

METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

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Part 5

I.—PROPERTIES OF METALS

(Continued from pp. 129-137.)

Aluminium. Physical and Chemical Characteristics. S. R. Carter (*Times Trade and Eng. Suppt.*, 1937, 40, (877), ii).—A brief summary, emphasizing the high reflectivity and conductivity, and the protective action of the oxide film.

—H. W. G. H.

***The Effect of Annealing Procedure on the Tensile Properties of Arsenical Copper Bar.** E. F. G. Gilmore (*Bull. Indian Inst. Research*, 1936, (3); *Current Sci.*, 1937, 5, 402).—The results are given of a series of tests carried out to ascertain the effects on the tensile properties of (a) annealing temperature and conditions; (b) period of annealing under constant conditions; and (c) size of test-pieces. A short description is given of the construction of the annealing furnace through which either steam or nitrogen could be passed continuously. It was found that constant conditions of annealing were obtained by heating for not less than 60 minutes at 750° C. and for 120 minutes at 650° C. Longer periods of annealing had no effect on the process. Further, the properties of the specimens annealed at the lower temperature were more satisfactory. No differences in the tensile stress were observed in the experiments employing steam or nitrogen, but the specimens heated in steam remained comparatively bright while those heated in nitrogen were tarnished a dull brown. The steam method is therefore recommended for general practice.—S. G.

***Superconductivity of Lanthanum.** K. Mendelsohn and J. G. Daunt (*Nature*, 1937, 139, (3515), 473-474).—Experiments are described which establish the superconductivity of lanthanum, the transition point in zero field being 4.71° K. This is the first example of superconductivity in an element of group IIIa, and the significance of this is discussed.—B. C.

***The Exact Measurement of the Specific Heats of Metals at High Temperatures. XXVII.—The Specific Heats and Electrical Resistance of Lanthanum.** F. M. Jaeger, J. A. Bottema, and E. Rosenbohm (*Proc. K. Akad. Wet. Amsterdam*, 1936, 39, (8), 921-927).—[In English.] Lanthanum occurs in 3 modifications: a hexagonal form, a cubic form, and a modification stable below -163° C. Values of the mean specific heat of lanthanum between about 21° and 750° C. are given. Differential heat-capacity curves indicate discontinuities at 548°, 665°, and at 709° C. The temperature-resistance curve shows an additional discontinuity at about 420° C.—J. S. G. T.

Lead: The Material, Its Manufacture and Properties. — (*Lead Industries Develop. Council Tech. Publ., Bull. No. 2*, 1937, 19 pp.).—Methods of manufacturing lead sheet and pipe and soft solders are given together with standard specifications for these materials and tables of general properties, thermal properties, electrical characteristics, mechanical properties, and eutectic compositions containing lead.—A. R. P.

***On the Fluid Deformation of Lead Due to Torsion.** Masujirō Nakahara (*Trans. Soc. Mech. Eng. Japan*, 1936, 2, (8), 332-335).—[In Japanese, with English summary in suppt., pp. 90-91.] An investigation of the fluid deformation of lead due to torsion, when its flow reaches the stationary condition or when the creep velocity becomes constant, shows that the relation between the first constant twisting moment and the angular velocity of twisting at the

* Denotes a paper describing the results of original research.

† Denotes a first-class critical review.

torsion with constant angular velocity is the same as the relation between the final constant angular velocity and the twisting moment at the torsion with constant twisting moment. A formula is given for calculating the shearing stress at the surface of round test-pieces.—J. W. D.

***Researches on the Experimental Determination of the Free Path of the Electrons in Lead and Cadmium.** Leonhard Riedel (*Ann. Physik*, 1937, [v], 28, (7), 603-631).—Wires of pure lead and cadmium down to 10^{-1} mm. diameter were prepared by sucking the molten metal into glass capillaries, which were then heated and drawn down to thin threads. The electrical resistance of the metal in these threads was then measured at 20° abs.—v. G.

***The Exact Measurement of the Specific Heats of Metals at High Temperatures. XXV.—The Specific Heats and the Allotropism of Nickel Between 0° and 1000° C.** M. Ewert (*Proc. K. Akad. Wet. Amsterdam*, 1936, 39, (7), 833-838).—Empirical formulæ for the specific heat of nickel at various temperatures are given for the ranges: 0° - 350° C. (α -nickel); 345° - 351° C. (α' -nickel); 360° - 1000° C. (β -nickel). The heat-effect of the transformation $\alpha \rightleftharpoons \alpha'$ at 345° C. is of the order 0.08 cal.; that of $\alpha' \rightleftharpoons \beta$ at 351° C. is of the order 0.31 cal.—J. S. G. T.

***On Metallic Scandium.** Werner Fischer, Karl Brünger, and Hans Grieneisen (*Z. anorg. Chem.*, 1937, 231, (1/2)).—Pure scandium has been prepared by electrolysis of scandium chloride in a fused eutectic mixture of potassium and lithium chlorides using molten zinc as cathode, filtering the resulting 2% scandium-zinc alloy through a porous tungsten crucible in an atmosphere of hydrogen to remove oxide, and then distilling off the zinc, potassium, and lithium in a high vacuum. The metallic residue of scandium melted at about 1400° C. and had a density of about 3.1.—A. R. P.

***Measurements of the True Specific Heats of Silver, Nickel, β -Brass, Quartz Crystal, and Quartz Glass Between $+50^{\circ}$ C. and 700° C. by an Improved Method.** Helmut Moser (*Physikal. Z.*, 1936, 37, (21), 737-753).—Values of the true specific heats, c_p , of silver, nickel, β -brass, quartz crystal, and fused quartz are given at intervals of 50° C. between 0° and 700° C. Anomalies in values of C_p for nickel, β -brass, and quartz crystal associated with transformations extend over a larger temperature range than is ordinarily considered to be the case from evidence derived from cooling curves. Empirical relations between t and c_p , C_p and C_v for silver are given.—J. S. G. T.

***A New Phenomenon in the Superconducting Transition of Tantalum and of Tin.** Francis B. Silsbee, Russell B. Scott, and Ferdinand G. Brickwedde, (*J. Research Nat. Bur. Stand.*, 1937, 18, (3), 295-314; and *Research Paper No. 977*).—The transition from the superconducting to the normal resisting state under certain conditions is found not to be continuous, but to include a hitherto unsuspected spontaneous increase in resistance followed by a slower decrease. The spontaneous decrease in resistance usually proceeds for several minutes in a succession of steps until only a fraction of its crest value remains. This crest value of the transient resistance is sometimes 75% of the normal. After such an effect has occurred, it will not occur again when the same conditions are re-established unless, in the meantime, the temperature has been decreased or else a time interval of at least $\frac{1}{2}$ hr. has elapsed. These spontaneous changes in resistance can be initiated by a step upward in temperature, in current, or in magnetic field and proceed thereafter as described above, while all three external conditions are maintained constant. The combination of temperature, field, and current at which this phenomenon appears has been studied, and the progress of the resistance change under various conditions noted. The effect is pronounced only when the current is relatively large (about 2 amp. in tin wire, diam. 0.022 cm.). The transition temperatures of two specimens of hard-drawn tantalum wire were found to be

3.961° and 4.068° K., respectively. The presence of a transverse magnetic field depressed the transition temperature at a rate of 1° K. per 1250 oersteds.—S. G.

***A New Phenomenon in the Superconducting Transition of Tantalum and of Tin.** F. B. Silsbee, R. B. Scott, and F. G. Brickwedde (*Nature*, 1937, 139, (3512), 325).—See preceding abstract.—B. C.

Influence of Magnetic Fields on Persistent Currents in Superconducting Single Crystals of Tin. E. F. Burton and K. C. Mann (*Nature*, 1937, 139, (3512), 325–326).—The superconducting galvanometer is used for detecting the critical magnetic field which restores normal resistance to a superconductor held below the transition temperature.—B. C.

***The Photoelectric Schottky Effect in Films of Sodium and Potassium on Tungsten.** R. C. L. Bosworth (*Trans. Faraday Soc.*, 1937, 33, (4), 590–596).—Dilute films of potassium deposited by condensation on tungsten have a low mobility, whereas concentrated films and the dilute films formed from them by evaporation have a high mobility which suggests that the last-named type consists of a network of veins rich in potassium. The photoelectric emission under white light for the first two types is in accordance with Schottky's theory, whereas that for the third type shows much greater variation, indicating that it is of a very inhomogeneous nature. The variation of thermionic and photoelectric emission from dilute films of sodium shows that the Schottky coeff. is 2–3 times the normal value.—A. R. P.

***Influence of Internal Heat Stresses on the Endurance Strength of Metals.** A. Thum and A. Erker (*Z. V.d.I.*, 1937, 81, (9), 276–278).—Tests on steel rods show that internal stresses produced by heat-treatment may, like mechanical stresses, improve or reduce the endurance strength according to whether they are compression or tensile stresses.—v. G.

***The Effect of Pressure on the Modulus of Rigidity of Several Metals [Aluminium, Copper, Nickel, Monel Metal, Steel] and Glasses.** Francis Birch (*J. Applied Physics*, 1937, 8, (2), 129–132).—The effect of pressure on the modulus of rigidity was determined by a dynamic method for aluminium, copper, nickel, Monel metal, and steel and two glasses, to 4000 kg./cm.². The corrections due to the viscous motion of the pressure medium are computed approximately and shown to be negligible. Absolute values of the dynamical Young's modulus and modulus of rigidity are also given, and the derived compressibilities compared with directly measured compressibilities.—S. G.

***On the Elastic After Effect in Torsion.** Tarō Ueda (*Trans. Soc. Mech. Eng. Japan*, 1936, 2, (8), 401–404).—[In Japanese, with English summary in suppt., pp. 109–110.] The elastic after effect of cold-twisted bars of Armeo iron, 7 carbon steels, and copper were measured to an accuracy of 10⁻⁶ degree/cm. or 10⁻⁵ radian/cm. by means of a mirror on the test-piece, a telescope, and a scale. The twisting angles were 0.05, 0.2, 0.4, and 0.6 π /cm. and the dimensions of the test-piece 8 mm. diam. by 200 mm. gauge-length. Results of the measurements obtained give the relation between the amount of recovery increase with the degree of cold-twisting, and show that the amount of recovery increases with the degree of cold-twisting, and in the case of copper, Armeo iron, and certain steels their changes are proportional to each other.—J. W. D.

***Plastic Behaviour of Metals in the Strain-Hardening Range [—I].** A. Nádai (*J. Applied Physics*, 1937, 8, (3), 205–212).—The stress-strain relations for the cold-working of the ductile metals are described for a group of cases, assuming that the stresses under which they yield plastically depend only on the permanent parts of the strains, leaving out of consideration the influence of the elasticity and of the speed of the plastic deformation. The behaviour of the metals in the strain-hardening range is expressed by means of a strain-hardening function which connects the octahedral shearing stress

with the octahedral unit shear. These variables are defined for strains of finite magnitude.—S. G.

***Plastic Behaviour of Metals in the Strain-Hardening Range.**—II. Evan A. Davis (*J. Applied Physics*, 1937, 8, (3), 213-217).—In order to observe the behaviour of a material under various conditions of strain-hardening, copper bars were tested in tension, in compression, and in torsion. The results of the different tests were plotted on the same set of coordinates as a means of correlation. The shearing stress in the octahedral planes was used as ordinate and the corresponding octahedral shearing strain was used as abscissa. Good agreement was found between the curves for tension, compression, and torsion for small strains, but for very large strains (as obtained near the ultimate strength of annealed copper) the curves tend to separate to a marked degree. Hardness readings were also taken to check the relation between hardness and strain.—S. G.

***Modifications and Transformations of Metals, by Heating in Vacuo or in Different Gases** [—I-II]. Jean J. Trillat and Shigéo Oketani (*J. Phys. Radium*, 1937, [vii], 8, (2), 59-66; (3), 93-98).—(I.—) Employing the method of analysis by fast electrons, it is shown that thermal treatment of a pure metal, e.g. gold leaf, in *vacuo*, in an inert gas, or in air or nitrogen, can produce a hexagonal crystalline structure on the gold surface. The phenomenon is interpreted in terms of the mobility of the superficial atoms, and its significance in the phenomena of adsorption and catalysis is briefly discussed. Recrystallization of the gold is effected by heat-treatment at about 700° C. or by prolonged heating at 600°-650° C. (II.—) The marked effect of traces of impurities such as copper and silver on the absorption of oxygen by a gold film is shown. By heating gold in air, evidence is obtained by the method of electron diffraction, of the production of a compound of gold which is unstable at ordinary temperatures. Silver, possessing a lattice resembling that of gold, behaves like the latter metal, when heated in *vacuo* or in an inert gas. The effect of passage of a beam of electrons for long periods through thin films of gold, silver, platinum, and aluminium, and the effect of the nature of the substrate are briefly discussed.—J. S. G. T.

Oxidation of Fusible Elements. G. W. Nicholson (*Elect. Rev.*, 1937, 120, (3097), 500).—The formation of oxide coatings on the elements of fusible cut-outs affects the fusing current and the time needed for rupturing. The conditions controlling the oxidation of the metals commonly used are briefly discussed.—J. C. C.

†**Properties of Heat-Insulating Materials.** H. Reiher (*Internat. Assoc. Test. Mat. Conf. London, Advance Proof, Group D*, 1937, 50-53).—[In German.] Data relating to the thermal conductivity, its dependence on water content, water absorption, radiation coeff., coeff. of expansion, resistance to pressure and shock of a number of thermal insulators including aluminium, iron, and copper are briefly discussed. A bibliography of 20 references is given.—J. T.

On Fundamentally Wrong Methods for Establishing Non-Existence of Polymorphy. A. L. Th. Moesveld (*Proc. K. Akad. Wet. Amsterdam*, 1937, 40, (2), 155-164).—[In English.] Methods used in the study of allotropic phenomena are discussed. The conclusion that substances can exist in one single modification only may not be reached from experiments based on those methods. M. points out the importance of the phenomena of retardation for reconciling the existence of allotropic modifications and the smoothness of graphs of physical properties of a solid as a function of temperature. Results are given of measurements of the electrical conductivity of tin between -78° and +99° C.; their importance in this connection is due to the fact that the values found can be represented by a smooth curve, although tin has a transition point at 13.2° C.—S. G.

Recent Work on the Physical Properties of Thin Metal Films. Herbert Lange (*Kolloid-Zeit.*, 1937, 78, (Jan.), 109–114).—S. G.

*Secondary Electron Emission From Thin Metal Films Deposited on Glass. A. Afanasjeva, P. Timofejew, and A. Ignatow (*Tech. Physics U.S.S.R.*, 1936, 3, (12), 1011–1019).—[In German.] The secondary electron emission from thin films of molybdenum, nickel, and tungsten deposited on glass is found to be less than that from the respective massive metals, and to decrease with decreasing thickness of film.—J. S. G. T.

The Effect of Extension on the Electrical Conductivity of Metals. E. Lopukhin (*Tech. Physics U.S.S.R.*, 1937, 4, (1), 25–35).—[In German.] Experimental results relating to the change of electric resistance of polycrystalline samples of steels containing different proportions of carbon, of special alloy steels, and of copper, aluminium, zinc, brass, and bronze, when subjected to either elastic or plastic extension are discussed. The effect of the addition of alloying metals is in conformity with Mathiessen's rule. The proportional changes of the ohmic and specific resistances are much greater in the elastic than in the plastic range of extension.—J. S. G. T.

On the Theory of Superconduction. L. Landau (*Physikal. Z. Sowjetunion*, 1937, 11, (2), 129–140).—[In German.] It is shown mathematically that the thermodynamically-stable condition of a superconductor in a magnetic field whose mean value differs from zero consists of a series of superposed alternate layers which are alternately super- and non-super-conducting.—J. S. G. T.

*Transition Curve for the Destruction of Superconductivity by an Electric Current. L. W. Shubnikov and N. E. Alexejevski (*Nature*, 1936, 138, (3497), 804).—A method of investigating the superconductivity transition curve of tin, which depends on the higher thermal conductivity of He II, is described. The results show good agreement for the critical field, and the form of the transition curve is more fully determined.—B. C.

Sharpness of the Magnetic Curie Point. N. F. Mott and H. H. Potter (*Nature*, 1937, 139, (3514), 411).—A discrepancy between the results obtained for the sharpness of the Curie point is resolved in terms of the electronic theory.—B. C.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 137–144.)

*Diffusion of Copper and Magnesium into Aluminium. R. M. Brick and Arthur Phillips (*Metals Technology*, 1937, 4, (2); *A.I.M.M.E. Tech. Publ.* No. 781, 17 pp.).—The diffusion of copper and magnesium into solid aluminium was studied by a method in which a rod of pure aluminium was brought into clean contact with molten aluminium-magnesium or aluminium-copper eutectic alloys contained in a crucible which was then chilled. The resulting complex specimens were then heated at temperatures between 365° and 540° C. for known times during which the magnesium or copper diffused into the aluminium. The depth-concentration limits in the diffusion zone were then determined micrographically by reheating the specimens at lower temperatures so that precipitation of a second constituent occurred in those regions where the concentration exceeded the known solubility limits at the temperatures concerned. The diffusion coeffs. (D) at the different temperatures were calculated, and the heats of diffusion obtained from the Langmuir-Dushman equation, and from the slope of the lines obtained by plotting $\log D$ against $1/T$. Micrographic evidence suggested a possible anisotropy of the diffusion of copper in single crystals of aluminium.—H.-R.

*New Strong Light Alloys.—I. Isamu Igarashi and Goro Kitahara (*Sumitomo Kinzoku Kōgyō Kenkyū Hōkoku (Res. Rep. Sumitomo Metal Industries, Ltd.)*, 1937, 2, (9), 883–899).—[In Japanese.] A study was made of the effect

of heat-treatment of certain light ternary alloys: Super-Duralumin, Sander alloy, and "E" alloy, and their mechanical properties were investigated. The results are given in tables and diagrams.—S. G.

***On the Age-Hardening Mechanism in Silver-Aluminium Alloys.** Masahide Kosaki (*Sumitomo Kinzoku Kōgyō Kenkyū Hōkoku (Res. Rep. Sumitomo Metal Industries, Ltd.)*, 1937, 2, (9), 832-832).—[In Japanese.] See *Met. Abs.*, 1936, 3, 451.—S. G.

***Effect of Titanium on Aluminium Alloys.** Hideo Nishimura and Nobuo Kagiwada (*Suiyokwai-Shi (Trans. Min. Met. Alumni Assoc.)*, 1936, 9, (2), 95-98).—[In Japanese.] It is well known that in cast materials a very fine structure can be obtained by the addition of a very small amount of titanium to some aluminium alloys. The authors have also found grain-refinement due to titanium in aluminium-copper alloys. From an investigation of the equilibrium diagram of the system aluminium-copper-titanium it was found that a peritectic reaction line in the system liquid + $TiAl_3 \rightleftharpoons Al$ exists along the aluminium-binary system; consequently this reaction occurs immediately after the primary separation of aluminium or $TiAl_3$. It is concluded that grain-refinement due to titanium in aluminium-copper alloys is produced by this reaction.—AUTHORS.

***Fatigue Tests of Some Light Alloys.** Isamu Igarashi and Reijiro Taketomi (*Sumitomo Kinzoku Kōgyō Kenkyū Hōkoku (Res. Rep. Sumitomo Metal Industries, Ltd.)*, 1937, 2, (9), 900-910).—[In Japanese.] Endurance tests were carried out with Ono's rotating bending machine and also with the Schenk and Upton Lewis alternate bending machines. The differences between the values for fatigue limit obtained by these machines, and the form and surface conditions of the specimens, are discussed.—S. G.

Light Aluminium Alloys. Composition and Properties. P. M. Haenni (*Times Trade and Eng. Suppl.*, 1937, 40, (877), vi-viii).—The alloys are divided into 3 main groups, aluminium-copper, aluminium-silicon, and aluminium-magnesium. Each group is subdivided into types, according to the mechanism by which the improved properties are obtained—the formation of solid solutions or of compounds, with or without the addition of other elements. Examples are given of commercial alloys of each type and the characteristic properties are reviewed.—H. W. G. H.

***Precipitation-Hardening in the System Copper-Indium and the Effect Thereon of Nickel and Cadmium.** Friedrich Weibke and Ilse Pleger (*Z. anorg. Chem.*, 1937, 231, (1/2), 197-216).—The solubility of indium in copper is 19.2% at 574° C., 7.8% at 400° C., and about 3% at room temperature. If an alloy containing 12.8% indium is homogenized at 650° C. for 85 hrs., quenched and aged at 300° C., its Brinell hardness increases from 77 to 285 in 101 hrs. and then decreases, reaching 172 after 246 hrs.; at 400° C. a hardness of 212 is reached in 52 hrs. Similarly homogenization of a 15.2% indium alloy at 690° C., followed by quenching and ageing at 300° C., results in an increase in hardness from 70 to 257 in 100 hrs. and then a decrease to 79 in a further 98 hrs. The solubility of indium in nickel is 14.5% at the peritectic temperature (883° C.), 8% at 830° C., 5% at 740° C., and 0.7% at 400° C. Addition of 8-15% of indium to alloys with a copper: nickel ratio of 8-70: 84-25 produces relatively little precipitation-hardening and what little does occur rapidly disappears on prolonging the heating; this behaviour is ascribed to the reduction of the solubility of indium in copper by the nickel. Cadmium has a similar effect to nickel.—A. R. P.

***Fatigue Properties of Five Cold-Rolled Copper Alloys.** William B. Price and Ralph W. Bailey (*Metals Technology*, 1937, 4, (2); *A.I.M.M.E. Tech. Publ. No. 786*, 12 pp.).—The fatigue testing machine of Townsend and Greenall (*Proc. Amer. Soc. Test. Mat.*, 1929, 29, (II), 353) was used for bending tests on thin strips of the following copper alloys: (a), (b), and (c)

phosphor bronzes containing from 4.66 to 7.45% tin and from 0.032 to 0.106% phosphorus, (d) a "silicon bronze" containing 3.12% silicon, 0.22% zinc, and minor impurities, (e) the copper-nickel-tin alloy known as "Adnic." Phosphorus in the amount of 0.106% was detrimental to the fatigue properties of the 5% tin bronze at stresses above the endurance limit. The phosphor-bronzes (a), (b), and (c) were definitely superior to the silicon bronze (d) which was somewhat superior to the "Adnic." The importance of a smooth surface finish is emphasized.—W. H.-R.

***Mechanical Properties of "K.S." Bronze for Bourdon Tubes.** Goro Koiso (*Sumitomo Kinzoku Kōgyō Kenkyū Hōkoku (Res. Rep. Sumitomo Metal Industries, Ltd.)*, 1937, 2, (9), 865-873).—[In Japanese.] A study was made of the mechanical properties of "K.S." bronze. It was found that (1) in the cold-drawn condition the approximate ranges of tensile properties of the alloy are: tensile strength, 40-44 kg./mm.²; yield-point 38-42 kg./mm.²; elongation 5-13%; modulus of elasticity 13,100-14,200 kg./mm.². These values, it is stated, meet all the requirements as to physical properties for Bourdon tubes; (2) improved tensile properties are obtained by low-temperature annealing between 180° and 200° C.—S. G.

***On a Remarkable Case of Inverse Segregation.** Willi Claus (*Z. Metallkunde*, 1936, 28, (12), 391-393).—A hollow bronze cylinder 6 cm. in diameter and 15 cm. high with walls 9 mm. thick was cast in a dry sand mould and the sand broken away when the metal had cooled to dull redness. After some time beads of a fusible metal oozed out of the outside surface only. Analyses were made of these and of the outermost, central, and innermost zones of the cylinder with the following results (%):

	Copper.	Lead.	Tin.	Nickel.
Composition of melt	72	15	10	3
„ outermost zone	76.9	12.9	9.4	rest
„ central	79.2	8.9	10.6	„
„ innermost	74.6	13.4	10.3	„
„ beads	1.4	91.7	5.1	„

The explanation of this behaviour is that the metal shrinks round the core and the resulting radial and tangential stresses exceed the elastic limit of the hot plastic metal which is therefore made denser in the inner zones so that the still fluid metal is forced outwards. No such effect is obtained in solid cylindrical ingots in which it can be shown both theoretically and experimentally that inverse segregation is not due to shrinkage stresses—A. R. P.

***Contributions to Knowledge of the Systems Copper-Germanium and Silver-Germanium.** Herbert Maucher (*Forschungsarbeiten über Metallkunde u. Röntgenmetallographie*, 1936, (20), 32 pp.).—Germanium metal is prepared by reduction of the oxide by potassium cyanide and carbon. The product is purified by extraction with water. The equilibrium diagram of the copper-germanium system, as determined by M., differs somewhat from that given by Schwarz and Elstner (*Met. Abs.*, 1934, 1, 293). The α -range is found to extend to about 12.8% germanium, and about 1.8% further into the ($\alpha + \beta$)-range, which consequently appears to be of less extent than the β -range. A smaller difference of solubility corresponding to various temperature ranges is established. β -crystals occur in alloys containing up to 27% germanium. A γ -phase is present in alloys containing 20.2% up to 27.0% of germanium. The existence of an intermetallic compound Cu_3Ge which is undecomposed on melting is established; it suffers its first transformation at about 700° C.; the second modification, $\text{Cu}_3\text{Ge}'$, is precipitated from alloys containing 32.5-38.7% of germanium, the latter corresponding to the eutectic $\text{Ge} + \text{Cu}_3\text{Ge}$.

Germanium forms no solid solution with the compound Cu_3Ge . The eutectic point is found to be 638°C . The liquidus line of pure germanium is found to be different in its course and somewhat higher than that found by Schwarz and Elstner. The β -phase crystals exhibit a marked anisotropy effect; the lattice is hexagonal, spherical close-packed with an axial ratio $c/a = 1.63$. A similar structure characterizes crystals of Cu_3Ge ; in this case the axial ratio $c/a = 1.598$ with $a = 2.649\text{ \AA}$, $c = 4.243\text{ \AA}$. The equilibrium diagram of the silver-germanium alloys is simpler in character and the results obtained by M. confirm, in essentials, the results obtained by Briggs and his co-workers (*J. Physical Chem.*, 1929, **33**, 1080). The pure eutectic contains 17.6% of germanium and freezes at 649°C . α -solid solutions are present in the hyper-eutectic range; germanium and eutectic are present in alloys containing more than the eutectic proportion of germanium. The liquidus corresponds with that found by Briggs. The lattice constant, a , decreases with increasing proportion of germanium. Alloys containing less than 17.6% of germanium are silver-white; others are grey. The α -phase and eutectic are not decomposed by strong nitric acid.—J. S. G. T.

*Lead Coating of Steel [Equilibrium Diagram of Lead-Rich Lead-Zinc Alloys]. J. L. Bray (*Metals Technology*, 1937, **4**, (2); *A.I.M.M.E. Tech. Publ. No. 788*, 8 pp.).—(1) The freezing points of lead-rich lead-zinc alloys were determined, and suggest that at 318°C . lead can dissolve about 0.05% zinc. (2) Steel sheet and wire, previously coated with zinc by electrodeposition, were coated with lead by a hot-dipping process in a lead-zinc alloy. Satisfactory coatings were obtained provided that the composition and temperature of the bath were accurately controlled. The coating is probably bound by needles of zinc which attach themselves to the lead through a solid solution of zinc in lead, the zinc being bound to the iron by a series of solid solutions of the zinc-iron intermetallic compound in zinc. The resistance to corrosion of these lead-coated sheets is superior to that of ordinary galvanized material.—H. R.

*Alloys of Iron Research. XII.—Note on the β_{M} Transformation in Manganese-Rich Iron-Manganese Alloys. Marie L. V. Gayler and C. Wainwright (*Iron Steel Inst. Advance Copy*, 1937, (May), 5 pp.).—This investigation was undertaken in order to explain discrepancies between the results of Ohman, of Walters and Wells, and those previously published by G. and W. X-ray examination of two iron-manganese alloys containing 71 and 74% of manganese previously annealed at 573°C . and consisting of α_{M} only, were heat-treated at successively higher temperatures, quenched, and then submitted to X-ray analysis. The results obtained were in agreement with those of Walters and Wells. On the other hand, X-ray analysis of the specimens annealed at 750°C ., slowly cooled to and quenched from lower temperatures confirmed the present authors' previous results. It is shown, therefore, that manganese-rich iron-manganese alloys consisting of the β_{M} phase may exist in a metastable state at temperatures below that at which the $\alpha_{\text{M}}-\beta_{\text{M}}$ transformation takes place on heating, and that the upper limit is that found by Walters and Wells and the lower that obtained by G. and W. It is noted that a similar hysteresis loop occurs at the iron end of the iron-manganese diagram.—S. G.

*The Solubility of Indium in Mercury from 0° to 50°C . W. George Parks and Walter G. Moran (*J. Physical Chem.*, 1937, **41**, (3), 343-349).—The solubility of indium in mercury is reported at 0° , 12.5° , 25° , 37.5° , and 50°C . In the temperature range $0^\circ-50^\circ\text{C}$. the solubility is represented by the equation

$$\log N_2 = \frac{53.57}{T} + 1.714,$$

where N_2 is the weight fraction of indium in the saturated amalgam. The results indicate that indium has rather a high internal pressure, approximately the same as that of lead. From the general behaviour of indium amalgam it is considered to be suitable for precise e.m.f. measurements.—S. G.

*On the Paramagnetism of the System Sodium-Mercury. Walter Franke and Helmut Katz (*Z. anorg. Chem.*, 1937, 231, (1/2), 63-65).—Measurements of the specific magnetic susceptibility of amalgams with 21-95% sodium showed that no change in paramagnetism occurs throughout the system. Hence sodium is not dissolved in atomic form in mercury but exists in a similar state to that in which it exists in concentrated solutions in liquid ammonia and to that in which thallium dissolves in mercury.—A. R. P.

Heat Resisting Castings; Chromium-Nickel-Iron Alloys. J. D. Corfield (*Metal Progress*, 1936, 30, (4), 191-194).—The composition, chemical stability, and designed strength for high-temperature work of a number of iron-chromium-nickel alloys are discussed; the working stresses of 5 such alloys are shown graphically for temperatures from 1200° to 2000° F. Recommendations are appended regarding design, which should be such as to minimize shrinkage effects and dead weight.—P. M. C. R.

Materials for Permanent Magnets. H. Neumann (*Arch. tech. Messen*, 1937, (69), T38-T42).—This account of the general and individual characteristics of the best-known permanently magnetizable materials includes a bibliography and tabulated summaries of the magnetic properties and approximate composition of 20 alloys. Non-ferrous types include certain varieties of Oerstit (iron-nickel with or without important additions of cobalt, tellurium, and titanium), a platinum-iron alloy containing 78% platinum, and a 77-23 platinum-cobalt alloy. Graphical summaries of magnetization data are also given.—P. M. C. R.

*The Setting of Dental Amalgams.—V. VI.—The Theory of the Setting of Dental Amalgams. Marie L. V. Gayler (*Brit. Dental J.*, 1936, 60, (12), 605-613; 61, (1), 11-18).—(V.—) A ternary model has been constructed showing the dilatation of amalgams made from a silver alloy containing around 25% tin and 0.5% copper using an alloy: mercury ratio of 1:1.75. There is only a very narrow range of composition of alloys which give amalgams having an expansion of 2-4 μ in 3-4 mm. and of these, those which expand 4 μ are more stable than those expanding 2 μ . Alloys which expand 4 μ contain 23.35% tin with no copper, 25.4% tin with 1% copper, 25.75% tin with 3% copper, and 25.95% tin with 5% copper. Addition of zinc induces contraction, and it should be added, therefore, only when necessary for the purpose of flow; it must not exceed 1.5% and should replace silver. Addition of small amounts of beryllium is of no effect, and the alloys are very difficult to make. (VI.—) The setting of dental amalgams is ascribed to the transformation of Ag_3Sn and mercury into the β_1 and γ_1 phases of the silver-mercury system and the γ_2 phase of the tin-mercury system, followed by a gradual change of $\gamma_1 + \gamma_2$ into (a) the β_1 phase of the tin-silver system and the γ_2 phase of the tin-mercury system, (b) the $\beta_1 + \gamma_1$ phases of the silver-mercury system, or (c) β_1 only, according to the composition. The second stage of the reactions probably does not proceed to completion. Sometimes unchanged Ag_3Sn may remain in the set amalgam according to the method of mixing. Slow dimensional changes which occur some time after mixing are attributed to the second series of changes mentioned above.—A. R. P.

*A Method of Improving the Properties of Dental Casting Alloys. A. R. Raper and E. C. Rhodes (*Brit. Dental J.*, 1936, 61, (4), 204-211).—The grain-size of gold- and silver-base casting alloys containing copper, silver, platinum, and palladium can be refined by small additions of iridium or ruthenium. The refining element should be added as an alloy with platinum or palladium and its amount should not exceed about 0.1%. The fine-grained alloys have improved mechanical properties, especially resistance to shock and ultimate strength. The effect of 0.1% of iridium on the mechanical properties of an alloy of gold 70, platinum 6, silver 10, copper 13.5, and zinc 0.5% after various heat-treatments is shown in a table.—A. R. P.

*An Investigation to Develop Hard Alloys of Silver for Lining Ring Grooves of Light Alloy Pistons. Claus Guenter Goetzel (*Metals Technology*, 1937, 4, (2); *A.I.M.M.E. Tech. Publ. No. 794*, 5 pp.).—Attempts were made to develop silver alloys to be used instead of the currently employed insert of high-expansion austenitic ferro-nickel alloy to reduce the wear of ring grooves in light metal pistons; the requirements were a solidus temperature above 850° C., and a Brinell hardness of at least 60. No suitable alloy was produced, but hardness values are given for a few alloys of the systems: magnesium-silver, manganese-silver, ternary alloys of manganese and silver with magnesium, aluminium, zinc, and silicon, quaternary alloys based on manganese, silver, and silicon with iron or chromium, and ternary alloys of silver and antimony with zinc and cadmium.—W. H.-R.

*Scientific Principles of Tin Smelting. II.—The Simple System Tin-Oxygen at Temperatures Between 400° and 1200° C. Josef Klarding (*Metall u. Erz*, 1937, 34, (7), 164-169).—A thermodynamic study of the reduction of stannic oxide to tin by reducing gases shows that, while reduction starts at a relatively low temperature, it takes place at an appreciable rate only at temperatures above 844° C.—A. R. P.

A New Alloy of High Density. C. J. Smithells (*Nature*, 1937, 139, (3516), 490-491).—An alloy of tungsten with 5% nickel and 5% copper can be made by sintering a mixture of the powders in hydrogen at 1450° C. The density of the alloy, of which large parts can be made, is 16.3-16.5 grm./c.c. Primarily intended for radium bombs, it has also been used for balancing crankshafts and as a contact material for heavy circuit contact breakers.—B. C.

A Bibliography of the Most Important Work on Alloys of Noble Metals [Up to 1935]. — (*Izvestia Sektora Platini (Ann. Sect. Platine)*, 1936, 13, 179-191).—[In Russian.] The bibliography includes references to the systems: silver with Al, As, Au, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ga, Hg, In, Mg, Mn, Na, Ni, Pb, Pd, Pt, Rh, S, Sb, Se, Si, Sn, Te, Ti, V, Zn; gold with Al, As, Bi, Ca, Cd, Co, Cr, Cu, Fe, Hg, Mg, Mn, Na, Ni, Pb, Pd, Pt, Rh, Sb, Se, Si, Sn, Te, Ti, Zn; iridium with Re; palladium with Cu, Fe, Mn, Na, Ni, Pt, S, Sb; platinum with Al, As, Cu, Cr, Co, Fe, Ir, Ni, Pb, Re, Rh, S, Sb, Sn, Ti; rhodium with Bi, Cu, Re, and ternary alloys.—N. A.

*On the Mechanical Properties of Tin-Rich White Metals. Toshio Nishihara and Hideo Nishimura (*Suiyokwai-Shi (Trans. Min. Met. Alumni Assoc.)*, 1936, 9, (2), 99-106).—[In Japanese.] Two tin-rich white metals were cast in chill moulds; the compositions of the alloys were (a) tin 85, antimony 8, lead 3, copper 5% [this gives 101%] and (b) tin 78, antimony 13, lead 2, copper 6%, respectively. The tensile and compressive properties and hardness at ordinary and higher temperatures were studied, and alloy (a) is found to be superior to (b) in these respects. In abrasion tests with the Amsler machine alloy (b) gave somewhat better results than (a) when properly cast and when D.E.H. oil was used as lubricant.—S. G.

Alloys. W. L. Bragg (*J. Roy. Soc. Arts*, 1937, 85, (4401), 431-443; discussion, 443-447; also (summaries) *Metallurgia*, 1937, 15, (89), 147-148; and *Machinery Market*, 1937, (1898), 23-24, 30).—The nature of the metallic state, alloy phases and phase patterns, and atomic distribution in phase-patterns are briefly and very interestingly discussed. The treatment is limited to binary alloys.—J. S. G. T.

*Segregation in Single Crystals of Solid Solution Alloys. Arthur Phillips and R. M. Brick (*Metals Technology*, 1937, 4, (2); *A.I.M.M.E. Tech. Publ. No. 785*, 17 pp.).—Aluminium-base, copper-base, and silver-base alloys were cast in cylindrical graphite moulds, and carefully remelted without agitation or stirring in a single crystal furnace, and then lowered at such a rate that a single crystal was grown. Gravity segregation caused considerable vertical segrega-

tion when the two components differed greatly in density, the segregation being produced chiefly during the melting process. Segregation during slow solidification along a vertical temperature gradient was studied for single crystals in both aluminium-base and copper-base solid solution alloys. Examples of both normal and inverse segregation were encountered. The different theories of inverse segregation are discussed, and P. and B. consider that under conditions eliminating gas and contraction pressures, interdendritic feeding took place in practically all specimens; the diffusion rate of the solute, and the exact temperature conditions then determined whether this feeding overcame the tendency to normal segregation.—W. H.-R.

*On the Theory of Transformations in Metallic Solid Solutions. IV.—The Precipitation of Disordered Solid Solutions. G. Borelius (*Ann. Physik*, 1937, [v], 28, (6), 507–519).—In continuation of earlier work (see *Met. Abs.*, 1935, 2, 422, 510; 1936, 3, 39) the mechanism of phase changes in those types of alloys which form homogeneous solid solutions at high temperatures and miscibility gaps at lower temperatures is discussed on thermodynamic principles. From the curvature of the solubility curve the rate of decomposition can be calculated.—v. G.

*The Latent Energy of Solid Solutions. Jean Cichocki (*Compt. rend.*, 1937, 204, (4), 233–234).—By measurements on the solid-solubility of zinc–arsenic, cadmium–antimony, mercury–bismuth in copper, silver, and gold, J. O. Linde (*Ann. Physique*, 1932, 15, 219) has derived a formula for the electrical resistance, $\Delta p = a + bz^2$, where a and b are constants and z is the difference of the valencies of the atoms of the metal in solution and the solvent metal. N. F. Mott (*Proc. Camb. Phil. Soc.*, 1936, 32, 281), in explaining this relation theoretically, has deduced an equation for the electrostatic potential at a

distance r from the centre of the atom in solution: $\Phi(r) = \frac{ze}{r} e^{-qr}$, where e is positive and q is a constant which depends on the density of the free electrons in the solvent metal. This latter equation can be interpreted in a further manner by assuming that the atom in solution occupies the volume of a polyhedron such that its electric influence outside this atomic volume is negligible.—J. H. W.

*Theoretical Study of the Latent Energy of Solid Solutions. Jean Cichocki (*J. Phys. Radium*, 1937, [vii], 8, (3), 99–102).—In continuation of previous work (*Met. Abs.*, this vol., p. 91), C. calculates values of the energy associated with substitutional or interstitial atoms of aluminium dissolved in copper. The former is found to have the value 0.01 eV, the latter the value 0.33 eV, V denoting the atomic volume occupied by the aluminium atom in the alloy and e the electronic charge.—J. S. G. T.

The Use of the Centrifuge for Investigating Alloys. G. Komovskiy (*Metal-burg (Metallurgist)*, 1936, (12), 120–122).—[In Russian.] Cf. *Met. Abs.*, this vol., p. 144. A description is given of a centrifuge constructed by K. for separating a liquid from a solid phase at elevated temperatures. The scope of this method is discussed.—N. A.

Some Notes on Age-Hardening. R. Higgins and D. L. Phillips (*Proc. Swansea Tech. Coll. Met. Soc.*, 1937, March 20th).—An outline of age-hardening phenomena, with particular reference to steel.—R. Gr.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 145–147.)

Surface Temperature of Rubbing Solids and the Formation of the Beilby Layer. F. P. Bowden and T. P. Hughes (*Nature*, 1937, 139, (3508), 152).—Examples are given which show that polishing takes place when the melting

point of the polishing material is higher than that of the surface to be polished, but not when it is lower. Using the two surfaces as a thermocouple, it was shown that the temperatures reached are high enough to cause fusion of the polisher.—B. C.

***The Nature of Polish.** G. I. Finch (*Trans. Faraday Soc.*, 1937, **33**, (3), 425-430).—The phenomenon of surface flow and the fact that metallic polish yields halo patterns by electron diffraction is not sufficient evidence to determine whether the final polish layer is amorphous or crystalline, but, since metallic polish can dissolve metal crystals whereas the corresponding crystalline surface cannot, it is concluded that both surface flow and polish are due to amorphous metal; this is confirmed by the fact that the temperature of flow is limited by the melting point of the metal. Experiments on single crystals of calcite and on silicon carbide crystals are described which further confirm the amorphous layer theory in polishing.—A. R. P.

***The Application of Electrolytic Polishing to the Study of Metallic Deposits.** Pierre Jacquet (*Compt. rend.*, 1937, **204**, (3), 172-174).—See *Met. Abs.*, 1936, **3**, 116. The following conclusions have been drawn from the electrolytic deposition of copper on a polycrystalline cathode of the same metal in a bath of copper sulphate acidified with sulphuric acid: the various crystals are not equivalent from the point of view of the initial distribution of a deposit of the same metal effected at low current density. The differences appear to be bound up with the orientation of certain crystallographic planes in relation to the surface of the cathode. The places on which deposition appears from the beginning always correspond to heterogeneities (grain boundaries, broken crystallographic planes, dendritic systems). These results are in good agreement with the idea of active centres on the metallic cathode.

—J. H. W.

***The Structure of Electrolytic Deposits.** Pierre Jacquet (*Compt. rend.*, 1937, **204**, (9), 670-672).—See preceding abstract. A systematic study of the initial distribution of deposits of copper, nickel, silver, and cadmium gave the following results: (1) experimental conditions can, in general, be found which correspond to a regular increase in the crystal lattice of the cathode; (2) the nickel deposit is always microcrystalline, but in certain conditions of electrolysis this disappears and the structure develops according to the supporting crystal lattice; (3) if the electrodeposition is accompanied by an evolution of hydrogen ions, the crystal lattice of the cathode has no longer any effect on the initial distribution of the metal. These experimental results confirm N. Thon's hypothesis of the inhibition of active centres of a polycrystalline metallic cathode (*L'électrolyse et la polarisation électrolytique*, Paris, 1934). This shows that the hydrogen ion evolution plays an essential part in the structure of deposits of metals of the iron group and of all the metals obtained in complex baths. Macnaughtan's hypothesis (*Trans. Faraday Soc.*, 1933, **29**, 729) can explain the fine structure of nickel obtained with a large discharge of hydrogen ions, but cannot explain the results of copper and silver deposited in complex electrolytes.—J. H. W.

†Comparative Properties of Metallic Surfaces Polished Mechanically and Electrolytically. P. A. Jacquet (*1st Internat. Electrodeposition Conf. (London)*, Advance Copy, 1937, 11 pp.).—Mechanically polished surfaces show no crystalline properties and consist of an outer amorphous layer below which is a thicker zone of micro-crystals having an orientation differing considerably from that of the normal crystals of the metal. The properties of this surface are bound up with its special structure and are not specific to the metal. Electrolytic polishing, which is really a type of etching, reveals the true properties of the metal crystals since it exposes the true crystal structure of the metal. Thus electrolytically polished copper reflects 97% of incident light of wave-length 6800 Å. and 60% of light of wave-length 5000 Å.,

whereas the corresponding figures for mechanically polished copper are 88 and 46%. Methods of electrolytically polishing copper and lead are described.

—A. R. P.

***An Electrolytic Etching Method for Revealing the Microstructure of Electrodeposited Nickel.** A. J. Kromholz (*Trans. Faraday Soc.*, 1937, 33, (4), 511–512).—The metal is made the anode in a saturated solution of dimethylglyoxime in alcohol containing 2–3 c.c. of 1:9 HCl per 100 c.c. During etching a loosely adherent film of nickel dimethylglyoxime is formed over the metal so that a uniform etch is obtained without pitting or localized rapid attack. All scratches must be removed by careful polishing before etching, since otherwise they tend to become more pronounced by the etching process.—A. R. P.

***The Structure of Electrodeposited Nickel.** G. I. Finch and A. L. Williams (*Trans. Faraday Soc.*, 1937, 33, (4), 564–569).—Examination by electron diffraction methods of the structure of nickel electrodeposited on copper and cuprous oxide substrates shows that as the deposit thickens its crystal size and orientation depart more and more from those exhibited by the substrate until at thicknesses not exceeding 30,000 Å. its surface layer has a crystal size and orientation characteristic of the conditions of deposition but quite different from those of the substrate. Micrographic examination, however, does not reveal the new submicroscopic boundaries and, since the deposit faithfully reproduces throughout its thickness the network of crystal boundaries of the substrate, the photomicrographs falsely suggest a persistence of the substrate influence on, and continuity of, crystal size and orientation throughout the deposit. The crystal size of electrolytic nickel is controlled by bath composition, current density, and influence of the substrate. Interruption of the deposition process may produce an abrupt suppression of the substrate influence in layers subsequently deposited and consequent decrease in adhesion.—A. R. P.

***Structure Investigations on Roughness and Grain-Size by Means of Electron Diffraction.** W. Papsdorf (*Ann. Physik*, 1937, [v], 28, (6), 555–568).—From the sharpness of the interference lines of an electron stream passing through a 30×10^{-6} mm. thick film of silver the grain-size was found to be at least 5×10^{-6} mm. Reflection photographs showed a maximum surface roughness of 1×10^{-6} mm. The roughness depends on the base on which the metal is evaporated. Surfaces of liquid mercury and gallium give no interferences due to metals but only those due to oxides or impurities.—v. G.

The Existence Range of the β Hume-Rothery Phases. M. Hara (*Nature*, 1937, 139, (3509), 195).—A table is given showing the concentration ranges in which "electron compounds" ("Hume-Rothery Phases") are formed in binary alloys of zinc, copper, silver, gold, cadmium, aluminium. The existence ranges of the β -phases, as well as the solubilities in the α - and γ -phases, are considered in terms of atomic diameters.—B. C.

***On the Texture of Electrolytic Chromium Deposits.** W. Arkharow (*Tech. Physics U.S.S.R.*, 1936, 3, (12), 1072–1078).—[In German.] Electrolytic deposits of chromium may possess one of two textures: (1) a grey, matt texture characterizing deposits produced at room temperature and having the (100) planes parallel to the surface of the deposit, or (2) a lustrous texture characterizing deposits produced at 50°–80° C., and having the (111) planes parallel to the surface of the deposit. The degree of perfection of texture attained by the deposits at a definite temperature depends on the current density. It is suggested that texture and hardness of the deposits may be correlated.—J. T.

***X-Ray Study of the Structure of Copper, Lead, Cadmium, and Antimony at High Temperatures.** John E. Dorn and George Glockler (*J. Physical Chem.*, 1937, 41, (3), 499–506).—It is shown that the metals studied have the lattices indicated in the temperature ranges given: copper, face-centred cubic,

20°–420° C.; lead, face-centred cubic, 20°–185° C.; cadmium, hexagonal, 20°–120° C.; antimony, rhombohedral, 20°–170° C. In addition, none of these metals has transitions in the range of temperature investigated, as other authors have postulated. No evidence of metastable forms was found. Antimony was analyzed by the powder method, and the result was found to agree with that previously obtained by the single crystal method. A simple semi-graphical solution of powder diagrams from rhombohedral, hexagonal, or tetragonal crystals is outlined and applied to the case of rhombohedral antimony.—S. G.

***Lattice Relationships Developed by the Peritectic Formation of Beta in the Copper-Zinc System.** Alden B. Greninger (*Metals Technology*, 1937, 4, (2); *A.I.M.M.E. Tech. Publ.* No. 787, 12 pp.).—Single crystals of copper at the bottom of graphite moulds were covered with pieces of beta brass (47.19% zinc), and allowed to solidify after heating to 1050° C. In this way a zone was obtained in which the peritectic reaction $\alpha + \text{liquid} \rightleftharpoons \beta$ had taken place, and the mutual orientations of adjacent α and β crystals were determined by X-ray methods. The body-centred cubic β lattices were related to the face-centred cubic α lattices in three alternative ways:

$$(A) \left\{ \begin{array}{l} (110)_\beta // (111)_\alpha \\ (001)_\beta // (1\bar{1}0)_\alpha \end{array} \right\}, \quad (B) \left\{ \begin{array}{l} (110)_\beta // (111)_\alpha \\ (1\bar{1}1)_\beta // (1\bar{1}0)_\alpha \end{array} \right\}, \quad (C) \left\{ \begin{array}{l} (100)_\beta // (100)_\alpha \\ (011)_\beta // (010)_\alpha \end{array} \right\}$$

Of 41 grains examined, 38 corresponded approximately with relationships (A) or (B), and 3 with type (C). Deviations from the ideal relationships were always found, but were usually only a few degrees. The theory of the process is discussed. Considerations of minimum atom displacements may provide a satisfactory explanation of the deviation from ideal lattice relationships, but cannot yet account for the most probable or mean lattice relationships.—W. H.-R.

***The Electrical Conductivity of Nickel-Sulphur Electrodeposits.** H. Kersten and W. T. Young (*J. Applied Physics*, 1937, 8, (2), 133–134).—Under certain conditions, an electrodeposit from an aqueous electrolyte containing essentially nickel ammonium sulphate and sodium thiosulphate has an amorphous structure and contains approximately 13% sulphur and 87% nickel. It is shown that if this deposit is warmed to about 170° C. its electrical resistance suddenly decreases and its structure changes to crystalline, without appreciable change in weight.—S. G.

***On the Knowledge of the Rare Earth Metals.** W. Klemm and H. Bommer (*Z. anorg. Chem.*, 1937, 231, (1/2), 138–171).—The lattice constants of the rare earth metals were determined by X-ray analysis of the mixture of metal and alkali chloride remaining when the rare metal chloride was heated with potassium, rubidium, or caesium *in vacuo* until the excess of alkali metal had distilled off. The results obtained for yttrium and for the α - and β -forms of lanthanum, cerium and praseodymium confirmed those of Quill (*Met. Abs.*, *J. Inst. Metals*), 1933, 53, 17), Hull (*J. Inst. Metals*, 1922, 28, 561), and Rossi (*Met. Abs.*, 1934, 1, 238). New results are: (1) hexagonal metals: neodymium, $a = 3.655$, $c/a = 1.609$, $d = 6.99$; gadolinium, $a = 3.622$, $c/a = 1.587$, $d = 7.94$; terbium, $a = 3.585$, $c/a = 1.580$, $d = 8.33$; dysprosium, $a = 3.578$, $c/a = 1.579$, $d = 8.56$; erbium, $a = 3.532$, $c/a = 1.582$, $d = 9.16$; thulium, $a = 3.523$, $c/a = 1.580$, $d = 9.34$; lutecium, $a = 3.509$, $c/a = 1.584$; $d = 9.74$; (2) cubic face-centred metal: yttrium $a = 5.468$, $d = 7.01$; (3) cubic body-centred metal: europium, $a = 4.573$, $d = 5.24$. The atomic volume curve shows well-defined maxima at europium and yttrium and flat minima at cerium-praseodymium and terbium. Only gadolinium is ferromagnetic, but neighbouring elements show transition phenomena from para- to ferro-magnetism.—A. R. P.

†The Hypothesis of Secondary Structure Applied to the Mechanical Properties of Metals. Pol Duwez (*Internat. Assoc. Test. Mat. Conf., London, Advance Proof, Group D, 1937, 24-27*).—[In French.] Anomalies in the mechanical properties of crystals are mentioned, and Zwicky's theory of secondary structure (*Phys. Rev., 1932, 40, 63, and 1933, 43, 270*) is briefly referred to. Two sets of lattice planes are supposed to exist in a crystal, the one set (η) being equally and widely spaced relative to the primary (p) planes. These η planes influence the mechanical properties of a metal. Their efforts in hardening and fatigue are briefly discussed.—J. S. G. T.

IV.—CORROSION

(Continued from pp. 148-150.)

*Action of Copper Sulphate and Nitrate on Pure Copper. Georges Geneslay (*Bull. Soc. chim. France, 1937, [v], 4, (1), 111-114*).—In solutions of copper nitrate and sulphate copper becomes coated with cuprous oxide when the atmosphere above the solution contains only a little oxygen, but in the presence of more oxygen basic copper salts are also formed.—A. R. P.

*Corrosive Action of Alkali Carbonates and of Ammonium Carbonate on Copper. Georges Geneslay (*Bull. Soc. chim. France, 1937, [v], 4, (1), 120-122*).—In solutions of alkali or ammonium carbonate copper generally becomes coated with a film of malachite, but under some circumstances azurite may be formed.—A. R. P.

*Can Moulds Modify the Action of Copper Sulphate on Copper? Georges Geneslay (*Bull. Soc. chim. France, 1937, [v], 4, (1), 123-124*).—The mould *Penicillium glaucum* has no effect on the action of copper sulphate solutions on copper.—A. R. P.

*Identification by the Debye-Scherrer Method of Some Constituents of the Corrosion Patina on Copper. Georges Geneslay (*Bull. Soc. chim. France, 1937, [v], 4, (1), 125-129*).—The film formed on copper in copper sulphate solution in the presence of air consists of the basic sulphate, $3\text{CuO}\cdot\text{SO}_3\cdot 2\text{H}_2\text{O}$; that formed in tetrammine copper sulphate solution in the presence of air and carbon dioxide consists of malachite, and that formed in the absence of air consists of cuprous oxide. The blue patina produced by alkali bicarbonates in the presence of air consists of azurite, while the green patina produced by copper chloride solutions in air consists of the basic chloride, $\text{CuCl}_2\cdot 3\text{CuO}\cdot 3\text{H}_2\text{O}$ (atacamite).—A. R. P.

*Measurements of Oxide Films on Copper and Iron. U. R. Evans and H. A. Miley (*Nature, 1937, 139, (3511), 283*).—An electrolytic method for measuring the thickness of oxide films on copper and iron is described, and it is shown to be in good agreement with the results of optical and chemical determinations.—B. C.

Contribution to the Question of the Relations Between the State of a Metal [Brass] and Its Resistance to Corrosion. George Garre (*Chem. Zeit., 1937, 61, (24), 258*).—The brass spring contact strips of pocket lamp batteries were found to be broken off after a long sea voyage. The cause of this defect was found to be attack by moist ammonia evolved from the battery charge, i.e. the ammonia had accelerated a type of season-cracking. The strips were in a hard-worked state and contained ripples which acted as stress concentration notches.—A. R. P.

*Contribution to the Oxidizability of Nickel. Gabriel Valensi (*Bull. Soc. chim. France, 1937, [v], 4, (3), 405-415*).—Unannealed nickel commences to oxidize in air at 680°C . and the vacuum-annealed metal at 550°C ., but there is no difference in their rate of oxidation at higher temperatures. Cold-working, polishing, or annealing in hydrogen have no effect on the rate of

oxidation. Nickel reduced from its oxide at 750° C. oxidizes at 320° C. In no case is there any difference in the rates of oxidation in air and in pure oxygen, but the presence of water vapour accelerates oxidation by catalysis. Commercial nickel begins to oxidize at a slightly lower temperature than pure nickel.—A. R. P.

***The Entering of Tin into Canned Vegetables.** K. S. Grzhivo and K. I. Novikova (*Konservnaya Promishlennost (Canning Ind.)*, 1936, (5), 10-15; *C. Abs.*, 1937, 31, 2307).—[In Russian.] Of the vegetables studied, tin is destroyed most by rhubarb and eggplant; the main cause of this is the presence of nitrates. The porosity of the tin has an important effect. A high temperature and long sterilization increase the corrosion of the cans. It is supposed that the nitrate oxidizes the tin to SnO, and that this is dissolved in organic acids. This explains the decrease in acidity of canned vegetables.—S. G.

The Content of Tin in Canned Vegetables. Ya. L. Portnov (*Konservnaya Promishlennost (Canning Ind.)*, 1936, (4), 16-21; *C. Abs.*, 1937, 31, 2307).—[In Russian.] The content of tin depends primarily on the p_{H} of the initial material. Solvent action on tin decreases in the order tomatoes, eggplant, carrot, and pepper. Fat in preserved food retards the solution of tin. Other components and the method of processing also affect solution. The portion of preserved food which contains the least tin is the vegetable; the jelly contains the most. The skin of the vegetable lessens the action on the surface of tin at points of contact. Since the solution of tin continues a long time after sterilization, analysis for tin 10 days after sterilization does show the tin content of the product kept longer.—S. G.

Packaging [Pyrethrum] Fly-Sprays in Cans. Roger V. Wilson (*Soap (Sanitary Products Sect.)*, 1937, 13, (2), 94-95; *C. Abs.*, 1937, 31, 2315).—W. refers to Hoyer's work (*ibid.*, 1936, 12, (1), 105, 107), and states that the conditions of Hoyer's tests were different from those existing in commercially packed cans of fly sprays. W.'s tests were made on the effect of storage on pyrethrum fly-sprays in various types of can containers. Cans made from a coke plate and a specially coated manufacturing terne plate were used. Confectioner's glaze, rubber base, and glucose base were included as end-seam compounds, and the soldering methods included (1) inside soldered with rosin flux on both side seam and nozzle, (2) outside soldered, and (3) inside soldered with a special non-corrosive flux on the nozzle. Tin foil and tin foil felt-lined caps were used. Two different commercial pyrethrum fly-sprays were tried. Storage was at room temperature and at 98° F. No deterioration, either chemically or biologically, could be detected at the end of storage tests for 4 and 7 months.—S. G.

***Research on Thin Layers of Tin and Other Metals. III.—The Interaction Between Metals and Lubricating Oils.** P. J. Haringhuizen and D. A. Was (*Proc. K. Akad. Wet. Amsterdam*, 1937, 40, (1), 39-46; and *Tech. Publ. Internat. Tin Res. Develop. Council, Series A*, 1937, (51), 10 pp.).—[In English.] The corrosion of copper, tin, and lead, and the influence of these metals on the deterioration of lubricating oils were studied. The viscosity, surface tension, and acidity are not affected. It appears that copper stimulates sludge formation, while tin and lead act as anti-oxidants. Corrosion was investigated by an optical method. Copper is strongly attacked; tin and lead are protected by a film of reaction products. The corrosive properties of the oil are influenced by storing.—S. G.

***Reaction Between Nitric Acid and Tin in Presence of Catalysts.—I.** G. S. Kasbekar and A. R. Normand (*Proc. Indian Acad. Sci.*, 1937, [A], 5, (2), 115-123).—Ferrous sulphate and ferric chloride retard the reaction between tin and nitric acid and cause an increase in the yield of ammonia and a decrease in the hydroxylamine formed. Retardation of the reaction by sodium nitrite

and no change in the rate of solution by the addition of urea indicate that no nitrous acid is formed, and its presence is not essential during the solution of tin by nitric acid. Sulphuric acid and titanium trichloride retard the reaction when in lower concentrations, but accelerate it at higher ones. There is a considerable increase in the yield of hydroxylamine and ammonia. The catalytic effect of titanium ions is indicated. Glucose in small concentrations has no effect on the reaction. Sodium nitrate, acid sodium sulphite, sodium sulphite, and sodium chloride retard the reaction, whilst ammonium chloride does not. The action of sodium ions is suggested.—S. G.

Preventing the Failure of Boiler Fusible Plugs. E. I. Lloyd (*Steam Eng.*, 1937, 6, (66), 229-230).—The causes of the oxidation of plug metal are discussed, and tabulated analyses of oxide deposits are given. Factors contributing to corrosion either by feed-water or by furnace gases are reviewed.

—P. M. C. R.

***The Influence of the Mean Stress of the Cycle on the Resistance of Metals to Corrosion-Fatigue.** H. J. Gough and D. G. Sopwith (*Iron Steel Inst. Advance Copy*, 1937, (May), 21 pp.).—Whilst much attention has been devoted to the resistance of materials to corrosion-fatigue under cycles of reversed stress, no work has hitherto been carried out on the equally important practical cases of repeated or fluctuating stresses. This paper describes the results of tests under these conditions made on 6 aircraft materials, the behaviour of which under reversed stresses has previously been reported. These comprised a cold-drawn 0.5% carbon steel, 3 stainless steels, Duralumin, and a magnesium alloy containing 2½% of aluminium. These were tested in air, also in a spray of 3% salt solution, under cycles of repeated and of fluctuating stresses. The results show that, as in air, the fatigue-resistance of a material in a corrosive environment is considerably influenced by the mean stress of the applied cycle. As in the case of reversed stresses, no corrosion-fatigue limit was indicated for any of the materials. If the range for any given endurance is plotted against the mean stress, the form of the curve obtained is in general similar to that obtained in air, using the fatigue limit in place of the endurance range.

—S. G.

***The Suitability of Stainless Steel Compared With Other Metals in Bleaching.** Joseph E. Goodavage (*Amer. Dyestuff Reporter*, 1937, 26, p71-77; *C. Abs.*, 1937, 31, 2441).—A study was made of the effect on the 1-vol. hydrogen peroxide solution made alkaline with sodium silicate (p_H approx. 10.0) when metals used in the textile industry are placed in contact with it. The tests are outlined, and the results tabulated. It is concluded that (1) the most economical metals for peroxide bleach baths are nickel, aluminium, and Enduro 18-8S; (2) nickel and Enduro 18-8S are the most practical; (3) corrosion, contamination of the bath with undesirable salts and precipitates or mechanical fitness of the metals are not considered; (4) stainless steel, soldered with silver solder varies in its effects on the peroxide bath; (5) wool has a slight stabilizing effect on alkaline peroxide bleaching solutions; (6) the tolerance limits of area-volume ratios for several metals are: copper 3 cm.²/100 c.c.; Everdur and Monel metal less than 4:100 each, and aluminium 8:100; (7) Enduro 18-8 S is almost as inert as porcelain or glass to peroxide bleaching solutions.—S. G.

***Note on the Use of Sodium Diethyldithiocarbamate for Detecting the Solubility Corrosion of Metals.** W. R. G. Atkins (*Trans. Faraday Soc.*, 1937, 33, (3), 431-432).—By adding a little Na diethyldithiocarbamate to H₂O or neutral salt solutions used in corrosion tests on metals the formation of ions of the metals, *i.e.* the time in which corrosion begins, can be immediately detected. Thus in sea-water containing the reagent Zn produces a white turbidity in a few seconds, Cu a golden-brown colour in a few seconds and a precipitate in a few minutes, and Pb a very slowly-forming white film.

Gun-metal gives a slight Cu reaction in 24 hrs. and brass first a white and then a Cu precipitate more copious than with Cu alone.—A. R. P.

V.—PROTECTION

(Continued from pp. 150-151.)

***Anodizing of Aluminium Alloys in Chromic Acid Solutions of Different Concentrations.** Robert W. Buzzard (*J. Research Nat. Bur. Stand.*, 1937, 18, (3), 251-257; and *Research Paper No. 975*).—A study of the 3% chromic acid anodizing bath showed that the recommended voltage cycle was essential for the formation of the best coatings. It was shown that not only could the corrosion-inhibiting properties of the coatings be improved by an increase in concentration of the electrolyte to 5-10% of chromic acid, but that the cycle could be eliminated, the time decreased, and the anodizing range of voltage and temperature broadened.—S. G.

Anti-Corrosion Treatment [of Aluminium]. J. F. Crowley (*Times Trade and Eng. Suppl.*, 1937, 40, (877), xxxii).—Four methods are described and discussed: (1) increasing the thickness of the natural oxide film by electrolytic (anodic oxidation) or chemical (M.B.V. process) treatment; (2) electroplatings of zinc, chromium, or nickel; (3) deposition of zinc by spraying, and (4) application, after special preparation of the surface, of paints, varnishes, lacquers, and enamels.—H. W. G. H.

***Soil-Corrosion Studies, 1934.** Field Tests of Non-Bituminous Coatings for Underground Use. Kirk H. Logan and Scott P. Ewing (*J. Research Nat. Bur. Stand.*, 1937, 18, (3), 361-388; and *Research Paper No. 982*).—With the exception of the lead-coated specimens, all of the coatings treated in this report appear to have reduced the rate of corrosion of steel during the period of test. None of the coatings had a perfect record for all specimens removed, although in some cases of short-time exposures the rusting of the protected pipe was probably caused by moisture entering through the ends of the specimens and not through the coating. Specimens Calorized by the powder process showed somewhat higher rates of loss of weight and somewhat lower rates of maximum penetration than those Calorized by the dip process. Lead is sufficiently corrodible in most soils to result in the perforation of lead coatings of the thickness used in these tests within 10 years. After the lead has been punctured, accelerated corrosion may occur because of differences in potential between lead and steel. Over a 10-year period, the rates of loss of weight of galvanized steel were from $\frac{1}{3}$ to $\frac{1}{4}$ the rates for bare steel. Galvanized steel corrodes most rapidly in poorly drained acid soils and in those high in salts. For long periods of exposure, thick zinc coatings are superior to thin ones. A coating of 2.8 oz. per ft.² of exposed surface prevented the formation of measurable pits in all but one soil for a period of 10 years. The type of material to which zinc is applied does not have an appreciable effect on the rate of galvanized materials during the first 10 years of exposure. The rate of corrosion of galvanized steel is lower than that of either zinc or steel alone. Foundry and mill scale do not protect ferrous materials against underground corrosion. The coverings over the lead sheath in parkway cable prevent serious corrosion of the sheath for a period of 12 years at least. Of a group of non-metallic and non-bituminous coatings, vitreous enamel and hard-rubber coatings gave the best protection over a 2-year period of exposure. Thin coatings in this group permitted moisture to reach the pipe and rusting followed. It is not possible to determine from the data presented whether or not any of the coatings would be advisable under any of the soil conditions studied because this is an economic problem depending largely on the cost of the coating and other factors.—S. G.

***The Effect of Protective Coatings on the Corrosion-Fatigue Resistance of Steel.** D. G. Sopwith and H. J. Gough (*Iron Steel Inst. Advance Copy*, 1937, (May), 25 pp.).—A description is given of the results of tests made to ascertain the suitability of various protective coatings when applied to streamline wire steel subjected to alternating stress in a spray of salt-water. The fatigue-resistances, under reversed bending stresses in air and in salt-spray, of streamline wire steel have been determined, using the material in both the as-drawn and normalized conditions, uncoated and with the following types of coating: (1) zinc, applied by (a) galvanizing, (b) sherardizing, (c) electrodeposition; (2) electrodeposited cadmium, (a) alone and with supplementary coatings of (b) enamel and of (c) boiled linseed oil; (3) sprayed aluminium (a) with enamel and (b) without enamel; (4) phosphates plus enamel; (5) enamel only. A very satisfactory degree of protection was afforded by galvanizing, sherardizing, and sprayed aluminium plus enamel. Zinc- or cadmium-plating and sprayed aluminium alone gave a fair degree of protection. Phosphate treatment plus enamel and enamel alone gave considerably better results than the uncoated material, but were not nearly so good as the metallic coatings. Enamel was a useful addition to sprayed aluminium, but both enamel and oil reduced the degree of protection afforded by cadmium-plating.—S. G.

Tentative Method of Test for Uniformity of Coating by the Preece Test (Copper Sulphate Dip) on Zinc-Coated (Galvanized) Iron or Steel Wire (A191-36T). — (*Book of A.S.T.M. Tentative Standards*, 1936, 189-191; and *Proc. Amer. Soc. Test. Mat.*, 1936, 36, (1), 645-647).—This method—the Preece test—is designed as a factory inspection or acceptance test on new material. It is useful only for determining which are the thinnest portions of the coating. The fact that different processes of galvanizing produce coatings having widely varying rates of solubility in the copper sulphate solution precludes the use of the Preece test for determining relative weights of coating.—S. G.

***A Practical Trial of Roofing Sheets of [Galvanized] Copper Steels and Other Materials, with the Results as Regards Their Corrosion After a Period of Exposure of 9½ Years to Date.** (Sir) Robert Hadfield and S. A. Main (*Iron Steel Inst. Advance Copy*, 1937, (May), 5 pp.).—A brief account is given of a series of practical trials of roofing sheets, now in progress in Sheffield, with the results so far ascertained, *i.e.* after 9½ years' exposure. The trials concern galvanized sheets, both painted and unpainted, of the following materials: (a) copper-bearing steels of two different makes (0.22 and 0.35% of copper), and (b) ingot iron, these being compared with (c) ordinary unalloyed sheets as currently employed. Only the unpainted sheets have given useful information so far. Copper-bearing steel is proving definitely superior to ordinary steel, but its merits did not appear until the galvanized coating had weathered off. The ingot iron tried has proved definitely inferior to ordinary steel. The relative life periods of the different materials will only be ascertainable after further exposure. The four locations, of varying severity as regards corrosion, give consistent information. Steel containing both copper (0.42%) and molybdenum (0.10%) is included in a further series of trials not yet sufficiently advanced for report. The paper concludes with a commentary on the usefulness of practical trials of this nature, and the conditions for their successful conduct.—S. G.

The Galvanizing of Aluminium and of Its Alloys. H. Krause (*Werkstatt u. Betrieb*, 1937, 70, (7/8), 92-93).—The ferric chloride process originally patented by Canac is described, with some subsequent modifications. A description is then given of the zincate process, which is capable of adaptations permitting the deposition of copper, nickel, chromium, brass, silver, and gold. The process is inapplicable to magnesium-base materials.

—P. M. C. R.

Tests on the Constitution of Sprayed Metal.—V-VI. A. Dagory (*Métalliseur*, 1936, 1, (5), 1-5; (6), 1-3).—(V.—) D. deals with the oxidation of sprayed metal and refers to a paper by Ballard and Harris (*12th Internat. Congr. Acetylene*). Oxidation is less with metals of low melting point than with those of high melting point. The oxidation is affected by nozzle distance and also by the movement of the pistol. Photomicrographs are given showing the amount of oxidation in sprayed steel produced under varying conditions. (VI.—) The oxidation of sprayed metal coatings is considered and it is stated that, all other things being equal, an increase in the pressure of the compressed air used as a spraying medium, brings about an increase in oxygen in the coating produced. As would be expected, the oxygen content will also increase as the proportion of oxygen to combustible gas is increased.—W. E. B.

Metallizing for Corrosion Prevention. W. C. Reid (*Metallizer*, 1937, 5, (8), 4, 5, 14).—R. refers to the findings of the U.S. Bureau of Standards on the principles underlying the prevention of corrosion, and deals particularly with the protection which may be expected from zinc coatings. The data given largely concern galvanized coatings, but R. suggests that the same remarks apply to sprayed zinc coatings.—W. E. B.

Spraying Metallic Aluminium by the Wire Method. — (*Indust. Gases*, 1936, 17, (4), 170-172).—An elementary description of the process and some applications for food vessels, chemical plant, architectural ironwork, in the gas industry, for the cylinder heads of internal combustion engines, and for heat-resisting purposes.—H. W. G. H.

The Metallization with Lead of Transformer Tanks. J. Cauchetier (*Métalliseur*, 1936, 1, (5), 6, 7).—A description of the method of work employed in the protection of transformer tanks by sprayed lead.—W. E. B.

Metal Spraying of the Lock-Gates at Vauban and Strasbourg. J. Cauchetier (*Métalliseur*, 1936, 1, (6), 4-8).—A description is given, with photographs, of the metal spraying of these lock-gates with zinc in the year 1922. The gates are still in good condition.—W. E. B.

Rust-Proofing Iron and Steel by Metallizing. — (*Iron Age*, 1937, 139, (6), 54G-54H, 82).—Discusses the advantages of metallizing over hot galvanizing, and briefly describes the process.—J. H. W.

***The Protection of Metals Against Corrosion by the Use of Paint.** Maurice van Rysselberge (*Bull. soc. belge ing. ind.*, 1936, 533-570).—An exhaustive report is given on conditions essential to corrosion, and the methods of control. Results are tabulated and discussed for the corrosion of steels and their protection by means of paints and varnishes. The paper is fairly fully abstracted in *C. Abs.*, 1937, 31, 1338.—S. G.

VI.—ELECTRODEPOSITION

(Continued from pp. 152-155.)

Electroplating [with Cadmium] in a Modern Radio Plant. Wallace W. Boone (*Products Finishing*, 1937, 1, (4), 5-8, 10, 12-14; *C. Abs.*, 1937, 31, 1299).—A full description is given of plating of the parts with cadmium by use of the Udylyte cadmium process and an automatic plating machine. Factors discussed are: (1) the metal deposited (anode composition); (2) the metal receiving the deposit; (3) the chemical composition of the electrolyte, with addition agents; (4) gases dissolved in or evolved from the electrolyte; (5) insoluble impurities; (6) temperature; (7) current density; (8) agitation of the electrolyte; (9) time of deposition; and (10) placing of the anodes and extent of anode surface area. The usefulness of a chemical laboratory in determining the exact condition and efficiency of the plating solution is discussed in detail.—S. G.

Black Chromium. E. A. Ollard (*J. Electrodepositors' Tech. Soc.*, 1937, 12, 33-34).—Black chromium deposits are obtained from chromic acid solutions free from sulphate ions by using a high current density and a low plating temperature. Sulphate ions are best removed by agitating the solution with barium chromate. The black deposit has little artistic value but withstands a high temperature and may be used as a coating for articles, e.g. grids of thermionic valves, which are required to radiate heat. To plate tungsten or molybdenum wires with black chromium the wires are first cleaned in fused sodium nitrite, washed, and immersed directly in the plating bath. Further work is necessary to determine the best conditions for obtaining good adherence with maximum blackness.—A. R. P.

***The Structure of Thin Coatings of Copper Electrodeposited on Crystalline Copper.** P. A. Jacquet (*1st Internat. Electrodeposition Conf. (London), Advance Copy, 1937, 15 pp.*).—When copper is electrodeposited at very low current density on electrolytic copper which has been anodically polished it does not deposit uniformly over all the cathode grains, and when sufficient thickness has been built up the general structure varies from one grain to another. The deposit is formed first on those grains in which the crystal planes parallel to a crystallographic face cut the surface; these grains form preferred points for the insertion of the metallic ions. At somewhat higher current densities the initial distribution of the deposit depends to some extent on the age of the plating solution. Numerous photographs are included showing the types of structure built up on etched electrolytic copper of various structures and under different conditions of electrolysis.—A. R. P.

***Alkaline Plating Baths Containing the Ethanolamines. V.—Copper Plating from Diethanolamine Solutions.** C. J. Brockman and J. B. Whitley (*Electrochem. Soc. Preprint, 1937, (May), 241-244.*).—Solutions of copper sulphate containing diethanolamine do not deposit copper on steel by contact, and they do not produce dependable results. The deposits are unsatisfactory. The addition of sodium oxalate is decidedly beneficial. A series of baths containing copper sulphate, diethanolamine, and sodium oxalate yielded satisfactory cathode deposits at various concentrations and current densities, when the weight ratio of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ to sodium oxalate was approximately 3 to 1.—S. G.

***Alkaline Plating Baths Containing Organic Amines. I.—Copper Plating From Solutions Containing Diethylenetriamine.** C. J. Brockman (*Electrochem. Soc. Preprint, 1937, (May), 245-248.*).—Good electrodeposits have been produced from solutions of copper sulphate containing diethylenetriamine in sufficient quantity to produce a clear blue colour. The amine concentration and the bath temperature may be varied within fairly wide limits. The cathode current densities were 0.03-0.25 amp./in.² (0.46-4.1 amp./dm.²).—S. G.

***Electrodeposition of Manganese Using Insoluble Anodes.** Colin G. Fink and M. Kolodney (*Electrochem. Soc. Preprint, 1937, (May), 21-32.*).—Both the chloride and the sulphate baths were investigated. The virgin manganese deposit is very susceptible to oxidation. Rapid agitation of the bath tends to oxidize the plate. Similarly, exposure of the freshly deposited metal to air immediately gives rise to a dark surface film of oxide. The plate may, however, be stabilized by dipping it for a few seconds into a dichromate solution directly after withdrawal from the bath. Best deposits were obtained from a solution containing 100-200 gm./litre $\text{MnSO}_4 \cdot 4\text{H}_2\text{O}$, 50 gm./litre $(\text{NH}_4)_2\text{SO}_4$, and 50 c.c./litre glycerol; p_{H} 2.5-3.0; temperature 25° C.; current density 10-12 amp./dm.²; graphite anodes. Ammonia serves as an important buffer. Manganese can be plated to a considerable thickness; it is hard, white, and lustrous, and will remain so indefinitely after being made passive in a dilute dichromate solution; it may be codeposited with either iron or zinc.—S. G.

***The Electrodeposition of Manganese from Aqueous Solutions. II.—Sulphate Electrolytes.** W. E. Bradt and H. H. Oaks (*Electrochem. Soc. Preprint, 1937*, (May), 1-7).—Pure, smooth, coherent, silver-white manganese has been electrodeposited from aqueous sulphate electrolytes. Smooth deposits over 0.4 mm. thick have been prepared. These plates have resisted atmospheric oxidation and the corrosive action of laboratory fumes for over 3 years. Cathodic current efficiencies of 60-75% are normal, using an electrolyte of 100 gm./litre $MnSO_4 \cdot 2H_2O$, 75 gm./litre $(NH_4)_2SO_4$, 60 gm./litre NH_4CNS , a cathode current density of 25 amp./dm.², a p_H of 4.0-5.5, and a bath temperature of 25° C.—S. G.

Heavy Nickel and Chromium Deposition in England. Recovery of Excessively-Worn Machine Parts. Charles F. Bonilla (*Electrochem. Soc. Preprint, 1937*, (May), 9-20).—A description is given of the equipment and plating practice of the Fescol Co. in London, based on a tour of inspection. Most of the work plated consists of worn machine parts. Shafts and bearings are built up for re-use. The hardness of the applied nickel plate is that of annealed tool steel, whereas that of the chromium plate exceeds that of quenched case-hardened steel. The standard plating baths are used. For degreasing the surface before plating, trichlorethylene is used. Brief notes are appended on cadmium, copper, and lead plating practice.—S. G.

***A Study of Electrodeposits Containing Nickel and Sulphur.** Wm. T. Young and H. Kersten (*Electrochem. Soc. Preprint, 1937*, (May), 33-37).—Cf. *Met. Abs.*, this vol., p. 190. Electrodeposits containing nickel and sulphur were formed from an electrolyte containing essentially nickel ammonium sulphate and sodium thiosulphate. The composition of the deposits was found to depend on the current density, and ranged from about 27% sulphur and 72% nickel to 8% sulphur and 87% nickel. Four different structures were observed: nearly pure Ni_3S_2 ; the same plus an unknown structure; an amorphous structure; and a poorly crystallized nickel structure.—S. G.

***The Preparation of Thin Coatings of Titanium by Electrolysis.** M. Hatsinsky and (Mlle.) H. Emmanuel-Zavizziano (*Compt. rend.*, 1937, 204, (10), 759-761).—A deposit, weighing 0.1-0.2 mg./cm.² and having the properties of titanium, was obtained by electrolyzing sulphate solutions of titanium oxide, using a lead cathode, a platinum anode, and a current density of 15-20 m.amp./cm.². $Na_2SO_4 \cdot 10H_2O$ was added to the solution, the p_H value being 1.2-1.6. Similar deposits were obtained from solutions of p_H 1.6 and a cathode of zinc or tin, but with a cathode of nickel or platinum no deposit was observed.—J. H. W.

The Finishing of Zinc Alloy Die-Castings and Rolled Zinc. — (*Aluminium and Non-Ferrous Rev.*, 1936, 2, (2), 79-81; (3), 119-121).—Extracted from a bulletin published by Imperial Smelting Corporation, Ltd. Recommended procedure in the nickel plating of zinc is described in detail.—J. C. C.

†**Inclusions in Electrodeposits, Their Origin and Their Effect on the Structure and Mechanical Properties.** Michel Cymboliste (*1st Internat. Electrodeposition Conf. (London), Advance Copy, 1937*, 14 pp.).—The presence of inclusions in electrodeposits has a profound effect on their structure and mechanical properties, the extent of which varies with the physical and chemical condition of the impurities. Deposits of pure metals can be obtained only when the solution is free from suspended or colloidal particles and when such particles are not formed during electrolysis; such deposits consist of large crystals and have mechanical properties similar to those of the annealed metal. Very hard deposits are obtained when the solution contains or develops colloidal substances which migrate towards the cathode and there become incorporated as sub-microscopic inclusions in the deposit so as to give it a very fine-grained structure. When the colloidal impurities are in suspension, or become flocculated in the neighbourhood of the cathode, the deposit will contain large inclusions

regularly distributed and will generally have a more or less coarsely crystalline structure and a hardness little more than that of the pure metal. With very large inclusions, localized distribution may occur with abnormal crystal orientation and size. These points are illustrated by nickel and chromium deposits made under various conditions.—A. R. P.

Blister Pits in Electrodeposits. Michel Cymboliste and Jean Salauze (*Electrochem. Soc. Preprint*, 1937, (May), 171-183).—Under certain plating conditions, characteristic minute blisters or blister pits will form in nickel, copper, and other deposits. These blister pits are due, apparently, to small gas bubbles which adhere to the plate and are gradually closed in and covered up with metal; or they may be due to colloidal or suspended matter of some kind which attaches itself to the plate and then, especially when the electrical conductivity of these particles is relatively high, metal will electrodeposit on top of these particles. Photomicrographs are given to illustrate the different cases of blister pits encountered. These photographs indicate that as a rule the blister pits are fundamentally due to flocculent basic salt particles which attach themselves to the surface of the gas bubbles.—S. G.

Wiring Small Components for Electroplating. E. E. Halls (*Machinist (Eur. Edn.)*, 1937, 81, (8), 132E).—The wiring of small articles for zinc, cadmium, nickel, and copper plating is described. Iron or mild steel wire is extensively used owing to its cheapness and strength. Copper wire, however, has the great advantage that differences of the weight of metal deposited for different positions of the articles in the bath are much smaller than when iron wire is used.—J. H. W.

***Measuring the Plating on Screw Threads.** E. C. Erickson (*Bell Lab. Record*, 1937, 15, (6), 187-189).—The screw is mounted firmly in a jig at the object position of a projection system which throws an image of the thread on photograph paper through a graph screen which provides graph lines along the contour of the thread to aid in analyzing the results. The screw is then treated, without moving its position, with a stripping solution to remove the plate, and a second photograph is taken. In this way a magnified shadowgraph of the plate is obtained from which its thickness and distribution can be deduced.—A. R. P.

German Electroplating Practice. Richard Springer (*1st Internat. Electrodeposition Conf. (London), Advance Copy*, 1937, 8 pp.; also *Met. Ind. (Lond.)*, 1937, 50, 308-310; and (slightly abridged) *Sheet Metal Ind.*, 1937, 11, (120), 386-388).—Details are given of German practice in nickel, tin, cadmium, and hard chromium plating, anodic oxidation of aluminium, cleaning by the Bullard-Dunn process, and the use of test papers for measuring p_{H} .—A. R. P.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition.)

(Continued from p. 104.)

***Metals Which Can be Made Passive in Bimetallic Electrode Couples.** Leopold Wolf (*J. prakt. Chem.*, 1936, 147, 133-144; *C. Abs.*, 1937, 31, 1301).—W. describes the use of metals capable of being made passive as reference electrodes in bimetallic electrode couples. The couples investigated were: chromium-mercury, chromium-silver, chromium-platinum, V2A-mercury, V2A-platinum as well as chromium or V2A alloy combined with silver electrodes (V2A steel contains chromium 23, nickel 9.5, carbon (max.) 0.4% remainder iron). The metallic reference electrode was made passive or kept passive by the addition of suitable "passivators" to the solutions to be titrated.—S. G.

***Electrochemical Behaviour of Mercury Solutions Containing Foreign Ions.** Pál Szarvas (*Magyar Chem. Folyóirat*, 1936, 42, 66-82; *C. Abs.*, 1937, 31, 1300).—The potential of mercury depends chiefly on the quality and concentration of the anion; it shows a logarithmic relation to the ion activity of the solution. Cations generally do not influence the electrode potential. Thallium and lead, however, make the potential of a dropping electrode significantly more positive. The potential corresponding with the maximum of the electrocapillarity curve can be observed even on an overflowing dropping electrode. This observation could not be made in oxygen-containing solutions. At the potential difference between dropping and fixed mercury electrodes, the dropping effect seems to be the result of its cathodic autopolarization caused by anion adsorption on the interface between mercury and solution.—S. G.

***The Adsorption Condenser and Electromotive Force.** Joseph F. Chittum and Herschel Hunt (*J. Physical Chem.*, 1936, 40, (9), 1083-1093).—An explanation is given of overvoltage and electrokinetic potentials. The origin of e.m.f. and the mechanism for conduction processes at a metal-solution interface are discussed, the explanation being based on the production of a colloidal layer of metal on the crystalline metal surface.—J. S. G. T.

***Electrokinetic Potential at Metal Surfaces.** J. F. Chittum and Herschel Hunt (*Electrochem. Soc. Preprint*, 1937, (May), 85-95).—The electrokinetic potentials of several metals were measured in various electrolytes and colloidal solutions. The theories of Procopiu and König were experimentally tested and discussed. The data show that the properties of a metallic electrode, especially its electrokinetic potential, are governed by the colloidal metal in the electrode surface. The results indicate the necessity for a modified form of the Helmholtz double layer as was presented in a previous paper (preceding abstract).—S. G.

***Kelvin Single-Potential Differences.** Wilder D. Bancroft and Jermain D. Porter (*J. Physical Chem.*, 1936, 40, (9), 1201-1215).—The energetics of various types of electric cells are discussed. Amongst the conclusions reached are the following: (1) A pure zinc surface in air is always coated with a coherent film of oxide which makes the metal appear more noble; amalgamated zinc is not so protected. (2) In the ordinary Daniell cell all the e.m.f. arises at the zinc/copper junction. (3) In the lead storage cell practically all the e.m.f. is developed at the lead peroxide electrode. (4) The Kelvin single p.d. for platinum/hydrogen and platinum/air is apparently 1.0-1.2 v. The change from air to hydrogen has no marked effect with zinc, copper, and silver. (5) With two-phase binary alloys the Kelvin single p.d. is a function of the nature and relative masses of the two phases.—J. S. G. T.

IX.—ANALYSIS

(Continued from p. 155.)

Industrial Spectrographic Analysis. A. Guillemonat (*Technique moderne*, 1936, 28, (14), 505-508).—Reference is made to the accurate standardization of spectrographic apparatus made possible by the use of the logarithmic sector and to Barratt's "twin-spark" method. Several types of instrument are illustrated, and industrial applications of the method are enumerated.—P. R.

***On the Analysis of Refined Aluminium.** R. Gadeau (*Ann. chim. analyt.*, 1937, [iii], 19, (3), 64-68).—The only impurities in highly refined Al are Fe, Si, and Cu of the order of < 0.004, < 0.005, and < 0.001%, respectively. Fe is determined by dissolving 2 grm. of metal in 100 c.c. of 1:1 HCl at 40° C. (dissolution takes 24 hrs. for 99.98% Al and as long as 18 days for 99.998% Al), the solution is evaporated until AlCl₃ begins to crystallize, and then diluted with 5 c.c. of 1:2 HCl, 10 c.c. of 10% H₂O₂, and 10 c.c. of 30% NH₄CNS

solution, and the colour of the resulting pink solution is compared with that of a standard prepared in the same way with a known amount of Fe. Si is determined by dissolving 10 grm. of metal in NaOH solution (from Na) in a Ag dish, pouring the solution into 150 c.c. of conc. HCl, boiling, adding Na_2CO_3 in slight excess, then 10 c.c. of 25% $(\text{NH}_4)_2\text{MoO}_4$ solution, and finally HNO_3 until distinctly acid, and, after 15 minutes, matching the yellow colour with a picric acid solution containing 0.147 grm./litre of the acid (1 c.c. of this solution = 0.001% Si). A blank must be put through the whole series of operations. Cu is determined by passing H_2S through a HCl solution obtained as for the determination of Fe and matching the colour against a similarly prepared standard.—A. R. P.

The Gay-Lussac Silver Assay. A. Wogrinz (*Metall u. Erz*, 1937, 34, (5), 100–104).—The magnitude of the possible errors in the titration of Ag with NaCl using a turbidimetric end-point and adsorption indicators is discussed theoretically.—A. R. P.

***On a New Colour Test for Magnesium.** Edwin Eegriwe (*Z. anal. Chem.*, 1937, 108, (1/2), 30–32).—Benzoaurin G in 0.1% aqueous solution, when added to a neutral Mg solution followed by 1 c.c. of NH_4OH , gives a blue colour with 0.5 μ grm. of Mg in 0.5 c.c. and a pale violet colour with 0.2 μ grm. Only the H_2S and $(\text{NH}_4)_2\text{S}$ metals interfere, and these are readily removed.

—A. R. P.

***Qualitative Microanalysis by Electrolysis and Spectrography.** Precipitation at the Mercury Electrode. A. Schleicher and Lore Laurs (*Z. anal. Chem.*, 1937, 108, (6/7), 241–247).—Alkalis, Ca, Ba, Sr, Mg, Zn, Pb, and Mn can be concentrated from a solution into a Hg electrode and then detected by spectrography; as little as 1–10 μ grm. of these metals can be so detected.—A. R. P.

***On the Determination of Aluminium with Eriochromcyanin R.** Edwin Eegriwe (*Z. anal. Chem.*, 1937, 108, (6/7), 268–269).—The method previously described (*J. Inst. Metals*, 1929, 42, 530) detects 1 μ grm. of Al in the presence of 100 times as much Pb, Ag, Hg, Cd, Bi, Sb, Sn, rare earths, Th, Mo, V, Ti, Zr, alkaline earths, and alkalis. Be interferes, but a modified method is given for detecting Al in the presence of Be.—A. R. P.

The Determination of Antimony in Lead-Rich Alloys. R. G. Robinson (*Analyst*, 1937, 62, (732), 191).—The metal (1 grm.) is dissolved by boiling with 10 c.c. of H_2SO_4 and 5 grm. of Na_2SO_3 ; after cooling, the white melt is boiled with 30 c.c. of H_2O and 20 c.c. of HCl for 30 seconds, and the solution is diluted with 80 c.c. of H_2O , cooled to 20° C., and titrated with KMnO_4 standardized against a known Sb–Pb mixture treated similarly.—A. R. P.

A New Electroanalytic Method for the Determination of Antimony. S. Lj. Yovanovitch (*Compt. rend.*, 1937, 204, (9), 686–688).—The metal is dissolved in concentrated H_2SO_4 and the solution cooled and diluted. Electrolysis is carried out at 85°–90° C. with agitation and using Fischer electrodes. The voltage is kept at 2.4 and the current at 3 amp. until the precipitate has disappeared, when the voltage is lowered to 2.2. When the current has fallen to 0.4 amp., electrolysis is continued for another 30 minutes and the deposit is then washed in water and alcohol, and weighed.—J. H. W.

***On a Method for the Determination of Barium and Lead.** Haldun N. Terem (*Bull. Soc. chim. France*, 1937, (v), 4, (2), 259–264).—The neutral solution is titrated with a solution of $\text{Na}_6\text{P}_6\text{O}_{18}$ until the precipitate first formed just redissolves.—A. R. P.

Remarks on Chiddy's Method for the Determination of Gold [in Cyanide Solutions, e.g. Plating Baths]. A. Wogrinz (*Z. anal. Chem.*, 1937, 108, (6/7), 266–267).—Chiddy's method (*Eng. Min. J.*, 1921, 111, 629) is not applicable to the analysis of Au plating solutions containing ferrocyanide; in this case the solution is evaporated to fumes with H_2SO_4 in a Kjeldahl flask, cooled, diluted with H_2O , boiled and filtered, the precipitate dissolved in *aqua regia*,

the HNO_3 removed by evaporation with HCl , and the Au precipitated by adding $(\text{CH}_3\text{-CO}_2)_2\text{Pb}$ and boiling with pure Zn powder. The washed precipitate is then extracted with boiling conc. HNO_3 and the residual Au collected, washed, ignited, and weighed.—A. R. P.

***A New Rapid Method for the Determination of Lead.** L. M. Jolson and E. M. Tall (*Z. anal. Chem.*, 1937, 108, (3/4), 96–105).—The method depends on the precipitation of the Pb from HCl solution by means of Al foil, followed by dissolution of the metal in HNO_3 and titration of the solution with $(\text{NH}_4)_2\text{MoO}_4$ using tannin as outside indicator.—A. R. P.

A Rapid Method for the Determination of Lead in Solder. L. I. Bocharova (*Voprosy Pitaniya (Problems of Nutrition)*, 1936, 5, (5), 147–150; *C. Abs.*, 1937, 31, 1321).—[In Russian.] Pb is determined colorimetrically by the comparison of the precipitated sulphide with samples prepared from a standard set of $\text{Pb}(\text{NO}_3)_2$ solutions.—S. G.

***Spot Test for the Determination of Osmium.** N. A. Tananaev and A. N. Romanjak (*Z. anal. Chem.*, 1937, 108, (1/2), 30–32).—A filter paper moistened with a $\text{CH}_3\text{-CO}_2\text{H}$ solution of benzidine or $\text{K}_4\text{Fe}(\text{CN})_6$ is coloured dark violet or light green, respectively, when held over a hot alloy containing Os owing to the OsO_4 which is evolved.—A. R. P.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

(See also "Testing" and "Temperature Measurement and Control.")

(Continued from p. 156.)

The Vacuum Distillation of Metals. N. D. Tomashev (*Metallurg (Metallurgist)*, 1936, (11), 109–116).—[In Russian.] A description is given of the various types of apparatus developed by T. for the distillation of metals in a vacuum.—N. A.

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

(Continued from pp. 156–158.)

†**The Transfer of Tests of Materials from the Laboratory to the [Actual] Works.** A. Weigl (*Internat. Assoc. Test. Mat. Conf. London, Advance Proof, Group D*, 1937, 1–4).—[In German.] The necessity for full knowledge of the characteristics of metals, alloys, &c., used in the construction of chemical engineering plant, determined by laboratory tests and verified on actual plant, is stressed and exemplified.—J. S. G. T.

†**The Testing of Materials and Confirmation in [Actual] Plant.** R. Kühnel (*Internat. Assoc. Test. Mat. Conf. London, Advance Proof, Group D*, 1937, 4–7).—[In German.] The nature and significance of tensile, pressure, impact, and alternating stress tests on constructional materials are briefly referred to. A bibliography of 12 references is appended.—J. S. G. T.

†**The Requirements of Constructional Materials Considered from the Works Point of View, and the Application of Laboratory Data.** E. Lehr (*Internat. Assoc. Test. Mat. Conf. London, Advance Proof, Group D*, 1937, 7–10).—[In German.] The necessity for carrying out life tests on constructional works on full scale or at least $\frac{1}{3}$ scale models, and the significance of the nick test number, β_k , are stressed. Forms of test-pieces are suggested. Laboratory apparatus designed by L. for carrying out special static and dynamic tensile tests is briefly referred to.—J. S. G. T.

†**Laboratory Tests in Relation to the Serviceability of Steel and Steel Products.** (Sir) Robert Hadfield and S. A. Main (*Internat. Assoc. Test. Mat. Conf. London, Advance Proof, Group D*, 1937, 10–13).—[In English.] Examples are given

illustrating the use and limitations of laboratory tests as a guide to the serviceability of steel. It is emphasized that the only fully satisfactory basis for successful service is, in all cases, experience in service of a similar kind. Laboratory tests, however, are useful under certain conditions, e.g. when the working conditions are simple, or the constructed plant comparatively small. Laboratory abrasion tests have mostly proved of little direct service.—J. T.

***The Measurement of Deformations or Cracks in Tensile, Pressure, and Flexure Tests, by Means of Polarization-Microscopic Methods.** Adalbert Pogány (*Internat. Assoc. Test. Mat. Conf. London, Advance Proof, Group D, 1937, 37-42*).—[In German.] The incidence of deformation or cracks in large structures, e.g. of metal or concrete, can be detected by the change of electrical resistance of the structure when deformation or cracking occurs. This change of resistance is indicated by a galvanometer inserted in an electrical circuit including the structure. Non-conducting structures are, for this purpose, given a coating of metallic paint. Apparatus for photographing the incidence of the deformation and for following its course during subsequent loading is described and the results illustrated by results obtained in the fracture of a beam of concrete by flexure. The method can be readily applied to the investigation of flow-figures in metals associated with the work of Hartmann and of Fry. Further illustrations given relate to the fracture of test-pieces of wax in tensile tests.—J. S. G. T.

Non-Destructive Tests. E. C. Rollason (*Welder, 1937, 9, (38), 6-11, 25*).—Hydraulic pressure, magnetic, and acoustic tests on welded vessels are briefly reviewed. At greater length, the application of X-rays is simply explained, both radiographic and spectrographic methods being dealt with, and, finally, the use of gamma rays is described.—H. W. G. H.

Machines and Apparatus for the Destructionless Testing of Materials. W. E. Schmid (*Maschinenbau, 1937, 16, (5/6), 149-152*).—A description of some new German apparatus for detecting faults in metal parts by X-rays and magnetic tests.—v. G.

†**New Results in Stress Optics.** L. Föppl (*Z. V.d.I., 1937, 81, (6), 137-141*).—A review of recent work on the study of internal stress distribution with transparent models. It is now possible to examine the state of stress in three dimensions and to examine rapidly alternating states of stress.—v. G.

RADIOLOGY.

†**Industrial Radiography Employing Gamma Rays.** Fern. Guyot (*Internat. Assoc. Test. Mat. Conf. London, Advance Proof, Group D, 1937, 21-24*).—[In French.] The detection and investigation of internal structural defects in metallic structures by γ -rays are described. Recent progress is briefly discussed.—J. S. G. T.

Radiology in Testing. V. E. Pullin (*Internat. Assoc. Test. Mat. Conf. London, Advance Proof, Group D, 1937, 32-33*).—[In English.] The inspectional testing of metals by X-rays and radium emanation is very briefly discussed.—J. S. G. T.

The Manufacture of the Napier "Dagger" Engine [X-Ray Inspection of Lead-Bronze Bearings]. — (*Machinery (Lond.), 1937, 49, (1275), 751-752*).—Contains an account of the use of X-ray photographs in the examination of lead-bronze bearings for lead segregation, porosity, and oxidation.—J. C. C.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from p. 159.)

***Influence of Steam on Readily Fusible Metals and Alloys.** R. Kleinert (*Metall u. Erz, 1937, 34, (2), 30-32; (3), 54-60; (4), 75-80*).—Steam reacts at an appreciable rate with lead at 950°-1000° C., antimony at 750°-800° C.,

tin at 650°–700° C., arsenic at 700°–750° C., cadmium at 400°–450° C., and zinc at below 350° C.; hence zinc can readily be removed from lead by steam treatment at 400° C. and from cadmium at 350°–400° C. Tin, arsenic, and antimony are only slowly removed from lead by steam at 900° C. The rate of removal of an impurity from lead by steam depends on the temperature, the concentration of the impurity, and the rate of access of steam.—A. R. P.

A Simple Control for Practical [Dental] Castings. R. E. Sturdevant (*J. Amer. Dental Assoc.*, 1937, 24, (2), 231–238).—Methods of removing wax patterns, making correct sprues, investing the pattern, preparing cores, and casting the gold are described with reference to diagrammatic illustrations.

—A. R. P.

The Development of a Deoxidizer for Melts of Copper and Copper Alloys. Willi Claus (*Giesserei*, 1936, 23, (27), 617–619).—Instead of using commercial copper phosphide, which has not always the same phosphorus content and frequently contains objectionable impurities, briquettes made by pressing up intimate mixtures of copper powder and red phosphorus in definite proportions are recommended for use in the deoxidation of copper and its alloys. Figures are given showing the superiority of this material over copper phosphide in phosphor-bronze castings.—A. R. P.

***Method of Making Compound Bearings.** J. Persicke (*Z.V.d.I.*, 1937, 81, (11), 337–338).—A method of casting red brass or lead bronzes into steel shells is described.—v. G.

Economies in Bearing Metal Casting by Centrifugal Methods. — Wagner (*Giesserei*, 1936, 23, (24), 619–623).—Centrifugal casting of bearings gives a hard running surface, and consequent better running properties, a denser and more uniform structure, better binding to the shell and longer life; the amount of finishing required is less, there is no waste in “lost heads,” and the bearings have longer life. Methods of casting the bearings are described, characteristic microstructures are illustrated, and the properties of certain special alloys are discussed.—A. R. P.

Colloidal Graphite as a Die-Casting Lubricant. William Jennings (*Iron Age*, 1937, 139, (8), 41, 82).—Describes the use of colloidal graphite for dressing metal moulds for various conditions of die-casting.—J. H. W.

Dies for Magnesium Die-Castings. — (*Machinery (Lond.)*, 1937, 49, (1274), 721–722).—A water-cooled die for producing a small reel in Dowmetal is described and illustrated.—J. C. C.

Bibliography of Synthetic Moulding Sands. G. R. Woodward (*Bull. Brit. Cast-Iron Res. Assoc.*, 1937, 4, (12), 461–464).—45 references are given, arranged in chronological order, covering the years 1918–1936.—S. G.

***Upon Properties of Moulding Sands of Nippon and Manchoukuo.** Kiyoto Matuzuka (*Mem. Ryojun Coll. Eng.*, 1936, 9, (10), 223–303).—[In English.]

—S. G.

XV.—FURNACES AND FUELS

(Continued from p. 160.)

Gas in Non-Ferrous and General Foundry Work. A. E. Wilson (*Gas World: Indust. Gas Suppl.*, 1937, 9, (2), 20–22).—A brief description of some installations for metal melting and ladle heating at Huddersfield.—A. R. P.E.

Gas-Fired Rolling Furnaces Give Worthwhile Results on Wide Range of Metals. A. J. G. Smith (*Amer. Gas J.*, 1937, 146, (1), 14–15).—A cylindrical melting furnace which can be oscillated about its (horizontal) axis is described, and working results are given for ferrous and non-ferrous metals.—A. R. P.E.

Linotype Metal Heating. — (*Gas World*, 1936, 105, (2719), 225).—With a suitable control, gas is an efficient fuel for the purpose.—A. R. P.E.

Use of Town Gas for Galvanizing. — (*Gas World: Indust. Gas Suppl.*, 1936, 8, (11), 15).—Advantages of gaseous fuel are set out.—A. R. PE.

Electric Furnaces [for Dental Work]. S. J. F. Webb (*Brit. Dental J.*, 1937, 62, (6), 313–316).—The construction of wire-wound muffle-type furnaces for use in fixing dental porcelain is described briefly. Rhodium-platinum wires are used for temperatures above 1250° C. and Megapyr and Kanthal wires for temperatures up to 1250° C.—A. R. P.

Electric Heat in the Foundry. A. J. G. Smith (*Elect. Rev.*, 1937, 120, (3095), 426).—Vertical elevator ovens, electrically heated, for core drying are briefly described. Charts are given showing the energy consumption when melting various non-ferrous metals in induction and arc furnaces.—J. C. C.

Experiences with High-Frequency Furnaces. N. Broglio (*Giesserei*, 1937, 24, (4), 73–80).—Modern types of high-frequency induction melting furnaces are described, and the principles of their construction are explained. The economics of this type of melting are discussed.—A. R. P.

XVI.—REFRATORIES AND FURNACE MATERIALS

(Continued from pp. 62–63.)

Materials for Electrothermal Purposes. H. Kirchrath (*Chem.-Zeit.*, 1937, 61, (28), 293–296).—K. tabulates and discusses the properties of silica, magnesia, zirconia and chromite bricks, graphite, and carborundum, and of the heating element materials: Nickelin, Constantan, Nichrome, Megapyr, tungsten, and molybdenum.—A. R. P.

Comments on the Present Status of the Testing of Refractory Materials. S. M. Phelps (*Internat. Assoc. Test. Mat. Congress, London, Advance Proof, Group B*, 1937, 147–150).—The activities of Committee C 8 (Refractories) of the American Society for Testing Materials include: study of standard conditions for cone, static loading, permanent linear change, and spalling tests; provision of standard analytical samples; preparation of simplified directions for the interpretation of test data; industrial surveys of practice regarding glass tanks and various types of furnace, metallurgical and otherwise; standardization of certain classes of refractory material and of terms relating to them; preparation of specifications; studies of the conductivity and other properties of insulating fire-brick.—P. M. C. R.

Chemical Analysis of Refractory Materials. E. Azzarello and F. Abramo (*Internat. Assoc. Test. Mat. Congress, London, Advance Proof, Group B*, 1937, 146–147).—The method suggested consists in (a) preliminary estimation of Si; (b) estimation of Zr, Al, and Ti as phosphates in one fraction of the solution; (c) precipitation from the remainder of Fe, Mn, Ti, Ca, Zr, and Mg, thus facilitating the estimation of Mg with *o*-oxyquinolin after removal of Ca. The procedure is described in detail.—P. M. C. R.

Rointjes Walls. — (*Blast Fur. & Steel Plant*, 1937, 25, (3), 324).—Sections of furnace walls are supported by horizontal castings attached to vertical columns. These belts of refractory material are thus not overloaded and expansion is localized.—R. Gr.

XVIII.—WORKING

(Continued from pp. 160–162.)

Inert Gas Controls Cable-Sheath Oxide. W. T. Peirce (*Elect. World*, 1937, 107, (13), 1070–1071).—By maintaining a positive pressure of carbon dioxide in the lead melting pot and flooding the press container and the lead ducts with a blanket of the gas before and during charging, it has been found possible

to reduce oxide inclusions at the junction welds of lead cable-sheath to a negligible amount.—J. C. C.

The Mechanics of Cold-Rolling. W. Trinks (*Blast Fur. & Steel Plant*, 1937, 25, (3), 285-288).—The Siebel theory of the "friction hill" is reviewed and modifications of it are suggested in order to make it applicable to practical purposes.—R. Gr.

Cold-Rolling Strip Metal. — (*Metallurgia*, 1937, 15, (90), 177-178).—A review of recent work on the subject of strip-rolling deals with types of cold-rolling mills; the influence of the continuous increase in the reduction of thickness per pass and of the width of strip on the construction of rolling mills; the deflection of the rolls; and the results of rolling experiments carried out to obtain information on the influence of the material to be rolled, the rolling speed, the width of the strips, and previous cold deformation on the rolling process.—J. W. D.

[Aluminium] Sheets and Circles. Fabricating Processes. — (*Times Trade and Eng. Suppl.*, 1937, 40, (877), lv).—A brief description of ingot casting, hot- and cold-rolling, stretching, shearing, and matting.—H. W. G. H.

Castings and Forgings [in Aluminium]. Various Production Methods. — (*Times Trade and Eng. Suppl.*, 1937, 40, (877), lii).—The characteristics of aluminium alloys, from the point of view of foundry and forge, and the precautions necessitated thereby are outlined.—H. W. G. H.

Causes of Trouble in Deep-Drawing. P. Mabb (*Machinery (Lond.)*, 1937, 50, (1277), 9-10).—Choice of lubricant, inter-annealing temperatures, and pickling solutions in deep-drawing practice are briefly discussed.—J. C. C.

Some Notes on Drop Forging. — (*Metallurgia*, 1930, 15, (90), 185-186).—Consideration is given to the various aspects of drop-forging of ferrous and non-ferrous metals and alloys including the making of suitable die blocks, the setting of dies, types of hammers used, the obtaining of proper grain flow by such treatment, and of the highest mechanical properties by subsequent heat-treatment.—J. W. D.

The Working of Elektron Sheet. Curt Winkler (*Werkstatt u. Betrieb*, 1937, 70, (7/8), 89-92).—An illustrated description is given of the cutting, flanging, welding, insulation, riveting, and repair of Elektron sheet, with special emphasis on methods of minimizing notch stresses in pierced work.

—P. M. C. R.

***Investigation of the Machining Properties of Light Metals.** A. Wallich and F. Hunger (*Maschinenbau*, 1937, 16, (3/4), 81-86).—The wear of the cutting tool can be used as a measure of the machinability of light metals; the results obtained with 33 aluminium-base casting and forging alloys and with three magnesium-base forging alloys are given. The 8% copper-aluminium alloy has the best machinability of the casting alloys and addition of 0.8% of copper to Silumin and Silumin-Gamma improves the relatively poor machinability of these alloys whereas addition of nickel has the opposite effect. Sand castings are generally more difficult to machine than chill castings of the same alloy. Of the forging alloys of aluminium, that with silicon 0.7, magnesium 1% and that with 8% magnesium are particularly easy cutting. Magnesium alloys can be cut the more readily the higher is the aluminium content.—v. G.

***Cutting Temperature in Lathe Cutting and Its Use as a Characteristic of Machinability.** H. Schallbroch and H. Schaumann (*Z.V.d.I.*, 1937, 81, (11), 325-330).—The thermoelectric measurement of the temperature at the point of cutting is described; this temperature is regarded as characteristic of the material being cut and appears to be related to the wear of the cutting tool. The tests were made on steels and aluminium alloys.—v. G.

XIX.—CLEANING AND FINISHING

(Continued from p. 162.)

Bright Pickling of Copper and Brass. E. E. Halls (*Metallurgia*, 1937, 15, (90), 175-176, 181).—The bichromate/sulphuric acid pickle provides a useful medium, where something brighter and more uniform in appearance is required than is provided by sulphuric acid pickles, and with the avoidance of the pitting usually associated with vigorous nitric acid containing dips. It yields very good results, but, if it is to be retained within economic bounds, several precautions must be observed. The use of aluminium baskets is recommended, organic matter must be rigorously excluded, and immersion time should be maintained at a minimum. Excessive immersion times consume an unnecessarily large quantity of bichromate, although without any deleterious effect on the thickness or appearance of the work. Loads to be treated should be economic, and the capacity of the bath employed chosen to take baskets conveniently without a superfluous excess of unoccupied space.—J. W. D.

Inhibited Pickling Solutions in General Finishing Shop Practice. P. Mabb (*Metallurgia*, 1937, 15, (89), 141-145).—A number of commercial inhibitors for hydrochloric and sulphuric acid pickling solutions are considered and compared on a practical basis. The work described demonstrates a method for determining the optimum concentration of an inhibitor, its efficiency over a range of concentrations, its protective action on the metal pickled, and the consequent saving in acid consumed.—J. W. D.

New Metal Cleaning Process. C. Johnson (*Products Finishing*, 1936, 1, (3), 15-22; *C. Abs.*, 1937, 31, 2144).—In the newly-developed process for the removal of dirt films from metals a solution of a water-soluble emulsifying agent in a hydrocarbon solvent is used. The hydrocarbon solvent dilutes the oil present on the surface and spreads the emulsifying agent over the surfaces of the particles, and this makes it possible for water to wet them. As the metal surface retains an oil film, the dirt particles which have been surrounded by a water film can be readily washed off. The effect is apparently due to the reduction of the interfacial tensions between water and dirt. A suitable emulsifiable solvent has specific viscosity 1.1-1.2 (water = 1.0), flash point (open cup) 54-44° or higher, density 0.840-0.850; it must remain homogeneous on absorption of 25% by volume of water; the emulsion formed when the solution is gradually diluted with more than 25% by volume of water must remain liquid throughout the entire dilution range; the solvent must absorb 25% by volume of heavy lubricating oil without losing its rapid emulsifying characteristics and without appreciable increase in viscosity. The cleaning process consists of (1) applying the hydrocarbon solution of emulsifying agent by dipping or spraying; (2) washing with water by immersion and agitation or by spraying; and (3) removal of a very thin residual oil film by any suitable method. Polished or bright cold-rolled steel stock can be cleaned and plated in a hot cyanide plating bath after the first two steps are performed. If the parts are to be painted the third step is unnecessary. Typical cases are discussed. Dirt films deposited from, or produced in, water solutions are not removed by the process, since both the metal surface and the dirt particles must be oily in order to set up the condition of a water-wet dirt particle and an oily metal surface which will be mutually repellent. The process is not designed for the removal of adherent films such as oxide films.—S. G.

Burnishing of Zinc Die-Castings. Herbert Chase (*Machinist (Eur. Edn.)*, 1937, 81, (8), 196-197).—Three separate operations are required to produce a high and enduring lustre on zinc die-castings: (1) the "cutting-down"

operation, in which a coarse abrasive mixture is used with the cutting-down chips; (2) dry tumbling with a standard burnishing compound; (3) lustring or colouring using colouring chips or a standard colouring compound. Small die-castings require 18–36 hrs. and larger sizes 23–40 hrs. for the entire process.—J. H. W.

Reducing Finishing Costs [by Barrel-Finishing]. J. R. Fawcett (*Machinery (Lond.)*, 1937, 49, (1276), 793–794).—The operations of scouring, burnishing, and polishing in barrels are briefly described.—J. C. C.

Treatments for Zinc Surfaces. E. Armstrong (*Machinist (Eur. Edn.)*, 1937, 80, (54), 788E).—Short article describing the pretreatment of zinc surfaces for various finishes.—J. H. W.

XX.—JOINING

(Continued from pp. 162–164.)

***Mechanical Properties of Aluminium Alloy Rivets.** Wm. C. Brueggeman (*Tech. Notes, (U.S.) Nat. Advis. Cttee. Aeronautics*, No. 585, 1936, 11 + 25 pp.).—The results of numerous riveting tests with 17ST alloy rivets in sheets of the same alloy are recorded in graphs. Complete heads of the round, button, mushroom, and brazier types could not be driven by the squeeze method since the sheets buckled and separated excessively when the driving stress was sufficient to complete the head. Cone-point heads could be driven without buckling of the sheets. Despite increase in the cross-sectional area of a rivet on driving the shear strength, tensile strength, and elongation are decreased. Failure of riveted joints under tensile loading occurs by rupture of the sheets when the driven heads have diameter less than $1.5d$ when $d/t = 2$ and less than $1.7d$ when $d/t = 2.5$ ($d =$ nominal shank diameter and t thickness of the sheet). With larger diameters failure occurs either in the shank or manufactured head of the rivet. When d/t is greater than 3.1 it is impracticable to obtain a head diameter at which failure of the rivet will occur.—A. R. P.

Welding, Soldering, and Riveting. Joining Methods for Aluminium. — (*Times Trade and Eng. Suppl.*, 1937, 40, (877), xxviii).—Oxy-acetylene welding is said to be the most important method for aluminium, whilst, for reasons not given, the oxy-hydrogen process is stated to be still "making material progress." Atomic hydrogen, arc and resistance welding, soldering, and riveting are briefly mentioned.—H. W. G. H.

Gas Welding of Aluminium and Its Importance for Chemical Plant. F. Zimmermann (*Autogene Metallbearbeitung*, 1937, 30, (1), 2–10; discussion, 10–11).—The development of aluminium plant and its advantages for use in chemical work are outlined. The superiority of fusion welding over riveting and hammer-welding is pointed out, and the properties of oxy-acetylene welded joints are discussed in some detail, attention being given to tensile strength and ductility, notched-bar impact value, and corrosion-resistance. The effects of hot- and cold-working the weld, on these properties and on the macrostructure are explained and some recommendations for design are given. In the discussion, — Vigener recommends the use of a tensile test-piece shaped to concentrate the stress on the weld metal and transition zones.

—H. W. G. H.

Theory, Practice, and Application of Arc Welding Aluminium. Friedr. H. Fliess (*Elektroschweissung*, 1936, 7, (12), 233–237).—A coated electrode suitable for metallic arc welding of aluminium is now said to be available. Although the coating is slightly hygroscopic, electrodes which have been in stock for over a year have been completely restored by heating to dryness. For butt-welds, the sheets should be placed with edges abutting; up to 10 mm. no

chamfer is needed and little preheating. Backing-plates of iron or copper are recommended. Rapid working and complete fusion of the edges of the sheets are essential, and currents up to 500 amp., for sheets of 8–10 mm. thickness, are suggested. The welds may be hammered and annealed in the same way as gas-welds, if necessary. The corrosion-resistance of the weld metal is said to be higher than that of the parent aluminium. The process is particularly recommended for joining castings to sheet, and several typical applications are illustrated and described.—H. W. G. H.

The Welding of Lead. — (*Illust. Zeit. Blechindustrie*, 1937, 66, (10), 297–298; (11), 323–324).—Welding is recommended for the effective joining of lead sheet, especially in acid-resistant linings and in plumbing work. The combination of high working temperature with small size of flame renders acetylene welding especially applicable to lead. Directions are given for the treatment of pure and antimonial lead sheet of various gauges.—P. M. C. R.

Lead-Burning with Dissolved Acetylene (High Pressure)—Not a Danger to Health. — (*Indust. Gases*, 1936, 17, (3), 140–142).—It is pointed out that hydrogen, acetylene, and coal-gas are non-poisonous, both before and after being burnt. Lead fumes are harmful and are best avoided by the use of a correctly manipulated oxy-acetylene flame, together with ample ventilation.—H. W. G. H.

The Welding of Inconel. A. Boutté (*Soudeur-Coupeur*, 1937, 16, (1)).—A special flux is necessary for oxy-acetylene welding; the blowpipe should have a capacity of 50–75 litres per hour (per mm. thickness); and a neutral flame should be used. Owing to the hot-shortness of the material, careful preparation of the work is necessary to avoid contraction cracking, and a table is given of tacking spaces for different thicknesses. Tables of mechanical properties, before and after welding, are also given.—H. W. G. H.

Welding of High Alloy Castings. F. K. Ziegler and L. B. Haughwout (*Metal Progress*, 1936, 30, (4), 195–198, 200).—The large structures required by modern heat-treating practice can conveniently be built up by the welding of several constituent castings, the soundness of the welds being subsequently checked by X-ray examination. An example of such a welded structure is discussed from the point of view of soundness and possible danger due to variations in microstructure; the material contained nickel 65, chromium 15%.—P. M. C. R.

Welding Non-Ferrous Metals—Some Problems. H. W. G. Hignett (*Welding Ind.*, 1937, 4, (12), 460–466).—Economic, metallurgical, engineering, and psycho-physiological problems are reviewed and some suggestions are made for future research.—H. W. G. H.

The Control of the Welding Operation in the Electric Resistance Process. H. Wilbert (*Elektroschweissung*, 1937, 7, (12), 229–233).—The heat input for producing a satisfactory weld in a given material can vary between an upper limit, at which burning occurs, and a lower limit, below which welding will not take place. For some materials, the useful range is small and the welding operation must be accurately controlled. Some methods of control for spot-, seam-, and butt-welding are described.—H. W. G. H.

Electric Resistance Welding—The German Patent Position. Werner Simon (*Welding Ind.*, 1936, 4, (11), 407–412).—A review of existing German patents dealing with the diminution of inductive losses. Special designs of transformer, conducting leads, twin-spot welders, and seam-welding of tubes with a mandrel and sliding roller are dealt with.—H. W. G. H.

Theoretical Study of Welding Machines Operated by the Discharge of Energy Stored in an Inductance. Marcel Mathieu (*Rev. gén. Élect.*, 1937, 41, (10), 293–297).—Mathematical. Welding equipment operating on this principle would be heavy, large, and difficult to construct.—J. C. C.

The Distribution of Stresses in Fillet Welds. David Victor Isaacs (*J. Inst. Eng. Australia*, 1936, 8, (8), 286-294).—Existing theories on the distribution of stresses along side fillet welds are critically discussed. Experimental and theoretical research work is then described, showing that many assumptions, on which previous mathematical work has been based, are unjustified. Among the results obtained from an elaborate investigation, which is said to be still incomplete, are analyses of the factors influencing stress and load distribution; concrete recommendations for design; and the conclusions that butt welds should be used where possible, and that intermittent fillets have very little inferior fatigue properties to continuous fillets.—H. W. G. H.

Fatigue Strength of Welded Joints. A Review of the Literature to October 1, 1936. W. Spraragen and G. E. Claussen (*J. Amer. Weld. Soc.*, 1937, 16, (1), Suppt., 1-44).—A comprehensive report is presented by the Fundamental Research Sub-Committee. Of the 44 pages, less than a column and a half suffices to review available information on the fatigue properties of welded joints in non-ferrous materials. A bibliography of 310 references is given.—H. H.

Non-Destructive Tests [of Welded Vessels]. (Rollason.) See p. 203.

Notes on the Training of Oxy-Acetylene Welders. F. Clark (*Welding Ind.*, 1936, 4, (10), 366-368; (11), 413-417).—Recommendations are given for what is claimed to be a more comprehensive type of instruction and more consideration to a student's individuality than is generally given. Considerable attention is paid to safety measures, and psychological factors. Brief notes are given on the technique to be adopted for steel, stainless steel, cast-iron, and non-ferrous metals; and a syllabus is suggested for 250 hours' practical instruction.—H. W. G. H.

XXI.—INDUSTRIAL USES AND APPLICATIONS

(Continued from pp. 164-166.)

From the Literature on Substitution and Economy of Metallic Materials. M. Philipp (*Maschinenbau*, 1937, 16, (3/4), 78-80).—A review of the extensive German literature on the finding of substitutes for imported metals.—v. G.

Chemical Plant. Utilization of Aluminium. A. J. V. Underwood (*Times Trade and Eng. Suppt.*, 1937, 40, (877), li).—The high resistance to corrosion of aluminium and the fact that its salts are colourless and non-toxic, account for its extensive use in chemical plant. The alloys used, typical applications possible, and the precautions necessary in design, fabrication, and use are discussed.—H. W. G. H.

[Aluminium] Brewery Equipment. Storage and Transport of Beer. Peter B. Mürer (*Times Trade and Eng. Suppt.*, 1937, 40, (877), lvi).—The advantages of aluminium and the many applications found in brewery plant are set forth.—H. W. G. H.

Aluminium in the Dairy. Growing Use in Denmark. Peter B. Mürer (*Times Trade and Eng. Suppt.*, 1937, 40, (877), lvi).—The advantages of aluminium are enumerated. The content of vitamin C in milk boiled in aluminium is said to be the same as in milk boiled in glass. The precautions necessary for cleansing aluminium plant are pointed out.—H. W. G. H.

Laundry Industry. Aluminium Fittings. — (*Times Trade and Eng. Suppt.*, 1937, 40, (877), xxxvii).—Light weight and high resistance to corrosion account for the use of aluminium for the drums of washing machines and the containers of hydro extractors. Many parts of domestic washing machines, made of aluminium, have given satisfactory service over many years. The high thermal conductivity of aluminium makes it very suitable for steam-heated equipment, sole-plates for electric irons, condensers, and moulds for drying stockings and sleeves.—H. W. G. H.

Rubber Industry. Extensive Use of Aluminium. J. F. Crowley (*Times Trade and Eng. Suppl.*, 1937, 40, (877), lxii).—Aluminium does not corrode in the warm, moist atmosphere of curing shops, rubber does not stick to it, and it is highly resistant to the chemicals used in the industry. Aluminium cups are used for collecting the latex, and the coagulating pans and tanks are lined with aluminium. It is used for drying trays and for mandrils, moulds, and formers, and its applications in the rubber industry are still increasing.

—H. W. G. H.

Sterile Wrappers. Uses of Aluminium Foil. C. Blattner (*Times Trade and Eng. Suppl.*, 1937, 40, (877), lix).—High melting point enables aluminium foil to be sterilized at a higher temperature than is possible for tin. Difficulties in rolling have now been overcome by highly-developed technique and in 1936 the world's consumption of foil exceeded 25,000 tons, with a superficial area of over 247,000 acres. Some applications are wrapping cigarettes, butter, and chocolate, lining tea-chests, and for heat insulation.

—H. W. G. H.

Food Preservation. Progress in [Aluminium] Canning. J. Mürer and D. Nickelsen (*Times Trade and Eng. Suppl.*, 1937, 40, (877), lvi).—Sardines, fresh herring, meat, shrimps, tuna, asparagus, strawberry jam, crabs, kippers, and shell-fish are satisfactorily canned in aluminium containers. Absence of discoloration, smell, taste, and solution of injurious metal, combined with light weight and facility of opening the boxes, are the principal advantages.

—H. W. G. H.

Containers. Some Novel Applications [of Aluminium]. — (*Times Trade and Eng. Suppl.*, 1937, 40, (877), xxxiv).—Containers for pharmaceutical and cosmetic products, carrier-pigeon note cases, match-box cases, miners' lamps, beer tankards, and many applications of foil for wrapping purposes, are described.—H. W. G. H.

Bottle Closures. Use of Aluminium Seals. W. R. Gamble (*Times Trade and Eng. Suppl.*, 1937, 40, (877), lii).—The development of aluminium bottle caps results from the high ductility of the metal, its pleasing appearance, absence of rusting, non-toxicity, and low density. The construction and methods of manufacture of the rolled-on and pilfer-proof types of seal, and applications to milk and beer containers are described.—H. W. G. H.

Textile Industries. Rapidly Extending Uses [of Aluminium]. J. F. Crowley (*Times Trade and Eng. Suppl.*, 1937, 40, (877), lv).—The employment of aluminium alloys results in a reduction of weight of moving parts, with consequent reduced vibration, wear on bearings, and power consumption. The resistance to corrosion of these alloys is important in the moist atmosphere in which textile operations are carried out. Typical applications are light-weight high-speed pulleys, carding rollers, fast-moving parts of spinning machines, bobbins, bobbin-trays, beams, and bleaching and dyeing equipment.—H. W. G. H.

Mechanical Construction. Advantages of Light Metals. — (*Times Trade and Eng. Suppl.*, 1937, 40, (877), xlv).—The specific weights of aluminium alloys are compared with those of other materials, and the advantages of low weight in reducing power consumption and inertia effects in moving parts is emphasized. Advantages of reduced dead-weight are also pointed out, and the high corrosion-resistance, ease of fabrication, and high scrap value of the light metals is said to offset their high first cost.—H. W. G. H.

[Use of Aluminium in] Excavating and Mining. S. E. Clotworthy (*Times Trade and Eng. Suppl.*, 1937, 40, (877), xl).—Excavator buckets are made of aluminium alloy to reduce weight, with consequent reduction in operating costs and increase in operating speeds. Booms for drag-line excavators are also made in aluminium alloy, with a saving in weight of 40–50%. Similar savings are obtained with mine skips and cages. With aluminium alloy skips,

it is estimated that the depth of operation can be increased by 50%, using the same hoisting equipment.—H. W. G. H.

Machine Tool Design. Growing Field of Application [of Aluminium Alloys]. — (*Times Trade and Eng. Suppl.*, 1937, 40, (877), xlv).—Many parts of portable tools are made of aluminium alloy to reduce weight. In the same way, parts of fixed tools, which have to be lifted by the operator for changing work, are made as light as possible. Power consumption is reduced by making rotating and reciprocating parts of aluminium alloy, and aluminium pulleys have been found to wear no more than cast-iron, and to produce less wear on the belting, owing to lower inertia. For sliding surfaces, the hardness of aluminium alloys is not sufficient to withstand accidental damage, and steel linings are essential.—H. W. G. H.

Motor Vehicle Construction. Advantages of Light Metals. K. Sutter (*Times Trade and Eng. Suppl.*, 1937, 40, (877), xlvi).—The advantages of reduced weight are pointed out, and various ways of achieving it, by the use of aluminium alloys, are described. An example is given of an omnibus fleet in which a saving in weight of 33% reduced the expenses for petrol, oil, tyres and maintenance by 25% and enabled the buses to accelerate 45% faster. Various applications for bulk transport are described, e.g. insulated vans for perishable goods, petrol tanks, and milk tanks.—H. W. G. H.

[Aluminium for] Bicycles. Difficulties of Design. — (*Times Trade and Eng. Suppl.*, 1937, 40, (877), xlvii).—Delay in the development of the all-aluminium bicycle is thought to be due mainly to the cost factor, highly developed production methods being used for the steel bicycles at present made in large quantities. Aluminium components are, however, very popular and the saving in weight to be obtained by using them is indicated: it can amount to over 25% of the original weight of the machine. Modifications in design, necessitated by the low modulus of elasticity of aluminium alloys, are discussed.—H. W. G. H.

The Modern Aeroplane and Power Unit. M. Précoul (*Rev. Combustibles Liquides*, 1937, 15, 1-13; 39-58).—Light structural materials include Duralumin, alloys of magnesium, and plywood to which aluminium sheet is glued. For engine parts alloys of aluminium, of magnesium, and of copper-nickel-titanium-silicon, and bronzes containing lead, vanadium, or beryllium are mentioned.—A. R. PE.

Aircraft. Unique Position of Aluminium. H. Sutton (*Times Trade and Eng. Suppl.*, 1937, 40, (877), xlvii).—The principal applications of aluminium alloys in aircraft are reviewed with a brief discussion of the methods used in fabrication, jointing, and protection from corrosion.—H. W. G. H.

Aluminium in Diesel Engine Construction. P. B. Jackson (*Diesel Power*, 1937, 15, (1), 49-50).—A list is given of Diesel engine parts now available in light alloys, and castings for engine frames, cylinder blocks, cylinder heads and blowers are briefly described and illustrated.—P. M. C. R.

Railway Rolling Stock. Vital Factor of Weight Reduction. K. Sutter (*Times Trade and Eng. Suppl.*, 1937, 40, (877), xxxiii).—The reduction of dead-weight by the use of aluminium alloys necessitates modifications in design and monocoque structures have been developed. The resistance to corrosion of aluminium alloys reduces maintenance costs and ease of fabrication simplifies design. Application to tramways, suburban traffic, locomotives, and freight trains is rapidly developing.—H. W. G. H.

Ship Construction. Promising Field for Light Alloys. E. H. Smith (*Times Trade and Eng. Suppl.*, 1937, 40, (877), xlii).—A review of the design factors governing the application of aluminium alloys, in which their advantages are pointed out and many examples described, such as motor-launches of riveted construction, life-boats, small fittings, and engine casings. The development of aluminium alloy superstructure and deck-houses for liners is forecast.

—H. W. G. H.

Electrical Industry. Substitution [of Aluminium] for Copper. W. Zwanzig (*Times Trade and Eng. Suppt.*, 1937, 40, (877), lxiv).—In addition to the steel-cored conductor, aluminium has found many applications in the electrical industry, in which its low density and ease of working outweigh its greater resistivity compared with copper: e.g. bus-bars, squirrel-cage rotors, casings of transformers, &c. The dielectric properties of the anodic film has led to the extensive use of aluminium in electrolytic condensers.—H. W. G. H.

Power Transmission. Aluminium Conductor Lines. Theodore Varney (*Times Trade and Eng. Suppt.*, 1937, 40, (877), xlviii).—The development of high-power transmission lines in various countries, the advantages of the steel-cored aluminium conductor, and design factors are discussed.—H. H.

Bridgework and Dams. Aluminium in Large-Scale Structures. — (*Times Trade and Eng. Suppt.*, 1937, 40, (877), xl).—The development of large aluminium alloy structural shapes has led to such applications as a rebuilt floor for an old bridge, by which the load on the trusses was reduced by 750 tons, bulkheads for dams, light-weight overhead travelling cranes, and innumerable aircraft and other transport constructions.—H. W. G. H.

Building Construction. Architectural Uses of Aluminium. K. Sutter (*Times Trade and Eng. Suppt.*, 1937, 40, (877), xxvii–xxviii).—Ease of fabrication and resistance to corrosion, combined with attractive appearance, account for the many applications of aluminium in architecture. Amongst these are exterior decorations, such as facias, statuary, grilles, railings, &c.; doors, in which light weight and freedom from buckling are advantages; window frames, mullions, transoms, and window bays; spandrels and pilasters, often of intricate design; cornices; shop fronts; and roofings. A tendency towards all-metal façades makes probable the development of walls built up from aluminium alloy sheet and backed by insulating material for cases in which the exterior walls do not support the structure.—H. W. G. H.

Office and Home. [Aluminium] Domestic Appliances and Furniture. — (*Times Trade and Eng. Suppt.*, 1937, 40, (877), xxxi).—The use, in America, of aluminium furniture, cooking utensils, lighting fittings, and labour-saving appliances is described.—H. W. G. H.

Wireless. [Use of Aluminium in] Modern Receiving Sets. — (*Times Trade and Eng. Suppt.*, 1937, 40, (877), xlii).—Low sp. gr., high electrical conductivity, low magnetic susceptibility and ease of fabrication by pressing or spinning, account for the many applications of aluminium in receiving sets. These include electrostatic screens, condensers of fixed and variable capacity, frames and cases for portable sets, supporting spiders for the diaphragms of moving-coil speakers, and aerial masts.—H. W. G. H.

Sports and Pastimes. Varied Range of Equipment [in Aluminium]. — (*Times Trade and Eng. Suppt.*, 1937, 40, (877), xxxvii).—Amongst the applications mentioned are: camp fittings, and equipment for mountaineers and hikers; caravans and canoes; parts of yachts and sailing-boats; skis and sleighs; bows and fishing-rods.—H. W. G. H.

The Rare Earths as Catalysts. B. S. Hopkins and W. A. Taebel (*Electrochem. Soc. Preprint*, 1937, (May), 45–51).—Summarizes the uses of cerium and other rare earths as catalysts of hydrogenation, dehydrogenation, and some other types of reactions.—S. G.

Cobalt as a Catalyst. Colin G. Fink (*Electrochem. Soc. Preprint*, 1937, (May), 39–44).—S. G.

Activity in Copper and Light Metals. — (*Metal Progress*, 1936, 30, (4), 229–234).—A review of recent developments in the treatment and applications of aluminium, magnesium, and copper alloys.—P. M. C. R.

Safety in Solvent Extraction. M. Bonotto (*Oil and Soap*, 1937, 14, 30–33; *C. Abs.*, 1937, 31, 2312).—Among the general precautions recommended are: all piping handling solvent should be welded; differences of voltage between

sections of pipe-lines or machines should be avoided; the use of compressed air in pipe-lines generates static electricity, and should be avoided; metallic moving parts that could cause sparks should be made of bronze, brass, or copper.—S. G.

Lead and Iron for Service Pipes and Carcassing as Compared with Copper. — (*Gas World*, 1937, 106, (2747), 314).—A discussion by members of the London and Southern District Junior Gas Association.—A. R. P.

***The Use of Copper-Nickel Alloys for Pickling Equipment.** Josef Teindl (*Chem. Obzor*, 1936, 11, (12), 272-275).—The theory of the corrosion of metals and alloys by acids, especially by sulphuric acid, is discussed, and copper-nickel alloys that resist corrosion by sulphuric acid are described. A comparison of Monel metal with other alloys shows that Monel metal is more suitable than corrosion-resistant steels for material for equipment for pickling brass sheet and strip.—S. G.

Monel and Nickel in Gas Works. — (*Internat. Nickel Co. Bull.* C-5, 1936, 18 pp.).—The uses and advantages of Monel metal, nickel, and certain other nickel alloys in gas works are described. The established uses are covered in detail, and information and data are included on the resistance of Monel metal to the corrosives encountered. The properties of "H," "S," and "K" Monel and of Inconel are given.—S. G.

Weldless Steel Chains. Ian M. Smith (*Shipbuilder*, 1937, 44, (326), 100-101).—The manufacture of lengths of steel chain, usually from 60 to 70 ft. long, from a bar of special section which is passed through a special rolling mill to form the links on the bar is described. It is also stated that weldless chains of Monel metal and of the lighter alloys such as Duralumin are made by a similar process.—J. W. D.

Report of the Research Commission of the American Dental Association [Specifications of Dental Alloys]. — (*J. Amer. Dental Assoc.*, 1937, 24, (2), 269-281).—Lists of commercial alloys which fulfil A.D.S. specifications are given.—A. R. P.

Modern Bearing Metals. J. G. M. Goller and E. F. Goode (*Modern Eng.*, 1936, 10, (12), 583-586).—The requirements of a bearing metal are outlined and the properties of tin-, lead-, copper-, and cadmium-base alloys are described in an elementary way.—H. W. G. H.

Bearing Metals for Oil Engines. H. N. Bassett (*Oil Engine*, 1937, 4, (48), 376-377).—The severe operating conditions in oil engines render the use of lead-base bearing alloys inadvisable. The relative merits of lead-bronzes and tin-base alloys are discussed from the points of view of wear, compressive strength, cooling, and renewal.—P. M. C. R.

Zinc and Light Metal Sheet in Shop-Window Construction. Helmut Hille (*Illust. Zeit. Blechindustrie*, 1937, 66, (7), 184-185; (8) 210-211).—The design, attachment, insulation, and protection of sheet-metal shop-window fittings of zinc, galvanized iron, or light alloy sheet are briefly described, and several structural details are illustrated.—P. M. C. R.

The Use of Metals in Present-Day Construction. Michel Nation (*Technique moderne*, 1936, 28, (8), 266-270).—The non-ferrous metals and alloys especially considered include Duralumin (the principal mechanical properties of which are tabulated and reproduced graphically in relation to temperature), Studal, an aluminium-manganese-magnesium forging alloy free from copper and possessing a high resistance to atmospheric corrosion, Almasilium, and lead. The principal architectural applications of these are indicated, and brief reference is made to the use of Duranie (aluminium 94, copper 27, manganese 2, nickel 2%) and Aeral (alloys of the Duralumin class containing additions of titanium, cadmium, or antimony) in interior decoration.—P. M. C. R.

Raw Materials and the Use of Substitute Materials for Metal Fittings. Werner Gebhardt (*Illust. Zeit. Blechindustrie*, 1937, 66, (11), 329-333).—A

full list of prohibited and permissible uses of copper, nickel, lead, tin, mercury, and their alloys in valves, piping, and sanitary and other fittings is accompanied by a discussion of the advantages of light alloys, zinc, and zinc-base alloys, and other substitute materials.—P. M. C. R.

Materials at the [Berlin] Motor Exhibition. — (*Automobiltech. Z.*, 1937, 40, (5), 136-138).—Bearing design in Germany has been much influenced by recent restrictions on the use of copper and tin: thicknesses are greatly reduced, or the body of the bearing is of steel or cast iron, carrying a thin facing of bronze or of the self-lubricating "Gittermetall." A light alloy (Alva 36) is said to possess satisfactory anti-friction properties, combined with relatively low thermal expansion. Among piston alloys, aluminium-silicon alloys are increasingly used on account of their high resistance to wear and low expansion. Starting friction is reduced in some cases by tinning the surface of the piston. Protective processes include anodic oxidation and "Alumetizing, but the hardness of the coating requires careful control. Silumin is said to be the most popular die-casting alloy, but Zamak zinc-base die-castings are now much used instead of brass.—P. M. C. R.

Roofs and Balconies. S. Dufour (*Technique moderne*, 1937, 28, (8), 280-288).—Metals used in roofing, flooring for balconies, &c., include lead and aluminium sheet, zinc and copper plates, and copper and zinc strip for use as flashing in expansion joints. The method of installation and joint construction is described and illustrated in each case.—P. M. C. R.

Protective Metal Coatings by the Wire-Spraying Process. H. J. Williams (*J. Inst. Production Eng.*, 1937, 16, (2), 76-83).—The use of the metal spray pistol for "building up" coatings on such machine parts as shafts and pistons is briefly described. The surface should first be machined dry under size, and rings—20 to 30 per in.—cut with a "V" tool. Carbon or stainless steel, nickel, or a nickel alloy is then sprayed so that the particles impinge above the centre-line when the article is rotated in a lathe. The temperature must be kept below 250° C.—J. C. C.

A Résumé of Metallizing Foundry Technique. W. C. Reid (*Metallizer*, 1937, 5, (8), 2, 3, 13).—A description is given of metallizing as applied to foundry work, with work by A. Roger on the metallizing of cores. The cores are sprayed with a thin coating of aluminium and this is claimed to cure small surface defects. The repair of blowholes and spongy places in iron castings by means of the metallizing process is also described.—W. E. B.

Metal Spraying on Wood. — (*Metallizer*, 1937, 5, (8), 10).—Describes results of experiments conducted by the Forest Research Institute, India. It is found that metals of low melting point, such as tin, lead, and zinc, when sprayed on wood, reduced its susceptibility to changes in moisture content to $\frac{1}{2}$ to $\frac{1}{3}$. The metals of high melting point do not offer this protection. Sprayed metals do not protect wood against conditions of soaking.—W. E. B.

XXII.—MISCELLANEOUS

(Continued from pp. 166-167.)

Thomas Bolton, 1858-1937. — (*Bull. Brit. N.-F. Metals Res. Assoc.*, 1937, (97), 3-13).—Obituary, with appreciations, and portrait.—S. G.

The Rise of a New Industry. Arthur Vining Davis (*Times Trade and Eng. Suppl.*, 1937, 40, (877), i-ii).—The history of aluminium is reviewed, with particular reference to the work of Charles Martin Hall and the industrial development of aluminium production and application in the U.S.A.—H. H.

XXIII.—BIBLIOGRAPHY

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

(Continued from pp. 167-171.)

- ***Abegg, R., Fr. Auerbach, and I. Koppel.** Herausgegeben von. *Handbuch der anorganischen Chemie.* In vier Bänden. Vierter Band, Dritte Abteilung: *Die Elemente der achte Gruppe des periodischen Systems.* Vierter Teil: *Nickel und seine Verbindungen.* Lieferung 1. 17 × 24 cm. Pp. xviii + 827, with 247 illustrations. 1937. Leipzig: S. Hirzel. (Br., M. 78.)
- ***Air Ministry.** *Light Alloy Airscrew Forgings (Fairey Reed Type).* Provisional Air Ministry Aircraft Specification, D.T.D. 179. Fcap. Pp. 2. 1936. London: H.M. Stationery Office. (6d.)
- ***Air Ministry.** *7 Per Cent. Magnesium-Aluminium Alloy Bars, Extruded Sections, and Forgings (Softened).* Air Ministry Material Specification, D.T.D. 297. Fcap. Pp. 7. 1936. London: H.M. Stationery Office. (1s.)
- Alexejew, Wladimir Nikolaiewitsch.** *Qualitative Analysis.* [In Russian.] Second Edition. Pp. 346. 1936. Moscow: Onti. (Rbl. 5.50.)
- ***Aluminium-Zentrale.** *Aluminium-Automaten-Legierungen.* (Sonderdruck aus "Aluminium.") 21 × 29.5 cm. Pp. 125-196 + 4, with numerous illustrations. 1937. Berlin: Aluminium-Zentrale. (R.M. 3.)
- [Contents: H. Oplitz, "Das Laboratorium für Werkzeugmaschinen und Betriebswissenschaften an der Technischen Hochschule Aachen"; H. Schallbroch, "Das Versuchsfeld für Werkzeugmaschinen der Technischen Hochschule München"; Hans Bohner, "Leichtmetall-Automatenlegierungen auf Aluminium-Magnesium Basis"; H. Kästner, "Aluminium-Automatenlegierungen auf Al-Cu-Mg- bzw. Al-Mg-Si-Basis"; H. Oplitz, "Neuere Untersuchungen über die Zerspanbarkeit von Leichtmetallen, insbesondere von Automaten-Legierungen"; H. Schallbroch, "Prüfverfahren von die Zerspanbarkeit von Leichtmetallen"; H. Klein, "Fräswerkzeuge für die Bearbeitung von Leichtmetallen"; F. Pütz, "Werkzeuge zum Bohren, Senken, Reiben und Gewindeschneiden in Leichtmetallen"; K. Beuerlein, "Geegnete Oele für die Bearbeitung von Leichtmetall-Automaten-Legierungen"; E. Hermann, "Die gut zerspanbaren Aluminium-legierungen im Patentschrifttum"; J. Dornauf, "Schneidwerkzeuge für Silumin"; E. Hänsgen, "Revolverdrehbänke und Automaten für die Verarbeitung von Leichtmetallen."]
- ***Aluminium-Zentrale.** *Chemische Analyse-Methoden für Aluminium und seine Legierungen.* Bearbeiter: Chemiker-Fachusschuss der Aluminium-Zentrale unter der Obmannschaft von — Schall. 21 × 29.5 cm. Pp. 16. 1937. Berlin: Aluminium-Zentrale. (R.M. 3.)
- ***Aluminum Company of America.** *Finishes for Aluminium.* Post 8vo. Pp. 59, illustrated. 1936. Pittsburgh, Pa.: The Company.
- ***American Institute of Mining and Metallurgical Engineers.** *Transactions of the American Institute of Mining and Metallurgical Engineers.* Vol. 121.—*Metallurgy of Lead and Zinc.* Sponsored by the Rocky Mountain Fund. Med. 8vo. Pp. 748, with numerous illustrations. 1936. New York: The Institute, 29 West 39th St. (\$5.00.)
- [Contents: A. S. Dwight, "A Brief History of Blast-Furnace Lead Smelting in America"; H. J. Stehli, "Sintering Lead Ores"; G. H. Clevenger, "Blast-Furnace Practice at Midvale, Utah"; G. E. Murray, "Lead Blast-Furnace Practice at Trull, B.C."; P. C. Feddersen and H. E. Lee, "Blast-Furnace Practice at the Bunker-Hill Smelter"; C. M. Warner, "Lead Blast-Furnace Practice in Missouri"; G. L. Oldbright and V. Miller, "Smelting in the Lead Blast-Furnace"; L. J. Buck, "Lead Smelting in the Federal Improved Mechanical Ore Hearth"; S. F. Ravitz and K. E. Fisher, "Equilibrium in Lead Smelting"; C. M. Dice, G. L. Oldright, and T. M. Brighton, "Drosses in Lead Smelters"; O. P. Chisholm, "Treating Blast-Furnace Drosses"; G. U. Greene, "A

Study of Drosses from Lead Blast-Furnaces"; A. F. Hall, "Softening of Lead Bullion"; J. O. Betterton and Y. E. Lebedeff, "Debismuthizing Lead With Alkaline Earth Metals, Including Magnesium, and With Antimony"; G. K. Williams, "Continuous Lead Refining at Port Pirle, South Australia"; J. O. Betterton, "Chlorine Dezincking in Lead Refining"; P. F. McIntyre, "Electrolytic Lead Refinery, Betts Process, the Consolidated Mining and Smelting Company of Canada, Limited"; T. E. Harper, Jr., and G. Reinberg, "The Betts Process of Oroya, Peru, S.A."; R. P. E. Hermsdorf and M. Heberlein, "Electrolytic Solder" (see *Met Abs.*, 1930, 3, 128); R. L. Hallows and B. M. O'Harra, "Modern Automatic Baghouses for Collection of Lead Furnace Fumes"; H. V. Welch, "Collection of Lead and Zinc Dusts and Fumes by the Cottrell Process"; W. R. Ingalls, "History of the Metallurgy of Zinc"; H. J. Stehl, "Sintering Zinc Ores"; M. F. Warner, "The Warner-Ingalls Zinc-Roasting Process"; T. B. Gyles, "Horizontal Retort Practice of the National Smelting Company, Limited, Avonmouth, England"; E. H. Bunce and E. C. Handwerk, "New Jersey Company Vertical Retort Process"; E. J. Bruderlin, "Manufacture of Silicon Carbide Retorts"; W. M. Peirce and R. K. Waring, "New Jersey Zinc Company Process for the Refining of Zinc by Reddistillation"; A. Zentner, "World Survey of Electrolytic Zinc"; H. Bach, W. Hönig, W. Gehrhardt, E. Theurich, and W. Langner, "The Magdeburg Zinc Works of the Georg von Giesche's Erben Mining Company"; W. C. Snow, "Electrolytic Zinc at Risdon, Tasmania"; W. G. Woolf and E. R. Crutcher, "Electrolytic Zinc Plant of the Sullivan Mining Company"; B. A. Stimmel, W. H. Hannay, and K. D. McBean, "The Electrolytic Zinc Plant of the Consolidated Mining and Smelting Company of Canada, Limited"; W. S. Landis, "The Trollhättan Electrothermic Zinc Process"; G. F. Weaten, "St. Joseph Lead Company's Electrothermic Zinc-Smelting Process"; W. R. Ingalls, "Intermittent Zinc Distilling from Ore"; H. A. Doerner, "Reduction of Zinc Ores by Natural Gas"; E. H. Bunce and H. M. Haslam, "Direct-Process Zinc Oxide"; J. van Oirbeck, "Treatment of Residues from Electrolysis of Zinc and of Lead-Furnace Slags in Ash-Fusion Gas Producers"; W. E. Harris, "The Waelz Process"; R. R. McNaughton, "Slag Treatment for the Recovery of Lead and Zinc at Trail, British Columbia."

***American Society for Testing Materials.** *Index to A.S.T.M. Standards and Tentative Standards.* Med. 8vo. Pp. 118. 1937. Philadelphia, Pa.: The Society, 260 S. Broad St. (Gratis.)

v. **Angerer, E.** *Technische Kunstgriffe bei physikalischen Untersuchungen.* III. Aufl. Pp. 201, with 42 illustrations. 1936. Braunschweig: Verlag Friedr. Vieweg u. Sohn. (Geh., R.M. 9.80.)

Arcos. *15 Stunden Arcos Lichtbogenschweissung.* Ein Lehrbuch, herausgegeben von der Arcos-Gesellschaft für Schweisstechnik m.b.H., Aachen. 4. Ausgabe. Pp. 94, with numerous illustrations. 1936. Aachen: Arcos Gesellschaft für Schweisstechnik m.b.H. (R.M. 2.)

***Beard, E. H.** *Strontium Minerals.* Second Edition. (Imperial Institute, Mineral Resources Department, Reports on the Mineral Industry of the British Empire and Foreign Countries.) Med. 8vo. Pp. 33. 1937. London: H.M. Stationery Office. (1s. 6d. net.)

***Birmingham Jewellers' and Silversmiths' Association.** *Record of the Work of the Birmingham Jewellers' and Silversmiths' Association from 1887 to 1937, together with a brief survey of the rise and development of the Jewellery, Silver, and Allied Trades in Birmingham from 1524.* 4to. Pp. 55, illustrated. 1937. Birmingham: The Association.

Brady, G. S. *Materials Handbook.* An Encyclopædia for Purchasing Agents, Engineers, Executives, and Foremen. Third Edition. 8vo. Pp. viii + 663. 1937. New York: McGraw-Hill Book Co., Inc. (\$5.00); London: McGraw-Hill Publishing Co., Ltd. (30s.).

***Bristol.** *Directory of Bristol Industries.* 4to. Second Edition. Pp. 164. 1937. Bristol: Bristol Development Board. (5s.)

***British Engineers Association.** *Classified Handbook of Members and Their Manufactures.* 1937 Edition. Demy 8vo. Pp. 352. 1937. London: The Association, 32 Victoria St., S.W.1.

- ***British Standards Institution.** *Handbook of Information, including Indexed Lists of British Standard Specifications and Methods of Test.* January, 1937. Demy 8vo. Pp. 130. London: The Institution, 28 Victoria St., S.W.1. (1s.)
- Brown, W. Robson.** *Tinplate.* Llanelly: Old Castle Iron and Tinplate Co., Ltd. (2s. 6d.)
- Buxbaum, Bertold.** *Das Schleifen und Polieren der Metalle.* (Werkstattbücher für Betriebsbeamte, Konstrukteur und Facharbeiter, Heft 5.) Dritte, gänzlich umgearbeitete Auflage. Pp. 68, with 27 illustrations. 1937. (R.M. 2.)
- ***Buzzard, Robert W.** *Anodizing of Aluminium Alloys in Chromic Acid Solutions of Different Concentrations.* (Bureau of Standards, Research Paper No. 975.) Med. 8vo. Pp. 251-257, with 5 illustrations. 1937. Washington, D.C.: Superintendent of Documents. (5 cents.)
[See *Met Abs.*, this vol., p. 104.]
- Chapuis, J., et A. Jacquet.** *Elements de physique industrielle.* 10me. édition. Pp. iv + 338. 1937. Paris: Dunod. (Broché, 17 francs; cart., 19.50 francs; relié, 23 francs.)
- Chase Brass and Copper Company.** *Commercially Important Wrought Copper Alloys.* 8 × 10½ in. Pp. 60. 1936. Waterbury, Conn.: The Company.
- ***Clarke, Beverly L., L. A. Wooten, and C. L. Luke.** *Analysis by "Internal" Electrolysis. I.—Determination of Bismuth and Copper in Lead Alloys Containing Antimony and Tin.* (Bell Telephone System Technical Publications, Metallurgy, Monograph B-974.) Demy 8vo. Pp. 9, with 2 illustrations. 1936. New York: Bell Telephone Laboratories, Inc., 463 West St. (Gratis.)
[Reprinted from *Indust. and Eng. Chem. (Analyt. Edn.)*, 1936, 28, 411-414.]
- ***Constants and Numerical Data.** *Tables Annuelles de Constantes et Données Numériques. Tables de Matières des Volumes VI-X, Années 1923-1930.* 22 × 27 cm. Pp. xxiv + 48 + 304. 1937. Paris: Hermann et Cie (300 francs or £3); New York: McGraw-Hill Book Co., Inc. (\$15.00).
- ***Corrosion.** *Korrosion VI.* Bericht über die Korrosionstagung 1936 am 22. Oktober 1936 in Köln, veranstaltet von Arbeitsgemeinschaft auf dem Gebiete der Korrosion und des Korrosionsschutzes: Deutsche Gesellschaft für Metallkunde, Deutscher Verein von Gas- und Wasserfachmännern, Verein Deutscher Chemiker (mit Dechema, Deutsche Gesellschaft für chemisches Apparatewesen), Verein deutscher Eisenhüttenleute, Verein deutscher Ingenieure. 15 × 21 cm. Pp. iii + 61, with numerous illustrations. 1937. Berlin: V.D.I.-Verlag G.m.b.H. (Brosch., R.M. 5.00.)
[Contents: O. Lindermayer, "Begrüßungsworte des Vorsitzenden"; E. Dähnlick, "Einfluss der Formgebung auf die Korrosionsfestigkeit von Schienenfahrzeugen"; H.-U. Möller, "Bauliche Massnahmen zur Verhütung der Korrosion bei Strassenfahrzeugen"; P. Schafmelster u. H. Braun, "Bauliche Massnahmen zur Korrosionsverhütung an chemischen Apparaten"; R. Hartmann, "Bauliche Massnahmen zur Korrosionsverhütung bei Gasrohrleitungen"; H. Herbst, "Bauliche Massnahmen zur Korrosionsverhütung bei Förder- und Drahtseilen"; W. Adrian, "Bauliche Massnahmen zur Korrosionsverhütung im Stahlbau"; E. Gödecken, "Bauliche Massnahmen zur Korrosionsverhütung im Schiffbau"; — Lindmayer, "Schlusswort des Vorsitzenden."]
- Crane, E. V.** *Computations for Pressed Metal Working Operations.* Pp. 37. 1937. London: E. W. Bliss Company. (Gratis.)
- Crispin, F. S.** *Dictionary of Technical Terms.* Pp. 270. Milwaukee: Bruce. (\$2.00.)

- *Cronshaw, H. B. *The Wholesomeness of Canned Foods*. (Information Circular No. 2 of the International Tin Research and Development Council.) Med. 8vo. Pp. 16, illustrated. 1937. London: International Tin Research and Development Council, 378 Strand, W.C.2. (Gratis.)
- *Deutsche Normenausschuss. Herausgegeben vom. *Werkstoffnormen. Stahl, Eisen, Nichteisen-Metalle, Eigenschaften, Abmessungen*. (DIN Taschenbuch 4.) 11. Auflage. Pp. 184, illustrated. 1937. Berlin: Beuth-Verlag. (M. 6.)
- De Donder, Th., and P. van Rysseberghe. *Thermodynamic Theory of Affinity*. Pp. 142. 1937. Oxford: Oxford University Press. (13s. 6d.)
- Drotschmann, C. *Die Zinkkorrosion, betrachtet vom Standpunkt des Batterietechnikers*. Pp. ii + 55, with 96 illustrations. (R.M. 2.)
- Electrical and Allied Industries. *The Blue Book, 1937: The Directory and Handbook of the Electrical and Allied Industries*. Thirty-Fifth Edition. Pp. 1418. 1937. London: Benn Bros. (25s.)
- Engelder, Carl J., Tobias H. Dunkelberger, and William J. Schiller. *Semi-Micro Qualitative Analysis*. Pp. 265. New York: Wiley and Sons, Inc.; London: Chapman and Hall, Ltd. (13s. 6d.)
- Farbman, Samuil Aronowitsch, and I. F. Kolobnew. *Electric Induction Furnaces for the Melting of Non-Ferrous Metals and Their Alloys*. [In Russian.] Pp. 399. 1936. Moscow and Leningrad: Onti. (Rbl. 5.55.)
- *Federal Standard Stock Catalog (U.S.A.). *Federal Specification for Aluminium Alloy (Aluminium-Chromium-Magnesium-Silicon) Bars, Rods, Shapes, and Wire*. (Federal Standard Stock Catalog, Section IV (Part V); QQ-A-331.) Post 8vo. Pp. 11. 1936. Washington, D.C.: Government Printing Office. (5 cents.)
- *Gent, Ernest V. *A Review of the Zinc Industry*. Demy 8vo. Pp. 7. 1937. New York: American Zinc Institute.
- *Gmelins *Handbuch der anorganischen Chemie*. 8. Auflage. Herausgegeben von der Deutschen Chemischen Gesellschaft. System-Nummer 22: *Kalium. Lieferung 2*. 17 × 24 cm. Pp. 247-514, illustrated. 1937. Berlin: Verlag Chemie G.m.b.H. (Foreign price, R.M. 31.50.)
- Grenet L. *Thermodynamique et Métallurgie*. Pp. 222. 1937. Paris: Ch. Béranger. (60 francs.)
- Grodzinski, P. *Diamant-Werkzeuge*. 6 × 4½. Pp. 214. 1936. Berlin: M. Krayn. (R.M. 6.50.)
- Hamilton, Leicester Forsyth, and Stephen Gershon Simpson. *Talbot's Quantitative Chemical Analysis*. Eighth Edition, Revised. Pp. 311. 1937. New York: Macmillan. (\$2.50.)
- *Haringhuizen, P. J., and D. A. Was. *Research on Thin Layers of Tin and Other Metals. III.—The Interaction Between Metals and Lubricating Oils*. (Technical Publications of the International Tin Research and Development Council, Series A, No. 51.) Med. 8vo. Pp. 10, with 4 illustrations. 1937. London: International Tin Research and Development Council, 378 Strand, W.C.2. (Gratis.)
- [Reprinted from *Proc. K. Akad. Wet. Amsterdam*, 1937, 40, 39-46; see *Met. Abs.*, this vol., p. 192.]
- Haynes, William. Editor. *The Chemical Who's Who*. Volume II: 1937. Pp. 543. New Haven, Conn.: The Haynes and George Co. (\$6.00.)

- Herb, Charles O. *Die-Casting*. Med. 8vo. Pp. 300. 1936. New York: Industrial Press. (\$3.00.)
- Herdan, J. *Dictionnaire technique en 4 langues: Anglais, Polonais, Français, Allemand*. Pp. 485. 1937. Paris: Ch. Béranger. (75 francs.)
- Heynemann, E. Johannes. *Lötmittel und Löten*. (Bibliothek der gesamten Technik, Nr. 432.) Pp. iv + 48. 1937. Leipzig: Max Jänecke. (M. 1.20.)
- Hill, F. T. *The Materials of Aircraft Construction*. Third and Revised Edition. Pp. 422. 1937. London: Sir Isaac Pitman and Sons, Ltd. (20s. net.)
- *Home Office. *Ventilation of Factories and Workshops*. Third Edition. (Home Office Welfare Pamphlet, No. 5.) Med. 8vo. Pp. 52, with 53 illustrations. 1937. London: H.M. Stationery Office. (1s. net.)
- *Home Office. *Weight Lifting by Industrial Workers*. (Home Office Safety Pamphlet, No. 16.) Med. 8vo. Pp. 44, with 28 illustrations. 1937. London: H.M. Stationery Office. (1s. 3d. net.)
[Weight lifting in metallurgical works is dealt with.]
- *Horner, J. G. *Practical Metal Turning for Engineers*. Fourth Edition, Revised by Philip Gates. Demy 8vo. Pp. xi + 422, with 508 illustrations. 1937. London: Technical Press, Ltd. (10s. 6d. net.)
- *Import Duties. *Report on the Import Duties Act Inquiry (1934). Part II.—The Iron and Steel Trades, the Engineering and Vehicle Trades, the Non-Ferrous Metals Trades, the Timber, Paper, Clay, and Building Materials Trades, and a General Summary Statement*. Roy. 8vo. Pp. xii + 308. 1937. London: H.M. Stationery Office. (4s. 6d. net.)
- Index Generalis, 1937. *The Year-Book of the Universities, Libraries, Astronomical Observatories, Scientific Institutes, Museums, Academies, Learned Societies*. Issued under the direction of R. de Montessus de Ballore. Cr. 8vo. Pp. vii + BE232 + US232 + F180 + 2500. 1937. Paris: Masson et Cie. (275 francs.)
- *International Nickel Company, Inc. *Monel and Nickel in Gas Works*. (Bulletin C-5.) 8½ × 11 in. Pp. 19, illustrated. 1936. New York: The Company; London: Mond Nickel Co., Ltd., Thames House, Millbank, S.W.1. (Gratis.)
- *International Tin Research and Development Council. *Le fer blanc et conserves en France*. (Bulletin de l'International Tin Research and Development Council, No. 5.) 21 × 27 cm. Pp. 96, with 129 illustrations. 1937. London: The Council, 378 Strand, W.C.2. (Gratis.)
- *Jänecke, Ernst. *Kurzgefasstes Handbuch aller Legierungen*. 17 × 24 cm. Pp. xii + 493, with 800 illustrations in the text. 1937. Leipzig: Otto Spamer. (Geh., R.M. 52; geb., R.M. 55.)
- Keel, Carl Franz. *Der praktische Autogen-Schweisser*. Herausgegeben vom Schweizer Acetylen-Verein, Basel. 1. Aufl. Pp. 212; 2. Aufl. Pp. 224. 1936. Zürich: A.-G. Fachschriften-Verlag u. Buchdr. (3.50 francs.)
- Keel, C. F. *La pratique de la Soudure autogène*. Pp. 223. 1937. Paris: Ch. Béranger. (25 francs.)
- Kilger, H. *Die Abtrennschweissung*. Pp. 12, with 75 illustrations. 1936. Braunschweig: F. Vieweg u. Sohn.

- ***Kleinschmidt, B.** *Schleif- und Poliertechnik. Handbuch des gesamten Schleif- und Polierwesens.* In vier Bänden. 17 × 24 cm. Band I.—*Das Schleifen in der Metallbearbeitung.* Pp. viii + 368, with 457 illustrations. Band II.—*Das Polieren der Metalle.* Pp. viii + 163, with 190 illustrations. 1937. Berlin: M. Krayn. (Band I: Br., M. 16, geb., M. 18; Band II: Br., M. 8.50, geb., M. 10.50.)
- ***Kratz, Ernst.** *Über die Rekristallisation von Aluminium.* (Aluminium-Archiv, Band 6; Dissertation: Berlin.) 21 × 29.5 cm. Pp. 25, with 57 illustrations. 1937. Berlin: Aluminium-Zentrale.
- Krippendorf, H., and J. Litzinger.** Bearbeitet von. *Das Lagern im Betrieb, unter besonderer Berücksichtigung praktischer Beispiele aus dem Lagerwesen, vor allem der metallverarbeitenden Industrie, im Auftrage des Ausschusses für wirtschaftliche Fertigung (AWF) beim Reichskuratorium für Wirtschaftlichkeit (RKW).* Pp. 92, with 66 illustrations. (AWF-Schrift 263.) Berlin: Beuth-Verlag G.m.b.H. (Br., R.M. 3.30.)
- ***Kuhn, Paul.** *Strain Measurements on Small Duralumin Box Beams in Bending.* (Technical Notes, National Advisory Committee for Aeronautics, No. 588.) 4to. [Mimeographed.] Pp. 11 + 14 illustrations. 1937. Washington, D.C.: National Advisory Committee for Aeronautics.
- ***de Lattre, G.** *Le Décapage des Métaux et Alliages.* Préface de G. Charpy. 16 × 25 cm. Pp. viii + 189, with 41 illustrations. 1937. Paris: Dunod. (Relié, 58 francs; broché, 43 francs.)
- ***Logan, Kirk H., and Scott P. Ewing.** *Soil-Corrosion Studies, 1934. Field Tests of Non-Bituminous Coatings for Underground Use.* (Bureau of Standards Research Paper No. 982.) Med. 8vo. Pp. 361-388, with 6 illustrations. 1937. Washington, D.C.: Superintendent of Documents. (10 cents.)
[See *Met. Abs.*, this vol., p. 194.]
- Löwe, F.** *Atlas der Analysen-Linien der wichtigsten Elemente.* Pp. 37, with 3 illustrations. 1936. Dresden and Leipzig: Theodor Steinkopf. (Geb., R.M. 9.50.)
- ***McClelland, E. H.** *Review of Iron and Steel Literature for 1936.* A Classified List of the More Important Books, Serials, and Trade Publications During the Year; with a Few of Earlier Date not Previously Announced. (Reprinted, with additions, from "The Blast Furnace and Steel Plant.") Cr. 8vo. Pp. 22. 1937. Pittsburgh, Pa.: Carnegie Library of Pittsburgh.
- Manson, Numa.** *Tables de Constantes de l'Acétylène et de l'Oxygène.* Pp. 48. 1937. Paris: Institut de Soudure Autogène. (10 francs.)
- ***Mantell, C. L.** *Zinn, Berg- und hüttenmännische Gewinnung, Verarbeitung und Verwendung.* Ins Deutsche übertragen und bearbeitet von W. Lidle. (Monographien über Chemisch-Technische Fabrikations-Methoden, Band LVIII.) 16 × 23.5 cm. Pp. viii + 323, with 113 illustrations. 1937. Halle (Saale): Wilhelm Knapp. (Foreign price, R.M. 18.75; bound, R.M. 19.90.)
- Metal Industry.** *Standard Metal Directory, 1936.* Seventh Edition. Med. 8vo. Pp. 682. 1936. New York: Atlas Publishing Co., Inc. (\$10.00.)

***Metal Statistics.** *Metal Statistics, 1937.* Thirtieth Annual Edition. Post 8vo. Pp. 592. 1937. New York: American Metal Market, 111 John St. (\$2.00.)

[In addition to general information, statistics are given regarding: *Iron and Steel*; *Fuels*; *Aluminium*: Canadian exports; exports; imports; N.Y. prices; U.S. production; scrap prices; U.S. secondary production; world production; *Antimony*: U.S. consumption; prices 1898-1910; imports; U.S. production of antimominal lead and secondary antimony; N.Y. prices; world production; *Copper*: brands, prices; U.S. and world consumption; exports; grades and descriptions; imports; prices; production; refinery capacities of U.S.A. and Canada; sales agencies of principal producers; scrap prices; U.S. secondary production; sellers; shipments; stocks; uses; world consumption and production; *Copper, Brass, and Bronze Products*: deliveries; price changes; exports; imports; *Lead*: analyses; prices; brands; U.S. and world consumption; exports; grades; imports; producers; U.S. and world production; secondary production; shipments; stocks; *Nickel*: Canadian production and exports; forms of nickel and Monel metal; production of by-product and secondary nickel; imports; exports; prices; *Platinum metals*: imports and exports; consumption; prices; U.S. and world production; recoveries in U.S.A.; stocks; *Quicksilver*: production; N.Y. prices; imports, exports; *Silver*: brands; U.S. imports and exports; U.S. and world production; prices; *Tin*: analyses; consumption; deliveries; imports; prices; production; scrap prices; secondary production in U.S.A.; stocks; supplies, &c.; *Zinc*: analyses; brands; concentrate prices; consumption; exports; imports; grades; prices; producers; U.S. and world's production; sheet prices; scrap prices; U.S. secondary production; stocks; world consumption; retorts in operation, by years; *Gold*: prices; production; U.S. imports and exports; *Magnesium*: U.S. prices, imports, and consumption.]

Millis, C. T. *Metal Plate Work: Its Patterns and Their Geometry.* Sixth Edition. Two volumes. London: E. and F. Spon, Ltd. (Part I, 4s. 6d. net; Part II, 7s. 6d. net.)

***Moreux, René, et Christian Moreux.** *Navis 1937.* (1re. édition.) 14 × 21 cm. Pp. 495. 1937. Paris: L'Agence Latine, 190 Bld. Haussmann. (25 francs.)

National Bureau of Standards (U.S.A.). *Units of Weight and Measure. Definitions and Tables of Equivalents.* 1936. Washington: Superintendent of Documents. (15 cents.)

***National Physical Laboratory.** *Report for the Year 1936.* Med. 8vo. Pp. 144. 1937. London: H.M. Stationery Office. (2s. 6d. net.)

Nauman, Woldemar Gottfriedowitsch. *The Technology of Gas-Welding.* [In Russian.] Pp. 363. 1937. Moscow and Leningrad: Onti. (Rbl. 4.75.)

***Oxford, University of. Committee for Advanced Studies.** *Abstracts of Dissertations for the Degree of Doctor of Philosophy.* Vol. VIII. Cr. 8vo. Pp. 181. 1936. London: Oxford University Press (Humphrey Milford). (3s. net.)

Precious Metals. *The Metallurgy and Refining of the Precious Metals.* Pp. 149. 1936. Moscow: Glawsoloto.

Ramsey, A. S. *Electricity and Magnetism: An Introduction to the Mathematical Theory.* Pp. 279. 1937. Cambridge: University Press. (10s. 6d.)

Reinert, Guido G. *Praktische Mikrofotografie.* Pp. 123. 1937. Halle (Saale): Wilhelm Knapp. (Geh., M. 4.20; geb., M. 4.80.)

Rieman, William, and Jacob D. Neuss. *Quantitative Analysis: A Theoretical Approach.* Pp. 434. 1937. New York: McGraw-Hill Book Co., Inc. (\$3.25); London: McGraw-Hill Publishing Co., Ltd. (18s.)

***Rimarski, W.** Herausgegeben von. (*Forschungsarbeiten auf dem Gebiete des Schweissens und Schneidens mittels Sauerstoff und Azetylen.* Elfte Folge. 21 × 30 cm. Pp. 123, illustrated. 1936. Halle a. S.: Carl Marhold. (R.M. 5.)

[Contents: II. Holler und II. Frankenbusch, "Güte der Autogenschweißung in Abhängigkeit von Schweissart und Nachbehandlung"; O. Graf: "Über Dauerzugversuche und Dauerblegeversuche an Stahlstäben mit brenngeschnittenen Flächen"; K. Kohrs: "Vorteilhafte Anwendung der Gasschmelzschweißung im Maschinen- und Kesselbau"; — Dorn, "Autogentechnik im Schiffbau und Schiffbaubetriebe"; H. Melhardt, "Autogenschweisste Schienenstossverbindung"; W. Miller, "Beitrag zur Schienenstossschweißung"; F. Leitner und A. Schmidt, "Physikalische Eigenschaften und Gefügeausbildung bei Gasschmelzschweißungen"; E. Zorn, "Stand und Aussichten der autogenen Oberflächenhärtung"; L. Hunsleker, "Azetylenerschweißung von Elektrolitkupfer"; II. Cramer "Wiederherstellung von kupfernen Lokomotivfeuertüchsen nach neuzeitlichen Gesichtspunkten"; H. A. Horn: "Die Schweißung von Bronze-glocken"; — Bürgel, "Korrosionsbeständigkeit von Schweißungen"; E. Streb und II. Kemper, "Wärnwirkung der Azetylen-Sauerstoff-Flamme bei verschiedenen Ausströmungsgeschwindigkeiten des Brenngasgemisches"; E. Saucrbrei und W. Scheruhn, "Bestimmung der Vergasungsgeschwindigkeit von Kalziumkarbid"; O. Mies, "Die Karbidvergasung im Azetylenentwickler"; O. Mies, "Über den Betrieb kleiner Verdrängungsentwickler"; W. Rimarski und II. Friedrich, "Elektrostatische Aufladungen durch fließende Gase."]

Rosin, Joseph. *Reagent Chemicals and Standards.* Pp. 530. 1937. New York: D. Van Nostrand Co. (\$6.00.)

***Sarazin, R.** *La soudure électrique à l'arc.* 2e. Édition. 16 × 24 cm. Pp. 493, with numerous illustrations. 1937. Neuilly-s/Seine: The Author, 47-49 Bd. de Levallois. (40 francs.)

Schwartz, H. A. *Shrinkage.* Pp. 32. The Penton Publishing Co. (5s. net.)

Sellin, W. *Die Ziehtechnik in der Blechbearbeitung.* 2. verb. Auflage. Pp. ii + 55, with 96 illustrations. 1936. (Br., R.M. 2.)

***Silsbee, Francis B., Russell B. Scott, and Ferdinand G. Brickwedde.** *A New Phenomenon in the Superconducting Transition of Tantalum and Tin.* (Bureau of Standards Research Paper No. 977.) Med. 8vo. Pp. 295-314, with 15 illustrations. 1937. Washington, D.C.: Superintendent of Documents. (5 cents.)

[See *Met. Abs.*, this vol., p. 178.]

***Simpson J.** *Barium Minerals.* Second Edition. (Imperial Institute, Mineral Resources Department. Reports on the Mineral Industry of the British Empire and Foreign Countries.) Med. 8vo. Pp. 84. 1937. London: Imperial Institute. (2s. net.)

Soule, Bryon Avery. *Library Technique for the Chemist.* Pp. 231. 1936. Ann Arbor, Mich.: The Author, 408 Chemistry Building, University of Michigan.

***Stanley, Robert C.** *The Nickel Industry in 1936.* Demy 8vo. Pp. 35. 1936. Canada: International Nickel Company of Canada, Ltd.; London: Mond Nickel Co., Ltd., Thames House, Millbank, S.W.1. (Gratis.)

Tanzer, Gerhard. *Die Palladium-Silber-Edelmetall-Legierungen.* (Durchges. u. begutachtet v. d. Fachwiss. Arbeitsgemeinschaft d. Reichsverbandes Dt. Dentisten.) Pp. 64. 1937. Dresden: Püschel. (M. 4.)

- ***Union International de Chimie.** *Table Internationale des Poids Atomiques. Septième Rapport de la Commission des Poids Atomiques, 1937.* [In English and French.] Pp. 39. 1937. Paris: Union Internationale de Chimie, 28 Rue Saint-Dominique.
[See *Met Abs.*, this vol., p. 133.]
- ***U.S. Bureau of Mines.** *Directory of Employees.* January 15, 1937. [Mimeographed.] 4to. Pp. 32 + viii. 1937. Washington, D.C.: Bureau of Mines.
- ***Verein deutscher Ingenieure.** *V.D.I. Jahrbuch 1937. Die Chronik der Technik.* Herausgegeben von A. Leitner. 15 × 21 cm. Pp. xii + 228. 1937. Berlin: V.D.I.-Verlag G.m.b.H. (R.M. 3.50; V.D.I.-Mitgl., R.M. 3.15.)
- Vigoureux, P., and C. E. Webb.** *Principles of Electric and Magnetic Measurements.* London: Blackie and Son, Ltd. (20s. net.)
- ***Wegner, Herbert.** *Silber. Wandlungen in der Erzeugung und Verwendung nach dem Weltkrieg.* (Wandlungen in der Weltwirtschaft. Herausgegeben von Hermann Schumacher, Heft 5.) 16 × 23 cm. Pp. 176. 1936. Leipzig: Bibliographisches Institut A.G. (Br., R.M. 7.50; 25% discount to foreign buyers.)
- Wieland, M.** *Anleitung zur Bestimmung der Belichtungszeit für die mikrographische Aufnahme mit dem lichtelektrischen Belichtungsmesser.* Pp. 50, with illustrations. 1936. Wetzlar: Technisch-Pädagogischer Verlag.
- ***Wretblad, P. E.** *Hårdhetshandbok.* (Svenska Metallografförbundet.) 18 × 24 cm. Pp. xvi + 331, with 81 illustrations. 1937. Stockholm: AB Nordiska Bokhandeln. (Bound, 18 Swedish crowns; card cover, 16 Swedish crowns.)
- Zeriali, Giovanni.** *Saldatura elettrica.* Pp. 174. 1936. Milano: U. Marucelli e C. (Lire 20.)

XXIV.—BOOK REVIEWS

(Continued from pp. 171-176.)

Spanlose Formung der Metalle. Eigenspannungen in Metallen. Von G. Sachs. ("Handbuch der Metallphysik," Herausgegeben von G. Masing, Band III, Erste Lieferung.) 18 × 25 cm. Pp. 228 + 8, with 181 illustrations. 1937. Leipzig: Akademische Verlagsgesellschaft m.b.H. (Br., R.M. 22.)

This is the third volume of a "Handbuch der Metallphysik" being edited by Professor Dr. G. Masing, and consists essentially in a rewritten edition of the second volume of Dr. Sachs' "Praktische Metallkunde," which was published in 1934 and reviewed in *Met. Abs.*, 1934, 1, 473.

The first section of the book on deformation contains a wealth of information bearing on the fundamental principles involved in the working of metals, and discusses both the theory and practice involved in manufacturing processes such as stamping, forging, extruding, rolling, and drawing. The second section deals with the consideration of internal stresses resulting from deformation processes, and details the causes giving rise to such stresses, means for their detection and measurement, as well as for their removal.

The book is typical of earlier publications by the same author, in so far as the matter is logically arranged, clearly exposed, and well illustrated. Unlike his earlier book on the same subject, the references are collected at the end of each section instead of being brought to the bottom of the pages throughout the text, the latter being in my opinion the preferable arrangement. The book is full of information of value to all metallurgically interested in the manufacturing processes involved in the production of metal semi-finished and finished products, but those who have the second volume of Dr. Sachs' "Praktische Metallkunde" will not find much new matter in this later publication.—H. W. BROWSDON.