Welt Export-Ausgabe*, **1932**, (10), 92–97).—[In English, French, and Spanish.] After surveying the various types of annealing box extant, *viz.*, cast iron, riveted steel, welded steel, cast steel, and those fabricated in special heat-resisting alloys, W. urges that particular attention should be paid to the design of the base to avoid bulging in use and rapid thinning just above the bulge. It is also suggested that makers and users would benefit from a standardization of types and sizes.—A. B. W.

Heat-Treatment Without Detrimental Finish. J. Fallon. — Cookson. A. G. Robiette. — Kronsbein. A. Pinkerton. — Benton. J. W. Jenkin. A. G. Lobley. — Emms. — Crome and — Jones (*Met. Ind. (Lond.)*, 1932, **41**, 565–567).—An open discussion before the Co-ordinated Societies (Birmingham Local Section of the Institute of Metals, Birmingham Metallurgical Society, and the Staffordshire Iron and Steel Institute). J. F. stated that the main factors governing bright-annealing were the time, temperature, and atmosphere, the heating agent having little effect. No method of bright-annealing brass had yet been found, but copper could be so treated. A. G. R. stated that brass could be bright-annealed, but required pickling to remove the zinc oxide film; copper and nickel were easy, but chromium alloys were difficult. A. P. stated that in the Grünewald process an oil film on the metal forms the atmosphere. J. W. J. described the process wherein the furnace was lowered over the container. A. G. L. recommended the electric furnace for annealing and stressed the importance of the atmosphere. Jones raised the questions of gas mixtures and costs. B. described the zinc film on annealed brass and its prevention. The various points raised were replied to by J. F.—J. H. W.

Bright-Annealing. A. G. Robiette. A. Glynne Lobley. J. Fallon (*Met. Ind. (Lond.)*, 1932, **41**, 567, 597–598, 641).—A series of letters extending the open discussion on "Heat-Treatment Without Detrimental Finish" initiated by J. Fallon before the Co-ordinated Societies (see preceding abstract). A. G. R. maintained that brass can be "perfectly bright-annealed" and defended the use of the bell type of furnace carried to the charge. A. G. L. amplified his previous remarks, criticized J. F.'s replies and defended the use of the electric furnace. J. F. maintained that brass cannot be bright-annealed, stating that A. G. R.'s specimens were not bright and, in a later letter, disputes A. G. L.'s assertions and interpretation of his (J. F.'s) remarks.—J. H. W.

Influence of Electro-Magnetic Waves on the Hardness and Resistivity of Metals. G. Mahoux (*Usine*, 1931, **40**, (34), 29).—Abstract of a note presented to the Académie des Sciences. See this *J.*, 1931, **47**, 228.—H. W. G. H.

The Use of Oil as a Quenching Medium in Heat-Treating. Anon. (*Lubrication*, 1932, **18**, (4), 37–42).—The merits of oil, water, soap-solutions, brine, and glycerine as quenching media are considered, and the special advantages and limitations of each are indicated. A discussion of the quenching properties of various animal, mineral, and vegetable oils follows. It is suggested that a faulty quenching system is often the cause of errors in hardening, and diagrams of recommended systems and details of cooling apparatus are given. The effect of temperature, viscosity and circulation on quenching speed is considered, and requirements for quenching oils are formulated. It is stated that mineral oils

make satisfactory quenching media with sufficient attention to selection, fractionation, refinement, and addition of make-up oil. Purification of quenching oils, and the harmful effects of carbonaceous residues, are considered.
—P. M. C. R.

XVIII.—WORKING

(Continued from pp. 48–52.)

Variations in the Microstructure Inherent in Processes of Manufacturing Extruded and Forged Brass. Ogden B. Malin (*Trans. Amer. Inst. Min. Met. Eng.*, 1932, **99**, (Inst. Metals Div.), 165–173; discussion, 173–174).—For abstract of the paper, see this *J.*, 1932, **50**, 503, 703. In the discussion, in which *D. K. Crampton, K. R. van Horn,* and *O. B. Malin* took part, it is stated that within the range 56–64% copper a considerable difference is made to the grain structure by increasing the copper content, but little change occurs in grain-size. For a given copper content the best forging properties are obtained with straight zinc–copper alloys without additions of tin or aluminium, although addition of aluminium seems to cause the metal to fill out the corners of the die more readily. A brief outline is given of the modern theory of extrusion.—A. R. P.

An Extrusion Problem. Rubber Trade Methods Applied to Non-Ferrous Metals. Anon. (*Met. Ind.* (*Lond.*), 1932, **41**, 487–488).—A description of a forcing press used in the rubber industry, and a discussion of the application of the method of forcing with a screw feed as opposed to extrusion to non-ferrous metals are given.—J. H. W.

Vertical Extrusion Presses. Anon. (*Met. Ind.* (*Lond.*), 1932, **41**, 589–590).—Abstract of a trade publication (Fried. Krupp Grusonwerk) describing vertical presses for the extrusion of tubes, billets, and sections in brass, copper, and other alloys, and giving details relative to equipment and practice in extrusion.
—J. H. W.

Sheathing Cables with Lead. John R. Shea (*Dutch Boy Quarterly*, 1932, **10**, (1), 4–5).—Describes a press for the extrusion of sheaths of lead–antimony alloy for coating cables.—E. S. H.

The Rolling-Mill of the Future. C. E. Davies (*Met. Ind.* (*Lond.*), 1933, **42**, 59–64, 83–84).—An indication is given of the trend of rolling-mill design and practice in the near future.—J. H. W.

The Rolling Problem. E. Siebel (*Maschinenbau*, 1932, **11**, 497–500).—A report on the results of theoretical calculations and laboratory researches on the process of rolling metals with the technical conclusions reached from the work. The influence of roll diameter and friction is especially discussed. The article is written in a readily understandable manner without mathematical formulæ.—v. G.

The Calculation of Rolling Work. E. Cotel and I. v. Pattantyus (*Mitt. berg- u. hutt. Abt., Kgl. ung. Hochschule Berg- u. Forstwesen, Sopron, Ungarn,* 1929, (1), 17–48).—Methods of calculating in advance the work done in rolling are considered historically. C. and v. P. modify the formula of Henmann, preferring the form : $N = FkvC$, where N = required horsepower; F = reduction of sectional area (actual diminution in cm.^{2}); k = limit of compression, in kgm./cm.^{2}, for hot material; v = peripheral velocity of rolls in metres/second; C = a factor calculated from results obtained by Puffe, and varying with the forms of the rolled product. A series of graphs, of forms characteristic for each type of section, is appended, together with a table of values for C.—P. M. C. R.

Modern Methods for the Determination of the (True) Rolling-Work. O. Emicke, H. Allhausen, and W. Mauksch (*Siemens Z.*, 1932, **12**, 341–346).—Discusses the application of the Siemens torsion-dynamometer and the Siemens pressure-box for the determination of the real rolling-work. Experimental results will be published elsewhere.—M. H.

Cluster Mills, Four-High Mills, and the Trend of Rolling Mill Design. E. L. Williams (*Met. Ind.* (*Lond.*), 1932, 41, 489–490).—Abstract of a paper read before the Sheffield Local Section of the Institute of Metals. The production of sheet and strip was originally effected by stamp batteries which had the advantage that the properties of the sheet were the same in all directions. These were followed by continuous 2-high, 3-high, 4-high, and cluster mills. In these last, the work rolls are of small diameter, strictly parallel, and prevented from deflecting under load by stout rolls mounted above and below them. The factors affecting roll design, roll material (usually forged chromium steel), coiling devices, costs of production, running speeds (normally 60–100 ft./minute), and auto-control mills (such as the Steckel mill) are discussed. —J. H. W.

Modern Cold-Rolling Mills. Anon. (*Met. Ind.* (*Lond.*), 1932, 41, 365–368).—A description of modern cold-rolling mills and auxiliary equipment manufactured by Messrs. Brooks (Oldbury), Ltd., under licence from the Demag A.G., Duisburg, Germany.—J. H. W.

Aluminium Sheet Production. XIV.—Cold-Rolling Mills. R. J. Anderson (*Metallurgia*, 1932, 6, 163–164, 168, 185–187; 7, 11–13, 43–45).—The various types of mills which are, or may be, used for cold-rolling aluminium sheet and coil are described. Two-high sheet mills, 2-high coil (strip) mills, and 2-high continuous mills are considered as well as multiple-roll mills such as 3-high, 4-high, cluster, and Steckel mills. Various kinds of rolls are used, including plain chilled cast-iron, chilled alloy iron, cast steel (hardened), and forged and heat-treated alloy steel rolls. Rolling-mill bearings are of various types, and include leaded–bronze, phosphor–bronze, and nickel bearing-bronze for roll-neck bearings of the journal type. Brief reference is also made to various types of rolling-mill drive.—J. W. D.

Push Bench Process for Manufacture of Seamless Tubes. Wm. H. Engelbertz (*Rolling Mill J.*, 1932, 6, 91–96).—A description of the essential features of manufacture of seamless tubes by the push bench process, *viz.*, hydraulic punch piercing of the billet, hot-drawing on a mandrel in a ring bed (or push bench), cross-rolling (or reeling), and mandrel extraction, and finally reducing or sizing by means of grooved rolls. Reference is made to the recent installation of push bench plants in Canada and the United States following successful operations with such plants in Africa and Europe. E. also compares production costs by the push bench, butt weld mill, Moon continuous butt weld mill, and the electric butt-welding machine. He concludes that considering the relative prices of billets and skelp the push bench can produce tube more cheaply than any other process, save only the Moon continuous butt weld.—A. B. W.

The Tube Reducing or Sinking Mill. Wm. H. Engelbertz (*Rolling Mill J.*, 1932, 7, 81–84).—A discussion of multi-stand reducing mills having 2 or 4 rolls per pass. It is claimed that end-thickening and squaring of the bore are materially diminished in the 4-roll mill developed by Stueting; moreover, a greater reduction per pass is possible with the 4-roll mill.—A. B. W.

The Production of Brass Bars and Sections. P. Siebe (*Draht-Welt*, 1932, 25, (31), 483–486).—A brief description of the melting (Ajax–Wyatt), casting, extrusion, drawing, and annealing of brasses; together with specifications of mechanical properties obtainable and notes on faults and their avoidance. —A. B. W.

Copper Rod Rolling, Wire-Drawing, and Annealing. John R. McKean (*Wire and Wire Products*, 1932, 7, 328–337, 363).—Read before the Wire Association. A description is given of the manufacturing practice of a large, modern copper wire-drawing works. In particular, the lay-out of the factory, the plant, copper rod-rolling and cleaning, wire-drawing, the tungsten carbide dies, fine wire-drawing, annealing, and its effect on the tensile strength, elongation, and scleroscope hardness and the mechanical properties required for various gauges by the American Society for Testing Materials are considered. As a lubricant for drawing, an emulsion such as vegetable oil 2, soap 1, and water 75 parts, having a fat content of 3–4%, is used.—J. H. W.

Manufacture of Brass Wire. P. Siebe (*Draht-Welt*, 1932, 25, (32), 499–501).—The production of α- and of α + β-brass wires, D.I.N. specifications, and the mechanical properties obtainable with various degrees of drawing are given, together with a brief reference to faults associated with overheating in annealing.—A. B. W.

Studies of the Wire-Drawing Process. III.—Lubrication. Edgar L. Francis (*Carnegie Schol. Mem., Iron Steel Inst.*, 1932, 21, 1–30). **Appendix on Wire-Drawers' Dermatitis.** F. C. Thompson and E. L. Francis (*ibid.*, 31–34).—Experimental results show that the film of lubricant in wire-drawing must be of the order of 10^{-5} in. thick, and a good lubricant must be capable of molecular orientation and adsorption at the metallic surfaces. This condition is satisfied by animal, vegetable, and " Germ " oils, all of which contain free fatty acids, but not by mineral oils. Under these conditions, lubrication is uninfluenced by viscosity, pressure, or relative speed, but is affected appreciably by the amount of fatty acids present. The two forms of friction-testing machines described gave useful information as to the probable relative behaviour of an oil under wire-drawing conditions, but were of little value for quantitative tests. They can also be used for testing solid lubricants, providing that certain specified precautions are taken. The behaviour of soap depends as much on its physical as on its chemical properties; it should contain not less than 80% saponified acids. Practically all lubricants except commercial soap should be used at elevated temperatures from the point of view of low frictional loss. Dermatitis has so far been experienced only in the ferrous section of the wire industry, where certain kinds of soap are used. The cause of the trouble appears to be some constituent of the soap, such as coconut oil. Additional factors are the presence of sweat, undue scrubbing of the hands, normal irritation of the skin by soap and water, and the effects of grit. It is stated that the trouble can be eliminated by rubbing the hands well with a mixture of unsalted lard and 5% boric acid before work.—J. H. W.

The Cold-Working of Metals. J. W. Berry (*J. Inst. Production Eng.*, 1932, 10, 297–312).—A general account is given of the behaviour of metals under the operations of drawing, cold-rolling, hand-raising, spinning, stamping, and double-action press work.—J. C. C.

Modern Drop-Forging Equipment and Its Services to the Railway Engineer. B. Powell Brett (*J. Inst. Locomotive Eng.*, 1931, 21, 697–730).—Contains a brief account of the drop-forging of Duralumin.—J. C. C.

Free Cutting Brass : Machinability of the Various Alloys. D. K. Crampton and H. P. Croft (*Metal Progress*, 1933, 33, (1), 31–32, 62).—An abstract of published information on the machining properties of brass rod, and of some recent experimental results. Feeds for free-turning brass rod are tabulated for different types of tool, and some notes on practice are given. The mechanical properties and compositions of copper, leaded-copper, phosphor–bronze, Muntz metal, and several commercial bronzes and brasses are tabulated, together with relative machinability figures, and with brief notes on cold-heading and cold-bending properties. The influence of certain ingredients is separately considered.—P. M. C. R.

The Drilling of Deep Holes in Light Metals. H. J. Stoewer (*Maschinenbau*, 1932, 11, 469–472).—The most satisfactory shape of drill, cutting angle, and rate of rotation for drilling deep holes in aluminium, Silumin, and Elektron have been determined experimentally.—v. G.

Tungsten Carbide Used for Resisting Abrasion. Anon. (*Machinery* (*N.Y.*), 1932, 38, 909; and *Machinery* (*Lond.*), 1932, 41, 14).—The use of tungsten carbide inserts to prevent excessive wear on a guide block for spring steel stock is described and illustrated.—J. C. C.

XIX.—CLEANING AND FINISHING

(Continued from pp. 52–53.)

On the Degreasing of Metal Parts and Mass Production Articles. K. Altmannsberger (*Oberflächentechnik*, 1932, 9, 88–89).—For removing animal or vegetable fats the articles are treated cathodically in a solution containing (in 100 litres) 6 kg. of sodium hydroxide, 500 grm. of sodium cyanide, 300 grm. of ammonium chloride, and 3–4 kg. of commercial water-glass. For degreasing and at the same time coating the articles with a thin film of copper (prior to nickel-plating), the bath should contain (in 100 litres) 8 kg. of sodium hydroxide, 4 kg. of sodium carbonate, 1·5 kg. of sodium sulphate, 500–750 grm. of potassium cyanide, 1·5 kg. of copper cyanide, and 3–3·5 kg. of potassium copper cyanide; this bath is used cold or slightly warm, and the articles are treated in it for 1·5 minutes. When the articles are very greasy preliminary tumbling in milk of lime is recommended.—A. R. P.

Directions for Cleaning Architectural Anticorodal. —— Zurbrügg (*Aluminium Broadcast*, 1932, 3, (37), 17).—Periodic cleaning is advisable to retain a silver-white colour. Polished objects may be cleaned with metal polish, benzine, or petrol. Matt or score-brushed objects may be cleaned with soft-soap solution, benzine, or petrol, or dry-cleaned by rubbing with powdered pumice, pan cleaners, fine wire (not brass) or bristle brushes, or soft rubber. —J. C. C.

Metal Cleaning and Bake Finishing. Fred Mannhardt (*Indust. Finishing Mag.* (*U.S.A.*), 1932, 8, (3), 52–54).—An account of modern practice.—E. S. H.

The Cleaning of Small Metal Objects Coated with Varnish or Oil Paint. C. Duret (*Moniteur de la Peinture*, 1932, 20, 72; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (26), 111).—Where sand-blasting apparatus is not available, potassium hydroxide or sodium hydroxide may be used, or the article may be brushed over with turpentine or alcohol and immersed in C.O.V. which carbonizes the organic material. With the last two methods it is necessary to wash the articles very thoroughly after the treatment, and to remember that the materials handled are extremely corrosive.—S. G.

Preparing Metals for Finishing. Anon. (*Brit. Indust. Finishing*, 1931, 2, 99; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1931, (22), 215).—Methods of cleaning zinc, copper, and tin surfaces are recommended. The types of paints suitable for use on these metals and on Duralumin are indicated, and typical formulæ are given.—S. G.

On the Use of Sal-Ammoniac in the Metal Industry. Georg Buchner (*Oberflächentechnik*, 1931, 8, 21).—The hydrogen chloride in dry ammonium chloride is 100 times more active than pure dry hydrogen chloride on copper at 250°–350° C. and 40 times more active on silver and nickel. This is explained on the assumption that ammonium chloride at high temperatures behaves as an ammino-acid forming salts of the type $(NH_3M')Cl$; in aqueous solution it behaves as a hydroxonium acid.—A. R. P.

Finishes for Aluminium. T. D. Stay (*Metal Progress*, 1933, 33, (1), 24–27).—Architectural castings in aluminium and its alloys are finding increasing application; some finish is necessary to remove small surface blemishes and sand-cracks. Sand-blasting is used to give a uniform surface texture of somewhat diminished reflecting power, or to serve as a base for other finishes. The "de-plated" slate-grey finish is produced by anodic oxidation. A polished finish is obtained by using emery or some other abrasive after sand-blasting. Methods of producing polished, buffed, satin, or wire-brushed finish are described, as are certain combination methods. Painting and lacquering are easily applied after sand-blasting, whilst the "Alumilite" anodic oxidation process produces an oxide coating coloured by certain dyes or pigments.—P. M. C. R.

The Anodic Oxidation and Dyeing of Aluminium for Decorative Purposes. A. W. Weil (*Brit. Indust. Finishing*, 1932, **3**, 85).—The chromic acid process of anodic oxidation and the dyeing of the film produced are described.—E. S. H.

Clear and Colour Finishes on Aluminium. The Alumilite Process. Ralph E. Petit (*Indust. Finishing Mag.* (*U.S.A.*), 1932, **8**, (4), 12–14).—Describes a method of protection of aluminium and some of its alloys by anodic oxidation, with or without colouring the oxide film by means of dyes.—E. S. H.

Decorating Sheet Metal Ware. Anon. (*Brit. Indust. Finishing*, 1932, **2**, 245–247).—Describes methods for the chemical deposition of copper for decorative purposes and the colouring (especially "bronzing") of the films so produced.—E. S. H.

Black Finishes for Sheet Metals. Anon. (*Brit. Indust. Finishing*, 1932, **3**, 4).—A black finish on brass may be obtained by immersing the article in a solution containing potassium sulphide and ammonia. Aluminium may be blackened by immersing in a solution containing sodium hydroxide and sodium chloride, kept at 80° C. Tin or tinplate acquires a black finish, after degreasing in boiling sodium hydroxide solution, by placing in a bath containing solutions of antimony chloride and cupric chloride.—E. S. H.

Improved Continuity Test for Enamel Insulation on Wires. C. L. Erickson (*Bell Laboratories Record*, 1932, **10**, 287–289).—Enamelled copper wire is passed between 2 rollers pressed together by a system of levers and weights. Electrical contacts between the rollers and the copper core are counted by the operation of a message register operated through a grid-controlled discharge tube. The use of rollers instead of the usual mercury bath has the advantage of indicating the presence of slivers or irregularities that break through the enamel under pressure. Also, it does not make the wire unfit for further use.—J. C. C.

Tumbling Barrels for Finishing. Harold C. Booth (*Indust. Finishing Mag.* (*U.S.A.*), 1932, **8**, (5), 12–16).—A description of types of barrels and technique.—E. S. H.

Rubbing, Polishing, and Buffing Mechanically. P. C. Bardin (*Indust. Finishing Mag.* (*U.S.A.*), 1932, **8**, (5), 7–9, 17–20).—A description of types of machines, flexible shaft equipment, and types of wheels used.—E. S. H.

The Wet-Polishing of Small Metal Parts with Steel Shot. Anon. (*Werkzeug* (Suppt. to *Maschinenkonstrukteur*), 1932, **8**, 35–36).—A 60–90% saving of time is claimed to be effected by this process. The polishing fluid should be free from corrosive acids or alkalis; the pieces to be polished must be free from superficial unevenness, as the process does not remove this. The placing of too many pieces together in the polishing drum vitiates the method. Suitable adaptations of drum and shot for various types of work are given.—P. M. C. R.

Decorative Lacquers for Metal Goods. —— Sawifrie (*Ind.-Lack-Betrieb.*, 1931, **7**, (5), 69; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1931, (20), 98).—Small gold, silver, bronze and other metal articles used for ornamental purposes may be coated with nitrocellulose lacquers after the surface has been cleaned thoroughly with benzine. Extreme care must be given to the method of applying the lacquer or irregularities will appear on the surface. The subsequent polishing must also be very painstakingly performed, otherwise the proportion of rejects will be large.—S. G.

Coloured Finishes on Zinc. Anon. (*Brass World*, 1932, **28**, 224–225).—Reproduced from a booklet issued by the New Jersey Zinc Co., U.S.A.
—J. H. W.

New Methods of Surface Improvement [by Chromium-Plating]. K. Altmannsberger (*Oberflächentechnik*, 1932, **9**, 14).—The brass is etched in a mixture of nitric and sulphuric acids containing zinc sulphate, then nickel-plated, and the design produced by polishing certain parts. On subsequently plating with chromium the design appears in a matt and bright finish.—A. P.

XX.—JOINING

(Continued from p. 100.)

The Possibilities of Repairing Aluminium [and Its Alloys] by Soldering and Welding. H. Reininger (*Schmelzschweissung*, 1931, **10**, 86–88, 117–120, 196). —After reviewing the ordinary methods of joining aluminium by soldering and welding and describing the composition of solders and fluxes used, R. gives numerous practical hints on carrying out this work, with especial reference to the filling of pipes and cavities and the repair of fractures.—B. Bl.

Welding in Aeroplane Construction. Anon. (*Schmelzschweissung*, 1931, **10**, 290–293; 1932, **11**, 29–32).—Deals chiefly with steel, but some hints are given on the welding of aluminium and aluminium alloy tanks.—B. Bl.

Welding of the Aluminium Crank-Case of a Bus. Werner K. Raabe (*Schmelzschweissung*, 1931, **10**, 126).—The repair of fatigue cracks in a crank-case by welding is described with especial reference to the precautions necessary to avoid distortion.—B. Bl.

The Welding of Copper in the Construction of Apparatus. —— Geiger (*Schmelzschweissung*, 1931, **10**, 37–38).—Owing to its high heat conductivity, larger burners must be used for welding copper than for iron, and the distance between the two parts to be joined must also be greater; they should never be fastened together before welding. The weld should be made simultaneously from both sides, then hammered, annealed at 500°–550° C. and again hammered. When finished, the weld should be 20% thicker than the rest of the article, and should have a tensile strength of 90% of that of hard-rolled copper, with an elongation of 20%. Examples of copper-welding are illustrated.
—B. Bl.

The Application of the Oxy-Acetylene Burner in the Construction of Accumulators. Gustaw Jonscher (*Schmelzschweissung*, 1931, **10**, 189–190).—Examples of the practical welding of lead sheets are given.—B. Bl.

Fluxes for Welding and Brazing. E. Lüder (*Schmelzschweissung*, 1931, **10**, 197–201, 220–222).—The function of fluxes is to remove non-metallic impurities from the surface of the parts to be joined and from the liquid weld metal; this function can be fulfilled by (*a*) gases, *e.g.* the reduction of iron oxides by a reducing flame and the reduction of aluminium oxide by a chlorine–oxy-hydrogen flame, or (*b*) fused salts which dissolve the impurities either chemically or physically. The action of the latter is strongly dependent on the temperature, and hence their composition should be so chosen that their most intensive action occurs just below the welding temperature. The various welding fluxes are described systematically: (i) acid fluxes with a base of silica, boric acid, or borax, the last 2 types being especially suitable for iron, copper, and their alloys; (ii) basic fluxes with an alkali carbonate base; (iii) aluminium fluxes with a chloride or fluoride base.—B. Bl.

The Measurement of [the Thickness of] Weld Seams. E. Kalisch (*Schmelzschweissung*, 1931, **10**, 181–183).—Some instruments for measuring the thickness of welded seam are described.—B. Bl.

Shrinkage Stresses in Welded Seams. Karl Melcher (*Schmelzschweissung*, 1931, **10**, 128–129).—Shrinkage stresses are greater with butt-welds than with chamfer welds. The basic principles for calculating these stresses are given and the influence of transverse and longitudinal shrinkage, of the weight, size, and arrangement of the article, and of step-wise and jump-wise welding on the stresses in the seam, are discussed.—B. Bl.

Electric Arc-Welding with Alternating Current of Grid Frequency. H. Hafner (*Bull. Assoc. Suisse Elect.*, 1933, **24**, (1), 1–9).—Arc-welding is more cheaply performed with a.c. than with d.c., although some additional precautions are necessary. H. prefers the single-phase transformer with condenser to the tri-phase transformer with potentiometer; he describes a new transformer which may be introduced into comparatively weak circuits. Two modifying attachments for use in tri-phase systems are described, with circuit diagrams.—P. M. C. R.

The New German Welding Symbols. Otto Bondy (*Mech. World*, 1932, 92, 25–27).—Among the most important steps at present being taken in the development of welding practice is the standardization of the symbols used to specify the various kinds of welds. B., who collaborated in the preparation of the recently-completed German standards, explains their essential features and application. Wherever possible, the symbols should give a clear pictorial representation of the weld by the form of its cross-section, and suffixes are used to give additional information. The need for an international system of welding symbols is emphasized, and certain symbols which might form the nucleus of a uniform code are suggested. Various types of weld with suggested symbols are illustrated.—F. J.

Electric Arc-Welding of Non-Ferrous Metals. H. Martin (*Mech. World*, 1932, 92, 165–166).—Where it can be employed, the gas-torch is the most satisfactory, but its use is limited. The electric arc offers the advantages of intense local heat (double the temperature of the oxy-acetylene flame), speed of metal deposition, and absence of burnt gas by-products. In spite of the high temperature, however, some preheating arrangements are necessary when welding copper, owing to its high thermal conductivity. The technique of preheating is briefly discussed. Copper can be arc-welded only in a horizontal position at the present stage of development, but the welding of vertical seams should become possible. Coated electrodes are essential to prevent formation of oxide in the weld, the best results having been obtained by the use of bronze core wires suitably coated and used on d.c. Hard-drawn wires give a much steadier and more concentrated arc than annealed wires. The use of heavily-coated electrodes with a high arc voltage will probably solve many of the existing problems, in addition to obviating preheating. The atomic hydrogen process or the use of the oxy-hydrogen flame is unsuitable for copper welding, owing to the affinity which copper has for hydrogen. The technique of arc-welding bronze, brass, nickel, Monel metal, and aluminium is also briefly discussed. (Cf. following abstract.)—F. J.

Electric Arc-Welding of Non-Ferrous Metals. Anon. (*Mech. World*, 1932, 92, 222).—A letter. The suggestion made by H. Martin (cf. preceding and following abstracts) that oxy-acetylene welding of copper may be supplanted by arc-welding, is challenged.—F. J.

Electric Arc-Welding of Non-Ferrous Metals. H. Martin (*Mech. World*, 1932, 92, 246).—Reply to a correspondent (cf. preceding abstracts), maintaining the utility of arc-welding for certain purposes and its superiority over gas-welding as regards temperatures attainable.—F. J.

Measuring and Measurements in Electric Arc-Welding. P. Flamm (*Elektroschweissung*, 1932, 3, 50–51).—The arc performs 2 functions—heating and depositing metal. Two methods are described for determining the proportionate time taken by these. The first is qualitative, and employs a telephone-earpiece, in which the sound gives an indication of the deposition time. In the second, variations in the arc cause variations in the filament current of a thermionic valve, the plate current of which is recorded. The resulting graph shows the proportion of heating time. Examples are given to demonstrate the effect of electrode coatings, different materials, and faults in technique.
—H. W. G. H.

Practical Hints for the Welder. W. Kemsies (*Schmelzschweissung*, 1931, 10, 278–279).—Practical hints for the welding of cast-iron, brass, and aluminium are given and a number of common errors are described.—B. Bl.

From Welding Handicraft to Welding Technique. Otto Mies (*Schmelzschweissung*, 1931, **10**, 50–51).—Historical.—B. Bl.

Prevention of Accidents in Autogenous Welding. W. Kemsies (*Schmelzschweissung*, 1931, **10**, 124–126).—Most accidents with gas cylinders are due to careless or clumsy handling. Possible causes of explosions are discussed and means for their prevention described. An account of some accidents is given.—B. Bl.

Welding in the Technical Schools. W. Heimann (*Schmelzschweissung*, 1931, **10**, 110–111).—The inclusion of welding technique in the curriculum of technical schools for apprentices and workmen is recommended.—B. Bl.

Laboratory for Welding Studies. J. R. Townsend (*Bell Laboratories Record*, 1932, **10**, 306–310).—A brief illustrated account of the equipment in a new laboratory established by the Bell Telephone Laboratories to study welding problems.—J. C. C.

Autogenous Welding in Electrical and Mechanical Construction. Electric Welding. Anon. (*Technique moderne*, 1931, **23**, 313–316).—A review of apparatus and up-to-date practice, and some notes on probable developments and the trend of research.—H. W. G. H.

The Development of Atomic Hydrogen Welding in America and Germany. Anon. (*Technique moderne*, 1931, **23**, 234–236).—The atomic hydrogen process is described and particulars of the apparatus made by the General Electric Company (U.S.A.) and the Allgemeine Elektrizitäts Gesellschaft (Germany) are given.—H. W. G. H.

XXI.—INDUSTRIAL USES AND APPLICATIONS

(Continued from pp. 101–107.)

Bearings. Anon (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 177–178).—A brief discussion of present views on the properties required in bearings, the conditions of working, and features requiring explanation.—R. G.

Metals for Bearings. Anon. (*Technique moderne*, 1931, **23**, 803).—Without giving quantitative data, the author reviews the desirable properties of an ideal, and the actual properties of a typical bearing metal and emphasizes the necessity of knowing every possible factor before deciding on a suitable metal for a given purpose. The best choice made, it is essential to supervise the actual application of the metal in order to realize the properties which decided its adoption. The precautions which should be taken are outlined.—H. H.

Tentative Specifications for Aluminium–Copper–Magnesium–Manganese Alloy Bars, Rods, and Shapes (B 89–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 298–301; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 687–690).—No scrap shall be used in the manufacture of the material except such as may accumulate in the manufacturer's own plants from material of similar composition and of his own manufacture. The requirements as to composition as determined by chemical analysis are: aluminium, min., 92·0; copper 3·5–4·5, magnesium 0·2–0·75; manganese 0·4–1·0%. Tables set forth requirements as to physical properties, and dimensions and permissible variations of alloy bars, rods, and shapes.—S. G.

Aluminium. R. E. Baker (*Canning Age*, 1932, **15**, 550–551).—In the canning industry aluminium is used for steam kettles, pipes, pans, and vats.—E. S. H.

Aluminium in Central Heating. R. Touchard (*Rev. Aluminium*, 1932, **9**, 1867–1870).—An account of the application of aluminium to the construction of central heating appliances.—J. H. W.

Extra Light Metallic Constructions in Light Alloy. J. Bally (*Rev. Aluminium*, 1932, **9**, 1861–1866).—An account of the application of Duralumin to the construction of large light metal parts.—J. H. W.

Duralumin or Special Steels? A. Mazzini Beduschi (*Chimica*, 1932, 8, 267–269).—The relative merits of Duralumin and special steels for some modern constructional purposes, especially for aeronautics, are discussed.—G. G.

On the Problem of the Use of Aluminium Alloys. V. Magliocco (*Auto Italiana*, 1932, (31), 27–29).—The spheres of utility of light alloys are described.—G. G.

Cast Aluminium in the Electrotechnical Industry. O. Schaumann (*Elettrotecnica*, 1932, 370–372).—A descriptive article.—G. G.

Aluminium Paint. Ernest Scheller (*Official Digest, Federated Paint Clubs*, No. 119, 1932, 993–997; *C. Abs.*, 1933, 27, 197).—The manufacture of aluminium flake, its behaviour in various vehicles, and its place in paints are reviewed. —S. G.

Aluminium Paint as a Primer for Woodwork. Charles Whelan (*Decorator*, 1932, 30, 50).—Advantages of aluminium paint for use on woodwork are summarized, especially in regard to moisture-proofing and protection from oxidation under the influence of light.—E. S. H.

Aluminium Powder and Coloured Bronzes in the Paint Industry. H. Rabate (*Peintures, Pigments, Vernis*, 1932, 9, 134–138, 154–159; *Res. Assoc. Brit. Paint Manuf. Rev.*, 1932, (27), 255).—Cf. *J.*, this volume, p. 102. Although aluminium itself is a good conductor of electricity, aluminium paints are poor conductors. They are non-poisonous, traces of aluminium being harmless in human organism. Surfaces painted with aluminium are easily preserved in good condition; an alkaline wash followed by water is recommended. American tentative specifications covering vehicles for outside paints and paints for wood are given. Aluminium paints are particularly suitable for the protection of aeroplanes and in naval construction. In the final instalment of this article, R. describes the use of aluminium paints as impermeabilizing agents for wood and as coatings for objects already covered with materials containing mineral oil. Aluminium powder itself has a variety of uses outside the paint industry; it may be used, together with mica powder, for making " satin " paper, and is also incorporated in special rubber preparations. The polished powder is used in lithography, and aluminium dust is used as a source of heat in the Thermit process. Aluminium in the form of leaf is used in decoration. A *bibliography* of 70 references, mostly American, gives a comprehensive view of what has been written on this subject.—S. G.

Tentative Specifications for Hard-Drawn Copper Transmission Cable (B 87–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 226–229; and *Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 666–669).—Cover bare concentric-lay cables of 19 strands or less composed of copper wires laid helically about an axis in one or more layers. The copper from which the wires are manufactured shall conform in quality and purity to the requirements for wire-bars in " Standard Specifications for Lake Copper Wire-Bars, Cakes, Slabs, Billets, Ingots and Ingot Bars " (B 4) or " Standard Specifications for Electrolytic Copper Wire-Bars, Cakes, Slabs, Billets, Ingots and Ingot Bars " (B 5). The wires shall be continuous throughout the length of the cable; no splices or brazes will be permitted in any wire after final drawing. Details of pitch and lay of the wires are set forth, and a table gives the requirements as to tensile properties. The variation in tensile strengths of the wires in any cable length (exclusive of the soft or annealed core) shall not exceed 5000 lb./in.^{2}. Unless otherwise specified, 19-strand cable shall be made with a soft or annealed copper core having the same diameter as the other wires in the cable. This soft or annealed wire must have a tensile strength of not more than 37,000 lb./in.^{2} nor less than 31,000 lb./in.^{2}, and a minimum elongation of 30% on 10 in. Details are given as to test samples and their preparation and the determination of tensile properties and electrical resistivity. Finally, the requirements in respect of dimensions and omissible variations, finish, packing and marking, and inspection, are set forth.—S. G.

Tentative Specifications for Copper Water Tube (B 88–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 242–246; and *Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 682–686).—Cover seamless copper tubes especially designed for plumbing purposes, underground water services, &c., but also suitable for copper coil water heaters, fuel oil lines, gas lines, &c. There shall be 3 classes of copper water tube, depending on the principal uses: Class A.—Designed for underground services and general plumbing purposes; Class B.—For general plumbing purposes; Class C.—For use with soldered fittings only. The tubes must be made from copper free from cuprous oxide, as determined by microscopic examination at a magnification of 75. Class A and B tubes when furnished in coils must be annealed after coiling; when furnished in straight lengths they must normally be hard-drawn, but may be furnished with a light temper if so specified. Class C tubes must be furnished in straight lengths, hard-drawn. The purity of the copper shall be at least 99·90%, as determined by electrolytic assay, silver being counted as copper. The tensile strength and grain-size requirements are:

	Nominal Temper.		
	Annealed.	Light Temper.	Hard-Drawn.
Tensile strength, lb./in.² min.	30,000	32,000	48,000
,, ,, ,, max.	...	40,000	...
Elongation on 4 in., % min.	25	...	...
Mean grain-size, mm.	0·025 to 0·075	...	...

Hammering, opening, bend, expansion, and hydraulic tests are specified. A table sets forth standard dimensions, weights, and wall thickness tolerances. —S. G.

Copper Pipe for Gas Distribution. Arthur F. Bridge and Frederic A. Hough (*Gas Age-Record*, 1932, 69, 503–513).—The use of copper pipe for gas distribution in California is discussed in some detail. Among subjects treated are: corrosion tests, electrolysis and pipe-line currents, effects of gases on copper, mechanical properties and construction methods, making service connections, installing copper mains and services inside steel, economics of copper pipe installations, the life of gas mains.—J. S. G. T.

Tentative Specifications for Copper-Base Alloys in Ingot Form for Sand-Castings (B 30–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 234–238; and *Proc. Amer. Soc. Test. Mat.*, 1932, 32, (I), 674–678).—Cover copper-base alloys in ingot form for sand-castings in 20 different compositions, regularly sold by the trade and arbitrarily given numbers of 1–20 inclusive, to differentiate them from one another. Care is to be taken that each lot of ingot metal is as uniform in quality as possible; the metal may be manufactured by any refining process that will yield a satisfactory quality of product. The requirements as to chemical composition are set forth in a table, whilst tables in an appendix (which does not constitute a part of the specifications) indicate the approximate physical properties that may be expected of carefully manufactured alloys of the formulæ indicated.—S. G.

Alloy Cables at Dagenham. Anon. (*Met. Ind.* (*Lond.*), 1932, 41, 513).—The cables over the River Thames at Dagenham in the South-East England Electricity Scheme consist of 7 cadmium–copper wires surrounded by 84 phosphor–bronze wires all of 0·0856 in. diameter. The breaking strength of the completed cable was more than 26 tons/in.².—J. H. W.

Tentative Specifications for Sand-Castings of the Alloy: Copper 80 per Cent.; Tin 10 per Cent.; Lead 10 per Cent. (B 74–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 230–233; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 670–673).—Cover alloy castings, the alloy being of copper, tin, and lead, and known commercially as 80 : 10 : 10, deoxidized with phosphorus. The castings are intended for use for bearings and bushings in the cast state. This alloy is also frequently used for castings which are required to resist some of the mild acids such as are found in mine waters. The alloy may be made by any approved method, and the castings shall be of uniform quality. The requirements as to chemical composition are:

	Minimum, %.	Desired, %.	Maximum, %.
Copper	77	79·25	...
Tin.	9	10	11
Lead	9	10	11
Zinc	0·25	0·75	1
Phosphorus	...	...	0·01
Antimony	...	...	0·50
Iron	...	...	0·25
Nickel	...	...	0·50
Sulphur	...	...	0·08
Aluminium	...	...	none*
Silicon	...	...	0·03
Total constituents other than copper, lead, tin, zinc, nickel, and antimony . . .	...	...	0·50

* The term "none" is defined as a maximum of 0·005%.

The requirements as to tensile properties are: tensile strength, 25,000 lb./in.^{2}; yield-point, 12,000 lb./in.^{2}; elongation, 6% on 2 in. The yield-point is to be determined as the stress producing an elongation under load of 0·5%, *i.e.*, 0·01 in. on a gauge length of 2 in. The requirements as to pressure tests shall be mutually agreed on by manufacturers and purchaser. Details are given of the test-specimens.—S. G.

A New British Standard for Gold Wares. Ernest A. Smith (*Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 143–144).—Cf. this *J.*, 1932, **50**, 662. A brief historical account of gold standards, referring particularly to the recent legalizing of 14 carat gold (58·5) as a standard for gold wares, and the abolishing of the two standards of 15 carat and 12 carat quality.—R. G.

Abrasion-Resistant Hard Lead for Chemical Use. Anon. (*Lead*, 1932, **2**, (1), 7).—"Plumbalun" consists of lead, containing in the surface layer a finely-grained abrasive, aloxite. The material is used in the chemical and process industries, particularly for the buckets and flights of conveyors handling wet, corrosive substances.—E. S. H.

Lead Fittings for the Modern House. Bernhardt E. Muller (*Dutch Boy Quarterly*, 1931, **9**, (2), 14–15).—Discusses the use of lead in mediæval and modern architecture.—E. S. H.

Lead Mould Used to Cure Rubber Hose. James L. Cutler (*Dutch Boy Quarterly*, 1931, **9**, (2), 10–11).—Lead is extruded from a lead press and the uncured rubber hose is admitted into the lead tube, being thus carried along by the extrusion of the lead sheath. The hose, inside the lead jacket, is filled with water, placed in a heater, and cured under steam pressure.—E. S. H.

The Return of Pewter. Anon. (*Dutch Boy Quarterly*, 1930, **8**, (2), 11–12).—A historical survey, discussing modern uses of pewter. Outstanding properties are the resistance to tarnish and the soft surface to the touch.—E. S. H.

Lead–Asbestos Anti-Vibration Pads for Rubber Mills. Anon. (*Lead*, 1932, 2, (2), 2).—Pads consisting of a lead envelope, enclosing ½ in. asbestos, are used for absorbing vibration in rubber mills.—E. S. H.

Tentative Specifications for Magnesium-Base Alloy Sheet (B 90–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 305–306, and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 691–692).—Cover commercial magnesium-base alloy sheet having a sp. gr. of 1·9 or less. Annealed sheet is the only temper covered by these specifications, inasmuch as the metal should be in this form for subsequent forming operations. Two typical alloys are specified, and are designated as alloys Nos. 1 and 2. The alloys may be made from virgin metal or from purified scrap metal of known composition. The requirements as to chemical composition are: No. 1.—aluminium 3·5–6·5; manganese, min., 0·2; copper, max., 0·1; other impurities, max., 0·3%; magnesium, remainder. No. 2.—manganese, min., 1·2; copper, max., 0·05; other impurities, max., 0·2%; magnesium, remainder. The requirements as to physical properties are: No. 1.—tensile strength, min., 33,000 lb./in.; elongation on 2 in., min., 10%. No. 2.—tensile strength, min., 28,000 lb./in.^{2}; elongation on 2 in., min., 5%.—S. G.

Tentative Specifications for Magnesium-Base Alloy Wrought Shapes (Other than Sheet) (B 91–32 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, **1932**, 307–308; and *Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 693–694).—Cover commercial magnesium-base alloy shapes, other than sheet, having a sp. gr. of 1·9 or less. Mechanical working operations develop the maximum properties without the need for subsequent heat-treatment. The alloys are designated as alloys No. 1 and 2, and the requirements as to chemical properties are the same as for the magnesium-base alloy sheet (see preceding abstract). The wrought sections shall conform to the following requirements as to tensile properties: No. 1.—tensile strength, min., 35,000 lb./in.^{2}; elongation on 2 in., min., 8%. No. 2.—tensile strength, min., 30,000 lb./in.^{2}; elongation on 2 in., min., 4%.—S. G.

Ten Years' Progress in Nickel–Copper Condenser Tubes. Anon. (*Nickel Bulletin*, 1932, **5**, 234–236).—Ten years ago, condenser tubes were usually made of 80 : 20 nickel–copper, but more recently the 70 : 30 alloy has been used. The behaviour of these tubes shows that these alloys are well suited to withstand the severe conditions imposed on them.—J. H. W.

Controlling Cinema Lighting. Anon. (*Nickel Bulletin*, 1932, **5**, 204).—A brief account of the application of nickel–copper alloys, particularly of "Ferry" wire, an alloy containing 44% of nickel, to the construction of lighting resistances.—J. H. W.

Utilitarian Uses of Monel Metal in Building Construction. Anon. (*Amer. Metal Market*, 1932, **39**, (152), 6; and (abstract) *Met. Ind.* (*Lond.*), 1932, **41**, 198).—Short note describing the application of Monel metal in building construction in the U.S.A.—J. H. W.

"Tungum" in the Motor Industry. Anon. (*Met. Ind.* (*Lond.*), 1932, **41**, 302).—"Tungum," an alloy of unspecified composition, is said to be a suitable material for replacing steel for industrial purposes, in that it can be annealed to the softness of copper and work-hardened to a strength comparable to that of mild steel. It can be welded, &c., and spun, and will take chromium plate without intermediate nickelling. It is a corrosion-resistant alloy, and has a 22-carat gold colour.—J. H. W.

Closed and Intermittent Contacts of Light, Heavy, and Difficultly-Fusible Materials. B. Duschnitz (*Helios* (*Fachzeit.*), 1932, **38**, 300–301).—A review of the metals and alloys used for electrical contacts and a discussion of the properties necessary for this purpose.—v. G.

XXIII.—BIBLIOGRAPHY

(Books marked * may be consulted in the Library.)

(Continued from pp. 109–110.)

Ageew, N. W. *Röntgenology of Metals and Alloys.* [In Russian.] Pp. 192. 1932. Leningrad: Kubutsch-Verlag. (Rbl. 3.50.)

***Becker, Karl.** *Hochschmelzende Hartstoffe und ihre technische Anwendung (Metallisch leitende Carbide, Nitride und Boride und ihre Legierungen).* 6 in. × 8½ in. Pp. 227, with 99 illustrations. 1933. Berlin: Verlag Chemie G.m.b.H. (Geb., M. 21.)

***British Standards Institution.** *British Standard Specification for Wrought Light Aluminium Alloy Bars for General Engineering Purposes (Specific Gravity not greater than* 2·85). (No. 477.) Med. 8vo. Pp. 13, with 1 figure. 1933. London: British Standards Institution, 28 Victoria St., S.W.1. (2*s.* 2*d.* post free.)

[This specification covers the alloy generally known as Duralumin.]

***British Standards Institution.** *British Standard Specification for Wrought Y-Alloy Bars for General Engineering Purposes (Specific Gravity not greater than* 2·85). (No. 478.) Med. 8vo. Pp. 13, with 1 figure. 1933. London: British Standards Institution, 28 Victoria St., S.W.1. (2*s.* 2*d.* post free.)

***Butts, Allison.** *A Text-Book of Metallurgical Problems.* Med. 8vo. Pp. xiv + 425, with 13 illustrations. 1932. New York: McGraw-Hill Book Co., Inc. ($4.00); London: McGraw-Hill Publishing Co., Ltd. (24*s.* net.)

Chodakow, J. W. *Principles of Electrochemistry and Corrosion Studies.* Pp. 56. 1932. Leningrad and Moscow: Energoisdat. (Rbl. 2.50.)

Clark, George L. *Applied X-Rays.* (International Series in Physics.) Second edition. Med. 8vo. Pp. xiv + 470. 1932. New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd. (30*s.* net.)

***Claus, Willi, und Goederitz, A. H. F.** Herausgegeben im Auftrage des Vereins Deutscher Giessereifachleute E.V. Berlin. *Gegossene Metalle und Legierungen. Grundlagen der metallgiessereitechnischen Werkstoffkunde.* 8½ in. × 11¾ in. Pp. xii + 346, with numerous illustrations. 1933. Berlin: M. Krayn · Technischer Verlag G.m.b.H. (Geb., M. 68.)

Davies, Earl Claudius Hamilton. *Fundamentals of Physical Chemistry.* 8vo. Pp. 377. 1932. Philadelphia, Pa.: Blackiston's Sons. ($2.75.)

Deretschej, E. G. *Production of Non-Ferrous Metal Alloys.* [In Russian.] Pp. 319. 1932. Moscow and Leningrad: Zwetmetisdat. (Rbl. 4.40.)

***Deutsche Materialprüfungsanstalten.** *Mitteilungen der deutschen Materialprüfungsanstalten. Sonderheft XXI: Arbeiten aus dem Staatlichen Materialprüfungsamt und dem Kaiser-Wilhelm-Institut für Metallforschung zu Berlin-Dahlem.* 4to. Pp. 102, illustrated. 1932. Berlin: Julius Springer. (R.M. 16.50.)

[Contains the following papers: O. Bauer u. M. Hansen: "Der Einfluss von dritten Metallen auf die Konstitution der Messinglegierungen. IV.—Der Einfluss von Aluminium. Ein Beitrag zur Kenntnis des Dreistoff-Systems Kupfer–Zink–Aluminium" (see *J.*, 1932, **50**, 426); M. Hansen u. B. Blumenthal: "Zur Kenntnis der Zweistoffsysteme des Aluminiums mit Kadmium, Blei und Wismut" (see *J.*, 1932, **50**, 151); E. Schmid u. G. Siebel: "Röntgenographische Bestimmung der Löslichkeit von Mangan in Magnesium" (see *J.*, 1932, **50**, 155); M. Straumanis u. J. Weerts: "Über die β-Umwandlung in Kupfer–Zink– und Silber–Zink–Legierungen.—I." (see *J.*, 1932, **50**, 158); M. Straumanis u. J. Weerts: "Über die Ausscheidung der α-Phase im β-Messing" (see *J.*, this volume, p. 12); G. Wassermann: "Über die Umwandlung des Kobalts" (see *J.*, 1932, **50**, 338); W. Boas u. E. Schmid: "Über die Struktur der Oberfläche geschliffener Metallkristalle" (see *J.*, 1932, **50**, 552); V. Caglioti u. G. Sachs: "Die Walztextur von Zink und Magnesium" (see *J.*, 1932, **50**, 363); Erich Seidl: "Die Bedeutung der Struktur für die bleibende Formänderung von Kristallen" (see *J.*, this volume, p. 128); V. Caglioti u. G. Sachs: "Die Entwicklung von Eigenspannungen durch Dehnen" (see *J.*, 1932, **50**, 291); W. Fahrenhorst u. E. Schmid: "Über die plastische Dehnung von α-Eisenkristalle"; W. Fahrenhorst, K. Matthaes, u. E. Schmid: "Über die Abhängigkeit der Dauerfestigkeit von der Kristallorientierung" (see *J.*, this volume, p. 5); E. Schmid u. M. A. Valouch: "Über sprunghafte Translation von Zinkkristallen" (see *J.*, 1932, **50**, 342); M. A. Valouch: "Bemerkungen zur Walztextur von Zink" (see *J.*, 1932, **50**, 363); W. Boas u. E. Schmid: "Laue-Diagramme mit grossen Ablenkungswinkeln" (see *J.*, 1932, **50**, 165); G. Wassermann: "Über eine Heizvorrichtung für Röntgenpräparate" (see *J.*, 1932, **50**, 246); E. Schmid: "Über die Bedeutung der Röntgenstrahlinterferenzen für die Metallkunde" (see *J.*, this volume, p. 18); J. Weerts: "Präzisions-Röntgenverfahren in der Legierungsforschung" (see *J.*, 1932, **50**, 486); W. Boas u. E. Rupp: "Über Elektronenbeugung an reinem und an passiven Eisen"; E. Schmid u. G. Wassermann: "Röntgenographische Untersuchungen an elektrolytisch-oxydiertem Aluminium" (see *J.*, this volume, p. 84); B. Blumenthal u. M. Hansen: "Über die Einfluss von Kadmium und Blei auf die Eigenschaften des Aluminiums" (see *J.*, this volume, p. 120); O. Bauer u. P. Zunker: "Einfluss von Temperatur und Fremdmetallen auf die Walzbarkeit von Zink" (see *J.*, 1932, **50**, 701).]

***Eggert, J., und E. Schiebold.** Herausgegeben von, im Auftrage der Deutschen Gesellschaft für Technische Röntgenkunde beim Deutschen Verband für die Materialprüfungen der Technik. *Wechselwirkung Zwischen Röntgenstrahlen und Materie in Theorie und Praxis.* (Röntgentagung in Münster 1932.) (Ergebnisse der technischen Röntgenkunde. Herausgegeben von J. Eggert und E. Schiebold. Band III.) Med. 8vo. Pp. ix + 211, with 114 illustrations in the text. 1933. Leipzig: Akademische Verlagsgesellschaft m.b.H. (Brosch., M. 17; geb., M. 18.80.)

[Contains the following: M. v. Laue: "Die Röntgenstrahlen in ihrer Stellung zur allgemeinen physikalischen Theorie (Einführender Vortrage)"; P. Debye: "Streuung von Röntgen- und Kathodenstrahlen"; W. Heissenberg: "Über die Streuung von Röntgenstrahlen an Molekülen und Kristallen"; R. W. James: "Die absolute Bestimmung der Atomformfaktoren durch Versuche mit Kristallen"; H. Mark: "Die Dispersion der Röntgenstrahlen"; D. Coster: "Energieniveaus in Atomen und röntgenspektroskopische Forschung"; W. Noddack: "Die Anwendung der Röntgenspektroskopie in der chemischen Analyse"; J. Eggert und E. Schiebold: "Neuere Röntgentechnik (Einführender Vortrage)"; H. Seemann: "Erregung der Röntgenstrahlen"; H. Stintzing: "Die Vakuumtechnik offener Entladungsröhren"; O. Berg und W. Ernst: "Über einen Röntgenspektrographen und eine Spektraluntersuchungsröhre"; O. Fischer: "Neue Apparate für die Materialuntersuchung mit Röntgenstrahlen"; H. Behnken: "Die Anwendung extrem hoher Spannungen zur Erzeugung sehr schneller Kathodenstrahlen und sehr harter Röntgenstrahlen"; F. Luft: "Radiographie mit Gammastrahlen"; M. Widemann: "Moderne Röntgen-Prüfmethoden an Schwermetallerzeugnissen"; R. Berthold: "Neue Ergebnisse der Gemäldeprüfung mit Röntgenstrahlen"; F. Regler: "Quantitative Messungen elastischer Spannungen an technischen Werkstücken und Stahlbauten mit Hilfe von Röntgenstrahlen"; W. Schmidt: "Über thermische Ausdehnungsmessungen an Eisen mittels Röntgenstrahlen"; E. Schiebold: "Kristallstrukturforschung 1930–1932."]

***Frommer, Leopold.** *Handbuch der Spritzgusstechnik der Metallegierungen einschliesslich des Warmpressgussverfahrens. Grundlagen des Spritzgussvorganges. Konstruktionsprinzipien der Spritzgussmaschinen und Formen nebst Ausführungsbeispielen. Werkstoffkunde. Werkstattspraxis.* Med. 8vo. Pp. xvii + 686, with 244 illustrations. 1933. Berlin: Julius Springer. (Geb., R.M. 66.)

***Greaves, Richard Henry, and Harold Wrighton.** *Practical Microscopical Metallography.* Second edition, revised and enlarged. Med. 8vo. Pp. xi + 256, with 311 illustrations. 1933. London: Chapman and Hall, Ltd. (18*s.* net.)

*Gregg, J. L. *The Alloys of Iron and Molybdenum.* (Alloys of Iron Research, Monograph Series.) Med. 8vo. Pp. xii + 507, with 154 illustrations. 1932. New York: McGraw-Hill Book Co., Inc. ($6.00); London: McGraw-Hill Publishing Co., Ltd. (36*s.* net.)

*Institution of Mining and Metallurgy. *Transactions of the Institution of Mining and Metallurgy. General and Personal Index. Vols. XXXI to XL.* 1921–1931. Compiled and edited by Geo. Fredk. Bird. Demy 8vo. Pp. 143. [1933.] London: The Institution, 225 City Rd., E.C.1.

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

Kieser, August Jean. Herausgegeben von. *Handbuch der chemisch-technischen Apparate, maschinellen Hilfsmittel und Werkstoffe. Ein lexikal. Nachschlagewerk für Chemiker und Ingenieure.* Lieferung 1. Pp. 96. 1932. Leipzig: Otto Spamer. (Lfg. M. 8.50.)

Koppel, J. Herausgegeben von. *Chemiker-Kalender. Ein Hilfsbuch für Chemiker, Physiker, Mineralogen, Industrielle, Pharmazeuten, Hüttenmänner usw.* Begrundet von Rudolf Biedermann. Fortgef. von Walter Roth. Jahrgang 54, 1933. In 3 Tln. 8vo. Teil 1: Taschenbuch. Pp. viii + 56 Bl. Schreibpap. + 105. Teil 2: Dichten, Löslichkeiten, Analyse. Pp. iv + 708. Teil 3.—Theoret. Teil. Pp. v + 650 + 22. 1933. Berlin: Julius Springer. (In 2 Bände, geb., Lw. nn. M. 20.)

La Motte, Frank L., and others. *Hydrogen-Ion Concentration.* 8vo. 1923. London: Baillière, Tindall, and Cox. (21*s.* 6*d.* net.)

Library Association. *The Subject Index to Periodicals,* 1931. Roy. 4to. Pp. x + 267. 1932. London: The Library Association. (70*s.*)

*Masing, G. *Ternäre Systeme. Elementare Einführung in die Theorie der Dreistofflegierungen.* Med. 8vo. Pp. viii + 164, with 166 illustrations. 1933. Leipzig: Akademische Verlagsgesellschaft m.b.H. (Brosch., M. 8.30; Kart, M. 9.60.)

Nickel-Informationsbüro. Herausgegeben vom Leitung: M. Wachlert. *Nickel-Handbuch. Nickelstahl.* 1 Teil: *Baustähle. Nickel–Kupfer.* Pp. 46. 2 Teil: *Legierungen über* 50% *Nickel.* Pp. 32. 1932. Frankfurt a. M.: Nickel-Informationsbüro.

*Plant, C. Hubert. *The Metallography of Iron and Steel.* Demy 8vo. Pp. ix + 211, with 71 illustrations. 1933. London: Sir Isaac Pitman and Sons, Ltd. (12*s.* 6*d.* net.)

Royal Society. *Year-Book of the Royal Society of London,* 1933. (No. 37.) Demy 8vo. Pp. vi + 218. 1933. London: Harrison and Sons, Ltd. (5*s.*)

*Schumacher, Earle E., and Ellis, W. C. *The Deoxidation of Copper with Various Metals.* (Bell Telephone System Technical Publications, Metallurgy, Monograph B 707.) Med. 8vo. Pp. 8, with 9 illustrations. 1932. New York: Bell Telephone Laboratories, Inc., 463 West St.

[A reprint of a paper entitled "The Deoxidation of Copper with Metallic Deoxidizers, Calcium, Zinc, Beryllium, Barium, Strontium, and Lithium," read before the Electrochemical Society. See this *J.*, 1932, **50**, 580.]

*Schweiz. Verband für die Materialprüfungen der Technik. *Ergebnisse der an der Eidg. Materialprüfungsanstalt in den Jahren* 1930/31 *durchgeführten Versuche mit autogen und elektrisch geschweissten Stäben.* (Bericht Nr. 19. Diskussionsbericht Nr. 46 der Eidg. Materialprüfungs-

anstalt.) $8\frac{1}{4}$ in. × $11\frac{3}{4}$ in. Pp. 39, with 67 illustrations. 1932. Zürich: Schweiz. Verband für die Materialprüfungen der Technik.

***Schweiz. Verband für die Materialprüfungen der Technik.** *Härtekurs.* Veranstaltet vom Verein Schweiz. Maschinen-Industrieller und vom Schweiz. Verband für die Materialprüfungen der Technik in den Räumen der A.-G. Brown, Boveri & Cie., Baden (Aargau), 4 und 5 September, 1931. Kursleiter Hans Stäger. (Bericht Nr. 21. Diskussionsbericht Nr. 64. der Eidg. Materialprüfungsanstalt.) $8\frac{1}{4}$ in. × $11\frac{3}{4}$ in. Pp. 55, with numerous illustrations. Zürich: Schweiz. Verband für die Materialprüfungen der Technik.

***Society of Chemical Industry.** *Reports of the Progress of Applied Chemistry, Volume XVII*, 1932. Demy 8vo. Pp. 721. 1932. London: Society of Chemical Industry, Central House, 46–47 Finsbury Sq., E.C.2. (Members, 7*s.* 6*d.*; non-members, 12*s.* 6*d.*)

[Reports of non-ferrous metallurgical interest are: "Non-Ferrous Metals," by A. R. Powell; and "Electochemical and Electrometallurgical Industries," by J. H. West.]

XXIV.—BOOK REVIEWS

(Continued from pp. 111–112.)

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

Handbuch der technischen Elektrochemie. Herausgegeben von Victor Engelhardt. Erste Band. 2 Teil: **Die technische Elektrolyse wässriger Lösungen. A.—Die technische Elektrometallurgie wässriger Lösungen, Gold, Silber, Kupfer, verschiedene Metalle.** Bearbeitet von G. Eger, M. Hosenfeld u. W. Schopper. Med. 8vo. Pp. viii + 331, with 89 illustrations. 1932. Leipzig: Akademische Verlagsgesellschaft m.b.H. (Brosch., M. 30; geb., M. 32.)

The publication of this second part completes volume I of the "Handbook." It follows the same lines as Part I, of which a notice appeared in this *Journal*, 1931, 47, 506, and completes the account of the production of the metals by electrolysis of their aqueous solutions. The electrolysis of gold and silver is dealt with in two short monographs, each occupying about 20 pages, whilst four-fifths of the book is devoted to copper. This section is very exhaustive, both from the practical and theoretical aspects, and it is well illustrated by line drawings and half-tone figures of actual plant.

The last nine pages deal with the production of gallium, indium, thallium, tellurium, tungsten, molybdenum, and vanadium. These metals are of very little industrial importance, and the last three, which have some special applications, cannot be produced by electrolysis of aqueous solutions. This part of volume I is considerably smaller than was originally intended, owing to the omission of the section on electroplating and the related processes, which had been contemplated. This section will now form an appendix to volume III, and volume II, dealing with the application of electrolysis of aqueous solutions to the chemical industry, is already in the press.

The enormous amount of work involved in compiling this handbook—volume I has taken 4 years—will, we feel sure, be accounted well worth while by electrometallurgists the world over.—C. J. SMITHELLS.

Travail de l'Aluminium et de ses Alliages. La Fonderie. Demy 8vo. Pp. 163, with 53 illustrations. Paris: L'Aluminium français, 23 bis rue de Balzac.

Gas, electric resistance, and hammer welding, and various methods of soldering are described from an impartial point of view. The possibility of arc welding is not mentioned. Calculations for riveted joints in aluminium and Duralumin are explained.—H. W. G. H.

Who's Who, 1933. An Annual Biographical Dictionary with which is incorporated "Men and Women of the Time." Eighty-fifth year of Issue. 8vo. Pp. xlviii + 3648. 1933. London: A. & C. Black, Ltd. (60*s.*)

Tens of thousands of biographies are included in this invaluable annual publication which must find a place on the desk of everyone who has to deal with men and affairs.—ED.