METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

I.—PROPERTIES OF METALS

***Diamagnetism of Copper.** S. Ramachandra Rao (*Proc. Indian Acad. Sci.*, 1935, **2**, (3A), 249–259).—Colloidal copper, prepared by electrical dispersion in benzene or propyl alcohol, is found to have a diamagnetic susceptibility (χ) which increases as the size of the particles decreases, the critical diameter of the particles below which large changes of χ occur being 0·8 μ. The value of χ for copper in bulk is 0·080. The results with colloidal powders enable χ for the surface layer and the thickness of this layer to be determined. These are, respectively, 0·200 and 300 A. On the basis of the theory due to Honda and Shimizu, the density of the surface layer is found to be 8·404; the density of the metal in mass is 8·943.—J. S. G. T.

***Experiments on the Electrolytic Separation of the Isotopes of Lithium.** A. Eucken and K. Bratzler (*Z. physikal. Chem.*, 1935, [A], **174**, 269–272).— Attempts to separate lithium into its isotopes by electrolysis of lithium sulphate solution using a flowing mercury cathode failed to effect any appreciable separation after four repetitions.—B. Bl.

***On the Magnetostriction of Single Crystals of Nickel at Various Temperatures.** Kôtarô Honda, Hakar Masumoto, and Yuki Shirakawa (*Sci. Rep. Tôhoku Imp. Univ.*, 1935, [i], **24**, 391–410).—[In English.] The magnetization of single crystals of nickel at various temperatures ranging from — 252° to 370° C. was measured by the ballistic method. The magnetization at ordinary temperatures in the direction of the [111] axis increases at first rapidly and then slowly with the increase of the field, and afterwards reaches a saturation value. As the temperature is increased, the magnetization in weak fields gradually becomes easier and the saturation value of magnetization becomes less. The magnetization curves in the direction of the [110] and [100] axes are similar in form; they are almost the same as for the [111] axis, but at low temperatures the saturation value is not reached even in a field of 1000 oersteds. The saturation value of magnetization of a nickel crystal at absolute zero has been estimated to be 523 gauss.—S. G.

***Ionization of Hydrogen Gas in Contact with Platinum, Copper, and Nickel.** C. Y. Meng, Paul A. Anderson, and Y. M. Hsieh (*J. Chinese Chem. Soc.*, 1935, **3**, 103–114).—[In English.] The ionization of hydrogen in contact with platinum, copper, and nickel is studied quantitatively at different temperatures. An illustrated description is given of the ionization chamber and the purifier employed. Mercury vapour was eliminated by means of a potassium trap. Ionization of hydrogen occurred in the case of all three metals, the current observed being very small at room temperature and increasing markedly at about 65° C. Copper and nickel produced a slightly higher degree of ionization than platinum : the authors deduce that the activation of hydrogen in contact with platinum, which does not occur if copper or nickel are used, cannot be the result of ionization.—P. M. C. R.

The Effect of Crystalline Fields on the Magnetic Susceptibilities of Sm^{+++} and Eu^{+++} and the Heat Capacity of Sm^{+++}. Amelia Frank (*Phys. Rev.*, 1935, [ii], **48**, 765–771).—By assuming that the ion is subject to a crystalline field of a special type, it is shown that theoretical values of the paramagnetic susceptibility of samarium (Sm^{+++}) are in satisfactory agreement with the experimental

---

* Denotes a paper describing the results of original research.

† Denotes a first-class critical review.

data of Freed over the range from 74° K. to room temperature. In contrast to Sm^{+++}, europium (Eu^{+++}) behaves like the free ion even in the presence of a crystalline field. The general shape of the heat capacity–temperature curve of Sm^{+++} is shown to agree with that obtained experimentally by Ahlberg and Freed, but the theoretical values of heat capacity are consistently lower than the experimental values.—J. S. G. T.

*On the Increase in Deformability and Decrease in Cleavability [of Tin, Bismuth, and Zinc] with Increase in Temperature. G. Tammann and W. Müller (*Z. Metallkunde*, 1935, 27, 187–189).—If single crystals of the above metals are indented with the Brinell ball, characteristic twin lamellæ appear in definite crystallographic directions around the impression. Somewhat similar effects are produced by scratching the surface of the crystal with a diamond, small parallel fissures being produced on either side of the scratch forming a herringbone effect. With increasing temperature of test these effects become gradually less pronounced and eventually disappear, *i.e.* the once brittle metal becomes plastic. This disappearance takes place at definite temperatures which correspond with those at which the metal can be worked, *i.e.* for zinc 130° C., for bismuth 150° C., and for antimony 300° C. Single crystals of bismuth can be bent without fracture at temperatures above 100° C., whereas those of antimony can be bent only above 350° C. Since antimony at 300° C. is approximately as brittle as bismuth at 20° C. it follows that the two metals are equally brittle at temperatures which are the same fraction of their melting points in ° abs.—A. R. P.

*Effects of High Shearing Stress Combined with High Hydrostatic Pressure. P. W. Bridgman (*Phys. Rev.*, 1935, [ii], 48, 825–847).—Mean hydrostatic pressures up to 50,000 kg./cm.² combined with shearing stresses up to the plastic flow point are produced in thin discs confined between hardened steel parts so mounted that they may be subjected to normal pressure and torque simultaneously. Qualitative and quantitative studies are made of the effects of such stresses. Among the qualitative effects, it is found that many substances, *e.g.* celluloid, normally stable become unstable and may detonate, and some substances normally inert to each other, combine explosively. The shearing stress at plastic flow at 50,000 kg./cm.² may increase to as much as 10 or more times its normal value at atm. pressure; this is contrary to accepted views within a narrower pressure range. If the substance undergoes a polymorphic transition under these conditions of stress, a break may occur in the shearing stress–pressure curve. A number of new polymorphic transitions has thus been found amongst the elements, of which 57 have been examined. The metals exhibiting polymorphism are lithium, strontium, calcium, barium, cadmium, zinc, vanadium, manganese, antimony, tellurium, lanthanum, cerium, erbium, thallium, bismuth, thorium, tin, yttrium, and praseodymium.
—J. S. G. T.

*Polymorphism, Principally of the Elements, up to 50,000 kg./cm.². P. W. Bridgman (*Phys. Rev.*, 1935, [ii], 48, 893–906).—A new technique, whereby pressures of 50,000 kg./cm.² and higher can be applied to solids, and parameters of any transitions measured, is described. Many of the elements have been examined, in the new pressure range, for evidence of polymorphism. New modifications are found in the cases of bismuth, mercury, thallium, tellurium, gallium, and iodine.—J. S. G. T.

*The Theory of Surface Tension of Liquid Metals. D. V. Gogate and Duleh Sinha Kothari (*Phil. Mag.*, 1935, [vii], 20, 1136–1144).—A formula for the surface tension of liquid metals is derived by means of a theory which applies Fermi–Dirac statistics to the motion of electrons in a plane monomolecular film. Satisfactory agreement between calculated and experimental values of surface tension is shown by results relating to 15 metals.—J. S. G. T.

*The Pressure Effect of Electrical Resistance of Metals. N. K. Saha (*Indian J. Physics*, 1935, 9, (6), 623–635).—The pressure coeff. of electrical resistance of metals and the change of resistance at different pressures are calculated using the rigid ionic model of Nordheim. Good agreement is found between experimental and theoretical values in the cases of gold, silver, and copper, and, in general, for metals of low compressibility. The results are compared with those of Kroll using Fermi's statistical theory of ionic potential. Nordheim's model, using a screened Coulombian potential, gives the more consistent results. The alkalis, possessing very high compressibility, yield no satisfactory results on either form of theory.—J. S. G. T.

†Superconductivity. H. G. Smith and J. O. Wilhelm (*Rev. Modern Physics*, 1935, 7, 237–271).—Superconductivity is comprehensively reviewed. The subjects discussed include: the phenomenon of superconductivity; superconducting metals; interruption of superconductivity by a magnetic field; distribution of magnetic field around a superconductor; current in a closed superconducting circuit; thermoelectric effects; specific heats; thermal conductivity; superconductivity in thin films; anomalous superconducting alloys; theories of superconductivity; thermodynamics; electrodynamics; the London theory; the spontaneous current theory; quantum–mechanical theories.—J. S. G. T.

†The State of Research on Superconductivity. W. Meissner (*Elektrotech. Z.*, 1935, 56, 1061–1065).—Researches made during recent years have led to the following conclusions: superconductivity occurs not only in pure metals but also in all types of alloys including intermetallic compounds. The transition point to superconductivity varies between $0\cdot3°$ and $9\cdot2°$ abs. and is influenced by temperature and by external magnetic fields; in both cases hysteresis effects have been observed and in massive specimens of pure metals the magnetic induction suddenly becomes zero at the transition point. The specific heat and the heat conductivity change only slightly, but there is a relation between the effect of magnetic fields and the change in specific heat. Theories of superconductivity are briefly discussed.—B. Bl.

II.—PROPERTIES OF ALLOYS

*The System Iron–Cobalt–Cobalt Silicide–Iron Silicide. Rudolf Vogel and Kurt Rosenthal (*Arch. Eisenhüttenwesen*, 1935–1936, 9, 293–298).—The system was examined by thermal and micrographic methods and the equilibria are shown in a series of ternary and quasi-binary diagrams. CoSi and FeSi form a continuous series of solid solutions, and on addition of the other metal form the ternary compound FeCoSi below 980° C. In the section iron–cobalt–Co_2Si–FeCoSi–FeSi there are four planes of 4-phase equilibrium, two of which relate to transformation reactions, two to eutectic reactions, and one to a eutectoidal transformation. Analogous planes of equilibria occur in the section FeSi–FeCoSi–Co_2Si–CoSi, and since FeSi and CoSi and Co_2Si and FeCoSi form continuous series of solid solutions the 3-phase equilibria in the quasi-binary system Co_2Si–CoSi merge into those of the quasi-binary system FeSi–FeCoSi.
—A. R. P.

*The Reflection Coefficient of the Series of Copper–Nickel Binary Solid Solutions. P. Bergmann and W. Guertler (*Z. tech. Physik*, 1935, 16, 235–236).—Reflection coeffs. of 9 copper–nickel alloys containing from 0 to 100% of nickel are tabulated for the range of wave-lengths 4670–6100 A. The selective reflectivity of copper tends to disappear as the % of nickel in the alloy is increased. Alloys containing about 25 atomic-% of nickel or more, have about the same reflectivity as pure nickel.—J. S. G. T.

*The System Copper–Nickel–Iron. W. Köster and W. Dannöhl (*Z. Metallkunde*, 1935, **27**, 220–226).—The ternary diagram and several pseudo-binary sections through it have been constructed from the results of thermal analysis, magnetometric measurements, and determinations of the electrical resistance. The boundary of the field in which the α–γ transformation occurs is a straight line joining the copper corner of the ternary diagram with 28% nickel on the iron–nickel side. The miscibility gap in the iron–copper system is gradually closed by addition of nickel, disappearing entirely with 27% nickel at 1220° C. and with 82% nickel at room temperature; hence alloys within this range are amenable to precipitation-hardening treatment, which in certain alloys containing about 50% nickel leads also to changes in the Curie point.—A. R. P.

†On the Mechanism of Precipitation [in Supersaturated Solid Solution Silver–Copper Alloys]. U. Dehlinger (*Z. Metallkunde*, 1935, **27**, 209–212).—Microscopic observations on the separation of silver from supersaturated solid solution in copper shows that the particles of silver first precipitated in no way influence the rate or form of subsequent precipitations, and therefore precipitation cannot be attributed to nuclei formation but must be ascribed to lattice distortion probably at the boundaries of mosaic blocks. At these points very thin films of silver are probably first formed, and these subsequently coagulate into grains which can be detected first by X-rays and then, as they grow in size, by microscopic examination. In deformed and recrystallized metal microscopic observations reveal the presence, at the boundaries of regions in which precipitation has already begun, of an active factor which accelerates further precipitation and which is the cause of the high rate of precipitation, and the production of microscopically detectable heterogeneity.—A. R. P.

Caro Bronze. —— (*Machines*, 1935, (Nov.), 6).—A brief description is given of a phosphor–bronze bearing alloy containing copper 91·2, tin 8·5, and phosphorus 0·3%; the alloy is used in the cold-drawn condition.—P. M. C. R.

*The Materials for Condenser Tubes. Yoshiro Fujii (*Tetsu-to-Hagane (J. Iron Steel Inst. Japan)*, 1935, **21**, 568–575; *C. Abs.*, 1935, **29**, 7912).—[In Japanese.] Seven kinds of copper-base alloys and two stainless steels were subjected to tests of sp. gr., corrosion in a 3% aqueous sodium chloride solution, corrosion in sea-water, thermal conductivity, microstructure, and various mechanical properties. The actual test of the small condensers which were specially constructed using tubes made of the above-mentioned materials was carried out over a period of 4 years. In all these tests the following alloys showed good results : Hiro-ken (The Hiro Naval Arsenal) A alloy; aluminium 3, zinc 16%, remainder copper; and zinc 27, tin 1, iron 0·03%, remainder copper.—S. G.

*Magnesium–Aluminium–Nickel Alloys. G. Guzzoni (*Chimica e industria (Italy)*, 1935, **17**, 293–300; and *Industria meccanica*, 1935, **13**, 690–696; *C. Abs.*, 1935, **29**, 7917).—The effect of additions of nickel to alloys of magnesium and aluminium was determined. The best results were obtained with 3·5–4·0% aluminium and 0·5–0·6% nickel. All the alloys require a flux to improve castability; a mixture of anhydrous magnesium chloride and sodium chloride in equal parts was found best. Increasing the nickel content above 0·5% improves the tensile strength slightly, but reduces the castability and ductility. Alloys containing more than 2% nickel are almost impossible to make owing to the limited solubility with aluminium present, even though magnesium and nickel alone mix in all proportions. The optimum alloy mentioned above has the following properties : tensile strength 17–19 kg./mm.², elongation 8–12%, Brinell hardness 50–55. The best conditions for pouring are to heat to 850° C., hold for 10–15 minutes, and to pour when the temperature has decreased to 760°–780° C. Extrusion is carried out as for other light alloys, a temperature of 300°–350° C. being best. A tungsten–steel die should be used, tempered at 450° C.; moulds are best made of iron or mild steel free from graphite and

nickel. These alloys could not be heat-treated, hardened, tempered, or annealed successfully. For extrusions the alloy giving the best results contained aluminium 7 and nickel 1·0%; it had a tensile strength of 30–31 kg./mm.² and an elongation of 14%. Nickel makes the alloy more corrosive, thus counteracting the improvement due to aluminium. The alloys are difficult to weld.—S. G.

*The Equilibria Between Iron and Nickel and Their Silica-Saturated Silicates. Peter Bardenheuer and Erwin Brauns (*Mitt. K.W. Inst. Eisenforschung*, 1935, **17**, 128–132).—The equilibria between nickel–iron alloys and nickel–iron silicate slags at 1600° C. were determined; the distribution of iron and nickel between metal and slag layers agrees very closely with the ideal mass-action law. The oxide content of the metal layer in nickel-rich melts is determined almost entirely by the nickel oxide content of the slag layer and decreases with decreasing temperature; addition of excess of iron to the metal layer changes the partition coeff. of nickel oxide only by about 5%.—A. R. P.

Magnetic Properties of Some Nickel Alloys. Ray Chaudri and P. N. Sen Gupta (*Science and Culture*, 1935, **1**, 114–115; *C. Abs.*, 1935, **29**, 7918).—50 : 50 and 60 : 40 alloys of nickel and aluminium resemble nickel oxide in magnetic susceptibilities; hysteresis is absent. It is not possible to locate the Curie point. A 70 : 30 alloy of nickel and chromium shows a change of curvature on the temperature–magnetic susceptibility diagram at about 400° C.—S. G.

*The Solubility of Deuterium and Hydrogen in Solid Palladium. A. Sieverts and G. Zapf (*Z. physikal. Chem.*, 1935, [A], **174**, 359–364).—The values obtained between 300° and 1100° C. are in approximate agreement with those obtained by others. The relation between the solubilities of deuterium and hydrogen is 0·67 at 300° C., 0·91 at 1000° C., and approximates to unity at higher temperatures. The solubility of both isotopes in palladium is proportional to the square root of the gas pressure at constant temperature.
—B. Bl.

*The Electrical Resistance of Hydrogen-Charged Wires of Palladium–Silver and Palladium–Gold Alloys. A. Sieverts and H. Hagen (*Z. physikal. Chem.*, 1935, [A], **174**, 247–261).—The pressure–concentration isotherms of alloys with 5 and 10% silver are similar to those of pure palladium; they show hysteresis at 150° and at 200° C., a second section in which the concentration of hydrogen is independent of the pressure. All other isotherms have a parabolic shape. The pressure–electrical resistance isotherms are similar to those of palladium up to 30 atomic-% silver, but the change in resistance for equal increments of pressure and hydrogen content become smaller with increasing silver content. In alloys with 30 and 40 atomic-% silver the electrical resistance becomes smaller by absorption of hydrogen within a definite range of temperature and pressure; in alloys with 50 and 60 atomic-% silver absorption of hydrogen again causes large increases in the resistance. Palladium–gold alloys behave similarly to palladium–silver alloys with the same atomic-% palladium, but the decrease in resistance by hydrogen absorption in the 35 atomic-% gold alloy is much greater than in the 39 atomic-% silver alloy.
—B. Bl.

*On the Equilibrium Diagram of the Silver-Rich Silver–Aluminium Alloys, with a Note on the Nature of the Transformations. Ichiji Obinata and Masami Hagiya (*Kinzoku no Kenkyu*, 1935, **12**, 419–429).—[In Japanese.] The equilibrium diagram of the silver–aluminium alloys containing 0–11% aluminium was revised from the results of X-ray analysis at ordinary and high temperatures, electrical resistance measurements, and microscopic examination. Alloys containing 5·7–8 and 2% aluminium undergo the eutectoid and the metatectic transformation at 615° and 420° C., respectively. While the metatectic transformation can easily be suppressed by quenching in water,

complete suppression of the eutectoid transformation is scarcely possible. Thus, the alloys quenched from the β field always consist of the γ-phase, supersaturated with silver, showing the diffraction lines belonging to the hexagonal close-packed lattice. On heating, the quenched hypo-eutectoid alloys, an anomalous increase of resistance was observed at about 200° C., which is considered to be due to the formation of a compound Ag_3Al. The crystal structure of the β-phase was determined by X-ray analysis at high temperatures. As anticipated, this phase has a body-centred cubic lattice, the parameter of which is $3\cdot29^5$ A. at 700° C. (Al = $7\cdot98\%$).—S. G.

*The Electrical Resistance of Hydrogen-Charged Tantalum Wire. A. Sieverts and H. Brüning (*Z. physikal. Chem.*, 1935, [A], 174, 365–369).—The absorption of hydrogen and the change in resistance produced thereby in a tantalum wire have been determined at 400°–600° C. and at pressures from 1 atm. upwards. At 500°–600° C. the dissolved hydrogen is exactly proportional to the square root of the pressures, but appreciable deviations occur at 400° C. The increase in resistance is in all cases proportional to the amount of hydrogen absorbed. The phenomena observed in the tantalum–hydrogen system are thus similar to those in the palladium–hydrogen system; in both cases the relationships observed are in conformity with the above laws as long as no new phase is formed.—B. Bl.

*Decaying Intermetallic Compounds. G. Tammann and A. Rühenbeck (*Z. anorg. Chem.*, 1935, 223, 288–296; and (summary) *Light Metals Research*, 1935, 4, 20–24).—The intermetallic compounds of some metals with aluminium, silicon, calcium, magnesium, and cerium decompose on exposure to moist air owing to the reaction of the above-named metals with the moisture to form hydroxides, the other component of the compound being liberated as finely divided metal; examples discussed are the compounds $FeAl_3$, AlSb, PbCa, AgCa, $SnMg_2$, and BiCe. On the other hand no such reaction occurs with such compounds as Al_3Mg_4 and AuMg. The difference in behaviour is attributed to the formation of a non-porous, protective film in the latter, and the non-formation of such a film in the former case.—A. R. P.

*Examination of the Law of Mass Action of Concentrated Molten Solutions by Potential Measurements. F. Neubert and F. Sauerwald (*Z. physikal. Chem.*, 1935, [A], 174, 161–198).—The equilibrium constants and activity relationships in the reaction of metals with their molten salts were determined by measurements of the electrochemical potentials in order to confirm the constants determined analytically, the corresponding activities and the molecular weights derived from the results. In practically all cases the Lorenz–van Laar mass action law does not apply, the smallest deviations of the mean values of the constants from the ideal mass action law being about 25%. The following reactions were examined : lead with molten tin and silver chlorides and with silver bromide and iodide; lead chloride with thallium, zinc, and cadmium; cadmium and stannous chloride; and thallium and cadmium chloride.—B. Bl.

*On a New Method of Determining Transformation Points [Solidus of Copper–Silver Alloys]. H. Nipper and E. Lips (*Z. Metallkunde*, 1935, 27, 242–243).—Changes in the structure of alloys at high temperatures are usually accompanied by sudden changes in the mechanical properties. An apparatus has been constructed, therefore, to determine the torsion of wires at gradually increasing temperatures with automatic registration of the results; the method was applied to the determination of the solidus of copper–silver alloys.—A. R. P.

Stereo-Chemistry of Solids. Wilhelm Biltz (*Ber. deut. chem. Ges.*, 1935, [A], 68, 91–108).—The space occupied by the actual particles of a solid may be approximately represented by the sum of single increments each bearing a definite relationship to the nature and condition of the corresponding particle. The principle is applied to the case of certain glasses, the density

of which can be accurately predicted from their composition, and of 2 series of intermetallic compounds, in which " noble " and " base " metals, respectively, preponderate. The additive character of the increments rather than of the atomic volumes explains the striking discrepancies between observed and calculated molecular volumes in the latter case. This is further illustrated by references to the alkali metal amalgams. The particles of intermetallic compounds are compared to material in a state of mechanical compression, and the accompanying contraction in electronic volume is further related to variations in the ionic charges. The conception of the space-lattice is examined, from the standpoint of space increments.—P. M. C. R.

III.—STRUCTURE

(Metallography ; Macrography ; Crystal Structure.)

Statistical Investigations of the Structure of Metals.—I. E. Scheil (*Z. Metallkunde*, 1935, **27**, 199–208; discussion, 208–209).—Mathematical procedures for calculating the area and volume occupied by the various constituents of metals and alloys are described with reference chiefly to ferrous metals.—A. R. P.

†Relation Between Diffusion and Structure of Solid Alloys. W. Seith and A. Keil (*Z. Metallkunde*, 1935, **27**, 213–215).—Recent work of the authors and others is reviewed in an attempt to obtain a relation between the movement of atoms in solid solutions and other properties of the alloys. The amount of movement depends on the chemical affinity between, and the size of, the component atoms, and its dependence on the relative concentrations of the component atoms is in many cases determined by the melting points. Diffusion is appreciably increased by recrystallization and by transformations; in most cases too the passage of a direct current through the alloy causes the components to diffuse in opposite directions (electrolytic migration).—A. R. P.

*Detection of Metallographic Processes by Radioactive Methods. O. Werner (*Z. Metallkunde*, 1935, 27, 215–219).—The diffusion of radioactive emanations through a metal lattice is regulated by the lattice vibrations of the metal and hence the course of the temperature–radioactivity curve of a metal containing a radioactive substance, *e.g.* thorium-X, is determined by the frequency and amplitude of the atomic movements in the metal. The temperature coeff. of radioactivity of different metals is inversely proportional to the characteristic temperature of Debye's theory of solid bodies. Determination of this coeff. affords a means for calculating the energy absorbed in rolling a metal into sheet (this is illustrated by experiments on gold), for calculating the amount of dissolved hydrogen in the metal (illustrated by experiments on electrolytic copper), for determining the transformation point of metals (illustrated by curves for thallium and iron), for determining the Curie point (of iron and nickel), and for studying the course of the sintering process with compressed metal powders (illustrated by experiments on molybdenum and carbonyl nickel).—A. R. P.

*†The Lattice Constants of Beryllium. E. A. Owen and Llewelyn Pickup (*Phil. Mag.*, 1935, [vii], **20**, 1155–1158).—Redetermined values of the lattice constants at 18° C., of annealed beryllium of very high purity (Fe, 0·01%; C, 0·05%; N, 0·005%; and traces of silicon and aluminium) are : $a = 2·2810_5$ A.; c (axial ratio) = 1·5682. These values are in close agreement with the author's previous values and differ somewhat from those of other experimenters.—J. S. G. T.

†The X-Ray Powder Photography of Alloys. A. J. Bradley (*Metallurgia*, 1935, **13**, 69–70).—A condensed report of a lecture to the Midland Metallurgical Societies. The use of X-ray powder photography, as compared with

photomicrography, in establishing the equilibrium diagrams of the alloy systems is considered. The method of spacing determination is briefly described and the application of lattice space measurements in determining accurate coeffs. of expansion referred to. The influence of heat-treatment on X-ray photography in giving rise either to complete phase changes or to atomic distribution is discussed with particular reference to the nickel–aluminium, copper–aluminium, and iron–aluminium systems.—J. W. D.

*Precise Determination of Angles and Lattice Constants by the Debye-Scherrer Method.** M. Straumanis and A. Ieviņš (*Naturwiss.*, 1935, 23, 833).— The usual method is modified in that the end of the film is placed at an angle of 90° instead of at 0° or 180° to the primary X-ray; by measuring the interference rings with small and large ∂ the points of entrance and exit of the X-ray beam can be determined and hence the exact diameter of the camera. The lattice parameter of sodium chloride was found to be $a = 5\cdot6264 \pm 0\cdot0003$ A.—B. Bl.

IV.—CORROSION

*Inhibiting Additions to Solutions Which Attack Aluminium.** H. Röhrig (*Aluminium*, 1935, 17, 559–562).—Read before the VII Congrès International des Mines, de la Métallurgie, et de la Géologie, Paris, 1935. Various substances which inhibit the action of mineral acids on ferrous alloys also inhibit or greatly reduce the rate of attack of acids on aluminium and its alloys, thus addition of 1% of nicotine sulphate to 20% hydrochloric acid reduces the loss in weight of pure aluminium therein from 239 to 3·8 grm./m.^{2} in 15 minutes, while 0·1% of dibenzyl sulphide in 10% hydrochloric acid reduces the loss in weight from 77·1 to 2·8 grm./m.^{2} in 90 minutes. Still more effective is the inhibitor known as " Sparbeize 20," addition of which to N-hydrochloric acid reduces its attack on pure aluminium from 532 to 0·15 grm./m.^{2} in 6 hrs.
—A. R. P.

*Comparison of the Resistance to Corrosion of 11 Light Alloys under Natural and Laboratory Conditions.** E. K. O. Schmidt and E. Böschel (*Luftfahrtforschung*, 1935, 12, 116–120).—Tests were carried out in the laboratory by the D.V.L. method and under natural conditions in the North Sea on the behaviour of various grades of Duralumin, K.S.–Seewasser alloy, Hydronalium, Anticorodal S, and Silumin. The results showed that the laboratory tests provide a comparative guide to the resistance to corrosion under practical conditions in about $\frac{1}{18}$ of the time. The alloys tested fall into 3 groups : (I) those which show appreciable reduction in strength in sea-water in about a fortnight—Duralumin 681 ZB, Duralumin 681 A, and Duralumin 681 H; (II) those which suffer a loss in strength only after 6 months' exposure— Silumin, Anticorodal S; and (III) those which remain practically unaffected for 2 years—Duralumin 681 K, Duralplat, K.S.–Seewasser, and Hydronalium.
—A. R. P.

*On the Corrosion-Resistance of Hydronalium Especially Against Sea-Water.** G. Siebel (*Aluminium*, 1935, 17, 562–567).—Hydronalium alloys with magnesium 7–12 and manganese 0·3–0·5% have a high resistance to sea-water which is practically the same in the cast (heterogeneous) state as in the homogenized condition. After cold-work, however, the homogenized alloys become unstable at temperatures of 60° C. and higher and the new phase precipitated at the grain boundaries in a highly dispersed form induces serious intercrystalline corrosion in salt-water. By tempering at temperatures just below the solubility line to obtain a heterogeneous structure which is stable this sensitivity to intercrystalline corrosion on warming is entirely removed; a similar effect is produced by small additions of zinc, calcium,

silicon, titanium, or chromium which more or less stabilize the homogeneous state or at least render it insensitive to tempering.—A. R. P.

*The Corrosive Action of Sulphur on Metallic Copper During Vulcanization. Shozo Satake (*J. Soc. Rubber Ind. Japan*, 1935, **8**, 461–471; *C. Abs.*, 1935, **29**, 8403).—[In Japanese.] The corrosive action of compounded sulphur was studied by keeping copper and a rubber plate in contact during vulcanization. The corrosion can be expressed by the equation $x = Kt^n$, where x is the extent of corrosion in t hrs., and K and n are constants depending on the conditions of test. That n is inversely proportional to the velocity const. of vulcanization, which in turn is related only to the temperature of vulcanization and the kind and amount of accelerator, was confirmed by tests of the speed of vulcanization of the same rubber sample used in the corrosion test. K is directly proportional to the sulphur used in compounding (% by volume). The relation between K and the velocity const. of vulcanization was also studied. The corrosive action of combined sulphur (acetone–insoluble sulphur) in vulcanized rubber on copper is weak, and corrosion of copper during vulcanization is due mainly to the presence of free sulphur. The ratio of formation of sulphides was : $Cu_2S : CuS = 5 : 3$, and this ratio remained nearly const. and was not influenced by changing the percentage of sulphur or accelerator.—S. G.

Influence of Sugar in the Corrosion of [Tinplate by] Canned Fruits. E. F. Kohman and N. H. Sanborn (*Canner*, 1935, **80**, (9), Part 2, 111–112; *C. Abs.*, 1935, **29**, 6319).—In general, there is less container corrosion at the higher sugar syrup concentrations. Sugars in canned fruits decrease corrosion as compared with non-sugar packs. In both a citric acid–sodium citrate solution and in grape-fruit juice the addition of 25 or 50% dextrose, sucrose, or levulose definitely increased the H-ion concentration of the solution. It appears probable that sugars combine chemically with some of the fruit constituents.—S. G.

*Influence of Various Acids on Corrosion [of Tinplate] in Prepared Prunes. E. F. Kohman and N. H. Sanborn (*Canner*, 1935, **80**, (9), Part 2, 112; *C. Abs.*, 1935, **29**, 6319).—The ability of various organic and inorganic acids to prevent or retard corrosion of tinplate by canned prunes was determined. Sufficient of each acid was added to lower the p_H from 4·05 to 3·84. Citric acid gave the best results. This acid possesses the tendency to form complex citrate ions with metals.—S. G.

*Influence of Various Acids on Corrosion [of Tinplate] in Royal Anne Cherries. G. S. Bohart (*Canner*, 1935, **80**, (9), Part 2, 114; *C. Abs.*, 1935, **29**, 6318).—The principal acid produced by flat-sour bacteria in canned cherries is lactic acid. The acidity of the experimental pack of cherries was adjusted to p_H 3·5 by the addition of citric, lactic, phosphoric, malic, acetic, and butyric acids. The greatest loss of vacuum in the cans owing to corrosion was caused by phosphoric acid. There is a considerable natural phosphate in these cherries.—S. G.

*Corrosion Tests of Metals Used in Pea Processing. F. L. LaQue (*Canning Age*, 1935, **16**, 385–387, 406).—Copper, nickel, tin, zinc, cast tin–bronze, 2 and 1 brass, 50 : 50 soft solder, Monel metal, and 18% nickel silver were investigated. Sets of specimens were exposed in brine tanks, pails of wet peas, and other positions in a working pea-canning plant. The effect of 2, 6, 10, 20, 30, 50, and 80 p.p.m. of the metals chromium, copper, iron, nickel, tin, and zinc on the colour and flavour of canned peas was also determined.
—C. E. H.

Underground Corrosion. K. H. Logan (*Proc. Amer. Soc. Civil Eng.*, 1935, **61**, 317–329; discussion, 591–594, 919–923; *Build. Sci. Abs.*, 1935, **8**).—A summary of the conclusions reached by the National Bureau of Standards (U.S.A.), as a result of the corrosion of pipes in soil (see *Met. Abs.* (*J. Inst.*

Metals), 1931, **47**, 665; *Met. Abs.*, 1934, **1**, 242) leads to a discussion of the characteristics and course of such corrosion, and the means available for reducing corrosion losses. Further research in this field is urged. 25 references are given.—S. G.

The Corrosivity of Soils. —— (*Nat. Bur. Stand. Letter Circular* No. **433**, 1935, 13 pp.).—Gives abstracts and summaries of reports relating to investigations of the corrosion of ferrous and non-ferrous materials by soils.—S. G.

Corrosion of Metals. Nathalie Goldowski (*La Nature*, **1935**, (2955), 540–542; (2957), 69–72; *C. Abs.*, 1935, **29**, 7920).—Several new machines have been developed for alternate immersion of metallic plates in test solutions. The electrochemical phenomena involved in the corrosion of metals and results of variations in oxygen contact are associated with the rate of corrosion.—S. G.

V.—PROTECTION

*Influence of the Working Conditions in Tinning on the Porosity of Tinplate. Fritz Peter and Georges Le Gal (*Arch. Eisenhüttenwesen*, 1935–1936, **9**, 285–287; discussion, 288–291).—Numerous tests extending over a long period of large-scale tinning operations have shown that no single factor has a determining influence on the porosity of tinplate. The most important factors are absolute cleanliness of the steel, the thickness of the tin coating, the nature of the pickling process, and the purity of the flux. Absorption of hydrogen from the pickling operation does not appear to play the important part in producing porosity usually ascribed to it. The minimum thickness of tin to guarantee absolute freedom from porosity under correct working conditions is about 100 grm./m.^{2}. In the discussion *W. H. Creutzfeld* stated that before making tests for porosity all grease must be removed from the surface; this can be done most effectively by washing with trichlorethylene which has no action on the tin, whereas alkaline cleaners attack the metal and produce new pores. The best method for detecting pores consists in coating the metal with a warm (60° C.) solution of potassium ferrocyanide in 10–15% agar-agar containing 0·5–1% of sodium chloride. Other speakers produced evidence in favour of the theory that surface impurities on the iron are the chief cause of porosity in the tinplate.—A. R. P.

†**Copper Wire Tinning.** Ch. Bernhoeft (*Z. Metallkunde*, 1935, **27**, 264–266).— The tin coating applied to copper wire to prevent its being attacked by sulphur during vulcanization of the insulating rubber coating subsequently applied may be faulty owing to one or more of the following causes: incomplete removal of the acid used in pickling before passing the wire through the bath, too high a temperature of the tin bath which results in dissolution of 5% or more of copper, too thin a coating due to a low bath temperature or too rapid passage of the wire through the bath, or insufficient cleaning of the copper.—A. R. P.

Hot-Galvanizing. Hand Galvanizing of Small Pieces: Galvanizing by the Usual Method. A. Forny (*Galvano*, 1935, (35), 26–27).—Describes briefly the main features of the methods used in France for galvanizing small parts by hand, condemning the empirical control and inefficient working which appear to be usual in this field. A bright finish without spangles is best for small pieces. This is obtained by adding 0·015% each of tin and aluminium to the bath, and working at about 470° C. For hot-dip galvanizing a highly experienced staff is required. The equipment is briefly outlined.—C. E. H.

Lead and Tin in Zinc Used for Galvanizing. Werner Frölich (*Illust. Zeit. Blechindustrie*, 1935, **64**, 1298–1299, 1323–1324).—Remelted zinc usually contains appreciable proportions of tin and lead, probably derived from solder: the tin content may be reduced to 0·3–0·4% by means of sulphur, but F.

considers that small additions of metals other than zinc render the material less corrodible and less susceptible to embrittlement or discoloration, *e.g.* by antimony, than is pure zinc. He recommends a composition of lead 1, tin 0·6; iron 0·12, cadmium 0·07, aluminium 0·01%, antimony a trace·, and remainder zinc, for use in galvanizing baths, the temperature of which requires very careful control.—P. M. C. R.

*On the Reactions of Iron with Liquid Zinc [at Galvanizing Temperatures]. Wilhelm Püngel, Erich Scheil, and Robert Stenkhoff (*Arch. Eisenhüttenwesen*, 1935–1936, **9**, 301–304).—The attack on iron by molten zinc at galvanizing temperatures can take place in two ways, either (I) $FeZn_3$ is formed and the rate of dissolution of the iron is small and increases slightly with increase in temperature, or (II) $FeZn_7$ is the principal product of the reaction, being formed as loose masses of needle-like crystals which allow the zinc to come into contact with fresh iron surfaces, and thus attack on the iron is severe. In case (I) a dense protective layer is formed on the iron, and the reaction soon becomes very slow at constant temperature, whereas in case (II) a very thick non-protective layer is formed which sometimes assumes remarkable crystal shapes, several examples of which are illustrated. Above a certain definite temperature depending on the nature of the steel $FeZn_3$ is always formed, but below this temperature either compound may be formed according to the conditions. The presence of carbon and copper in the steel seems to favour case (II) whereas the presence of chromium and aluminium seems to favour case (I).—A. R. P.

*Metallic Cementation. VII.—Metallic Cementation [of Iron, Nickel, and Copper] by Means of Manganese Powder. Tsutomu Kase (*Kinzoku no Kenkyu*, 1935, **12**, 478–483).—[In Japanese.] The cementation of iron, nickel, and copper by manganese in the form of the pulverized commercial product at various temperatures between 600°–1100° C. for 1, 2, 3, and 5 hrs. was investigated. The hardness and depth of penetration of the surface layer of the cemented specimens was measured, and microscopic examination, chemical analyses, and corrosion tests with strong acids were also carried out. Manganese diffuses into iron, nickel, and copper at a temperature above 600° C., the rate of diffusion increasing with increase of temperature. In the case of iron the rate of diffusion increases almost abruptly at the $A3$ point (906° C.). The relation between the increase in weight of the specimens and the absolute temperature of cementation or the length of time for the treatment is given by an exponential function as previously shown (*Met. Abs.*, 1935, **2**, 165, 385, 463, 522), The surfaces of iron and nickel cemented with manganese are easily attacked by strong acids, but that of copper is unaffected by dilute sulphuric and hydrochloric acids or concentrated hydrochloric acid.—S. G.

[Metal Spraying in] Oil-Field and Refinery Practice in Foreign Countries. William Reid (*Metallizer*, 1935, **4**, (1), 2–5, 13).—R. lists the parts of oil-refinery plant which have been successfully treated by the metal spraying process. The article deals mostly with the building up of shafts, &c., with steel, but there is also a description of some work carried out by the spraying of Monel metal, zinc, and " aluminium-bronze."—W. E. B.

Metallizing New Refinery Vessels. G. M. Jackson (*Metallizer*, 1935, **4**, (1), 11).—A description of the use of metal spraying for the protection of condensers in oil refinery. The coating is 2 lb./ft.² of metal sprayed (lead), and the coating is applied both to the vapour and the water side of the condenser.—W. E. B.

Protection Against Burning-Out by Means of the " Alument " Process. —— (*Illust. Zeit. Blechindustrie*, 1935, **64**, 1389–1390).—The process consists in annealing at 900°–1100° C. the (ferrous) materials to be protected, after spraying with aluminium ; a special flux is painted over the sprayed metal, which it protects from oxidation in the early stages, whilst assisting its penetration into

the iron when combination occurs. A hard and resistant coating of FeAl₃ is said to be produced : it is claimed that treatment of an " Alument "-treated iron surface at 1000° C. for 1400 hrs. produced no appreciable alteration in structure. Thin-walled articles should be treated with special light alloys, as the brittleness of FeAl₃ would cause an undue decrease in strength.—P. R.

Anti-Rust Paints Containing Coal-Tar and Aluminium Powder. ——(*Ann. Ponts Chaussées*, 1935, **105**, 286–288).—An account is given of comparative tests on tar–aluminium paints and red-lead. The tests included exposure to ultra-violet radiation, salt-spray, freezing, moist and dry heat, and immersion in water. Both the durability and the covering power are stated to have proved superior in the case of the tar–aluminium paint.—P. M. C. R.

Aluminium Paints. Berthold Winter (*Petroleum Z.*, 1935, **31**, (44), 8).—Aluminium paint is stable and effective at temperatures up to 1000° C. : its high reflecting power renders it a useful protective medium for fuel tanks and containers, where a low temperature is desirable ; it affords valuable protection against rust even when used in conjunction with other pigments, and it resists attack by ammonia and hydrogen sulphide. It is also recommended as a preservative for wood.—P. M. C. R.

Improved Paints Spur Attacks on Corrosion Problems. J. O. Hasson (*Steel*, 1935, **96**, (10), 30–33).—The preparation of the surface to which they are to be applied is of particular importance in connection with anti-corrosion paint coatings. Galvanized iron is best first roughened by etching with an acid solution, or by exposure to the weather for some months. A good primer for galvanized iron is a zinc dust–zinc oxide paint.—S. G.

VI.—ELECTRODEPOSITION

Faulty Chromium Plating, Its Detection and Removal. Ralph W. Harbison (*Metallwaren-Ind. u. Galvano-Tech.*, 1935, **33**, 521–522).—For chromium plate direct on iron or steel the ferroxyl test or simple immersion in copper sulphate solution rapidly detects porosity but for chromium plate on nickel, copper, or brass undercoats it is preferable to make the article the cathode in acid copper sulphate solution, copper being deposited only on the porous parts. The best method for stripping faulty chromium plate consists in dissolving the chromium anodically in 3·5–4% sodium hydroxide solution ; the plating may be stripped more rapidly in hot hydrochloric acid but this produces severe etching of ferrous or copper-base metals.—A. R. P.

The New Methods of Nickel Plating. E. Staurenghi (*Industria meccanica*, 1935, **13**, 702–704 ; *C. Abs.*, 1935, **29**, 7821).—Present nickel plating processes are reviewed, and degreasing and cleaning methods are described. The nickel content of the bath is about 40–50 grm./litre ; current density 0·3–0·4 amp./dm.² while for rapid plating methods 1–3 amp./dm.² are employed. The bath is stirred and the pieces are moved to obviate streaks on the deposit ; p_H is 5·8–6·2. For rapid nickel plating the following bath is recommended : pure nickel sulphate 22·5 kg. ; pure ammonium sulphate 2·0 kg., pure nickel chloride 0·5 kg., pure sodium perborate 0·5 kg., water 100 litres ; 35°–40° C., voltage 2·75–3·5.—S. G.

Testing of Nickel Plate [on Steel]. (Liebetanz.) See p. 15.

*On the Polarization Potential in the Cathodic Deposition of Zinc from Aqueous Solutions of Zinc Sulphate.** Tomimatu Isihara, Takeo Onoda, and Katuo Umetu (*Kinzoku no Kenkyu*, 1935, **12**, 381–396).—[In Japanese.] The cathodic polarization potential, anodic overvoltage, and total polarization potential in the electrolysis of aqueous solutions of zinc sulphate of different concentrations, acidified with sulphuric acid and with the addition of various amounts of glue or gelatin, were measured by a direct method with a normal

calomel electrode and a potentiometer. The anode consisted of a platinized platinum plate, but the starting cathode was a zinc-plated platinum plate having an inner layer of copper. Except the active surface of the cathode, all portions of it were covered completely with lead glass by fusion. The effects of current density and the composition of the solution on the quantities referred to above were also measured. All the experiments were carried out at 35° C. in an electric thermostat of large capacity.—S. G.

Non-Poisonous Plating Baths. K. Assmann (*Chem.-Zeit.*, 1935, **59**, 904–905).—Owing to the highly poisonous nature of the components many attempts have been made in recent years to replace cyanide plating baths with those containing non-poisonous salts. Satisfactory results have been obtained in silver- and copper-plating by the use of solutions of the iodides in concentrated alkali iodide solutions. For silver the bath contains potassium iodide 450, silver iodide 45, hydriodic acid 15, and gelatin 3–4 grm. dissolved in 800 c.c. of water, and for copper potassium iodide 550, cuprous iodide 55, hydrochloric acid 10, and gelatin 3–5 grm. in 1 litre of water. The baths are operated at 20° C. with 0·5–1·5 amp./dm.² at 0·2–0·5 v. and yield fine-grained adherent deposits on copper, brass, nickel silver, and similar alloys. Much less expensive baths which yield brighter deposits than those obtained from cyanide baths are prepared by dissolving 33 grm. of silver thiocyanate or 43 grm. of cuprous thiocyanate in 1 litre of 20% sodium thiocyanate solution containing 1% of sodium sulphite. Silver has also satisfactorily been plated from nitrate solutions containing thiourea. No good non-poisonous brass plating bath has yet been developed but good cadmium and zinc deposits can be obtained from sulphate baths and good chromium deposits from solutions of violet chromic chloride using soluble chromium anodes and superimposed alternating current to overcome the passivity of the anodes.—A: R. P.

†**Bright Electrolytic Deposits.** Max Schlötter (*Z. Metallkunde*, 1935, **27**, 236–237).—Electrodeposited metals are never absolutely pure, small amounts of the anion of hydrolysis products of the salts in the electrolyte or of various addition agents being practically always included in the deposit. The structure of the deposit as regards grain-size and rate of growth is controlled chiefly by the nature of the anion, with increasing molecular volume of which the rate of grain-growth decreases and the number of crystallization nuclei increases. Under suitable electrical conditions, inclusion of anions in the lattice structure of the deposited metal may be induced and the appearance thus considerably modified. Working along these lines considerable advances have recently been made in the production of bright deposits of copper, silver, gold, nickel, and chromium. Bright nickel deposits contain inclusions of oxide, are not passive like matt deposits, and can readily be chromium plated; matt and bright deposits of nickel form a thermo-element the e.m.f. of which is $2·5 \times 10^{-6}$ v./° C.—A. R. P.

The Importance of Regularity in the Crystal Structure of Thick Electrolytic Coatings. W. Müller (*Metallwaren-Ind. u. Galvano-Tech.*, 1935, **33**, 477–478).—The factors influencing the structure of electrolytic deposits are critically discussed and their influence on the production of thick (0·5–5 mm.) deposits with a regular structure throughout is outlined, the importance of correct bath composition, standard electrical conditions, and absolute cleanliness being stressed.—A. R. P.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY
(Other than Electrodeposition.)

***Polarization of Electrodes in the Deposition of Metals from Solutions of Complex Cyanides.** O. Essin and A. Matanzew (*Z. physikal. Chem.*, 1935, [A], **174**, 384–394).—Many opinions have been expressed in the literature as to the

nature of electrode polarization in the deposition of metals from solutions of complex salts. Analysis of the experimental results of S. Glasstone shows that the concentration polarization caused by cyanide accumulation at the cathode leads in many cases to a relation between polarization and current density similar to the equation for hydrogen overvoltage. This relation in the case of mercury deposition from cyanide solution indicates that polarization is of a chemical nature and is induced by retarded discharge of the ions in the sense of Volmer's theory of overvoltage. No definite conclusions can, however, be drawn from the results available for cadmium and silver but in the case of copper they indicate that no chemical polarization, but rather a depolarization effect, takes place.—B. Bl.

The Hydrogen Film on a Polarized Metallic Electrode. G. Perfil'ev (*Sotzialist. Rekonstruktziya i Nauka*, 1935, (3), 168; *C. Abs.*, 1935, **29**, 7826).—[In Russian.] The polarization capacity of the hydrogen film formed on the electrode in cathodic polarization depends on the density and frequency of the a.c. The dependence of the capacity of the mercury cathode on the potential is expressed by a curve with a sharply marked maximum. The hydrogen overvoltage diminishes with increase in the capacity and the diminution of the active resistance of the polarization condenser under the influence of the a.c.

—S. G.

VIII.—REFINING

*Bullion Parting at the Homestake Mine.** Nathaniel Herz (*Min. and Met.*, 1935, **16**, 500–504).—The crude metal bars obtained in the extraction of the precious metals from the ore by cyaniding and amalgamation contain gold 73–82, silver 17·5–23, copper 0·5–3, lead 0·5–1·5, iron 0–0·05, and antimony 0–0·5%. The bars are melted in a small furnace and the metal transferred to clay pots brasqued with borax; a steady stream of chlorine is bubbled through the molten metal to convert all the base metals and the silver into chlorides leaving gold purer than 99·4%. The slag is melted with borax and a little soda ash to recover some of the silver and any suspended gold, while leaving most of the silver chloride unattacked; this metal is returned to the gold refining pots. The residual silver chloride is broken up and reduced to metal with iron and sulphuric acid, copper is extracted by digesting the sponge with hydrochloric acid, and the purified sponge is melted with borax and soda ash to give pure silver.—A. R. P.

IX.—ANALYSIS

Contribution to Applied Spectroscopy in Metal Working Laboratories. I.– The Spectrographic Apparatus of the M.A.N. G. Heidhausen (*Mitt. Forsch. Anst. G.H.H.-Konzern*, 1935, **4**, 59–70).—The spectrographic outfit of a German steelworks laboratory is described with reference to illustrations and wiring diagrams, and some examples of its value in the analysis of steel and cast iron are given.—A. R. P.

p-**Homosalicylic Aldoxime as a Reagent for Copper.** C. H. Kao and K. H. Chen (*J. Chinese Chem. Soc.*, 1935, **3**, (1), 22–26).—[In English.] The reagent solution is prepared by diluting an alcoholic solution of the oxime with water, and filtering. Cu is precipitated in the presence of acetic acid and sodium acetate, the precipitate containing 17·48% Cu. Ni is quantitatively precipitated from neutral solutions : the precipitation of Co is incomplete. Methods of separating Cu from Fe''', Ni, and other metals, and of Ni from Cd, Mg, and Al are shortly described.—P. M. C. R.

Pyrocatechol as a Reagent for Titanium. Nathan R. Pike, Joseph B. Ficklen, and I. Laird Newell (*Ber. deut. chem. Ges.*, 1935, [B], **68**, (6), 1023–1026).—Pyrocatechol gives a colour with as little as 2 parts of Ti in 10^7 parts of solution, but many metals and acid radicals interfere.—P. M. C. R.

The Determination of Aluminium in Nickel–Chromium and Nickel–Chromium–Iron Alloys : A Survey of Available Methods. Fred P. Peters (*Chemist-Analyst*, 1935, **24**, (4), 4–10).—The most rapid method for removing the other metals present in these alloys consists in electrolysis of a cold nearly neutral solution of the sulphates using a Hg cathode and a Pt anode; deposition of Fe, Co, Ni, Cr, Cu, and Mo is complete in $1\frac{1}{2}$–2 hrs. using 6 amp. at 9 v. If no other metals are present the Al can then be recovered from the solution by precipitation with NH_4OH, but if Ti is present the solution is treated with H_2O_2 and 8-hydroxyquinoline in $CH_3 \cdot CO_2H$, made ammoniacal and heated until the Al precipitate is crystalline. A colorimetric method for minute amounts of Al is also described.—A. R. P.

Determination of Small Amounts of Antimony in Zinc. Frank W. Scott (*Chemist-Analyst*, 1935, **24**, (4), 16–17).—The sample (5 grm.) is dissolved in 50 c.c. of Br-water and 10 c.c. of HNO_3, 50 c.c. of HCl are then added and the solution evaporated to a syrup, diluted with H_2O, neutralized with KOH, adjusted to 10% HCl, and saturated with H_2S. The precipitate is redissolved and the Sb separated from Cu, Pb, and As as usual and from Sn by precipitation with H_2S in the presence of $H_2C_2O_4$; it is eventually precipitated as Sb_2S_5, collected in a Gooch crucible, washed successively with H_2S water, CS_2, and C_2H_5OH, dried at 105° C. and weighed.—A. R. P.

*Determination of Magnesium in Duralumin.** G. Stanley Smith (*Analyst*, 1935, **60**, 812–814).—The alloy (2 grm.) is dissolved in 10% NaOH solution and the residue collected, washed free from Al salts, and extracted with hot H_2SO_4 (d 1·2). The acid $MgSO_4$ solution so obtained is purified by exact neutralization with NaOH and boiling with ZnO and $KMnO_4$ to precipitate Fe, Mn, and any Al still present, the excess of $KMnO_4$ being destroyed by adding a few drops of C_2H_5OH. The filtrate from this treatment containing all the Mg and a little Cu and Ni is treated with 1 grm. of KCN and 10 c.c. of 10% NaOH solution whereby, on boiling, practically pure $Mg(OH)_2$ is precipitated. The washed precipitate is dissolved in dilute H_2SO_4 and the Mg precipitated in the usual way as $MgNH_4PO_4$ which is ignited to $Mg_2P_2O_7$ for weighing.—A. R. P.

Testing of Nickel-Plate [on Steel]. R. Liebetanz (*Metall-Woche*, **1935**, 117–118).—After Ni-plated steel has been worked and annealed removal of the plated films by the usual reagents is difficult since the intermediate layer formed by diffusion is very resistant to attack. The following procedure is recommended : the outer film is removed by dissolution in a cold 3 : 1 mixture of concentrated and fuming HNO_3 and the Cu and Ni determined by electrolysis first in dilute HNO_3, then in ammoniacal solution; the intermediate diffusion layer is dissolved in cold HCl (d 1·12) saturated with Br, and the Cu removed with H_2S and the Ni with dimethylglyoxime.—A. R. P.

A Contribution to the Iodometric Titration of Tin. F. L. Okell and John Lumsden (*Analyst*, 1935, **60**, 803–810; discussion, 811).—Low results in the iodometric titration of Sn are shown to be due to the presence of dissolved O_2 in the I solution; a method of preparing air-free I solution is described and boiling with Al turnings is recommended as a means of reducing Sn^{IV} to Sn^{II} for titration.—A. R. P.

*On the Precipitation of Titanium as Phosphate.** Da-Tchang Tcheng and Houong Li (*J. Chinese Chem. Soc.*, 1935, **3**, (2), 115–117).—[In English.] Titanium phosphate was precipitated from solutions of the chloride having various degrees of (HCl) acidity; when the latter does not exceed 10% precipitation is complete. A very large excess of ammonium phosphate must be employed.—P. M. C. R.

Note on the Pyrophosphate Method for the Determination of Zinc. Z. H. Pan and C. H. Chiang (*J. Chinese Chem. Soc.*, 1935, **3**, (2), 118–121).—[In English.] The conversion of zinc ammonium phosphate into zinc pyrophosphate was found to begin at 350° C., and to be complete in 2 hrs. at 370° C.: temperatures up to 520° C. produce inappreciable degrees of volatilization. The temperature usually recommended (900°–1000° C.) is therefore unnecessarily high : it also leads to volatilization.—P. M. C. R.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.
(See also " Testing " and " Temperature Measurement and Control.")

On the Question of the Size of Photograph in Micrographic Work with the Metallurgical Microscope. Ernst Rossow (*Z. Metallkunde*, 1935, **27**, 263–264). —A large plate should be used only when a large print is required, when only a few prints are required, or when extreme sharpness of detail or specially sensitized layers (*e.g.* for the extreme infra-red) are necessary. In all other cases it is just as satisfactory and much more economical to use small films for taking photomicrographs.—A. R. P.

Surface Illuminator for Microscopes. Bausch and Lomb Optical Co., Ltd. (*J. Sci. Instruments*, 1935, **12**, 399).—An annular ring holding 6 electric light bulbs with individual reflecting surfaces is held in position over the microscope objective. The device is suitable for use with the 48-, 32-, and 16-mm. microscope objectives.—J. S. G. T.

*Microscope Tilting Stage. W. Watson and Sons, Ltd. (*J. Sci. Instruments*, 1935, **12**, 397).—A tilting microscope stage, constructed so that objectives of low-, medium-, or high-power (including oil-immersion objectives) can be used for making stereophotomicrographs without altering the illumination employed in ordinary microscopical observation. The specimen is photographed, then rotated through 15° about an axis at right angles to the optical axis, and photographed again.—J. S. G. T.

†The Electron Microscope. Walter Henneberg (*Elektrotech. Z.*, 1935, **56**, 853–856).—The principles, present position, and sphere of usefulness of electron microscopy are discussed.—B. Bl.

The Electron Microscope and Its Applications. L. Marton (*Rev. d'Optique*, 1935, **14**, 129–145).—The electronic microscope (see *Met. Abs.*, 1934, **1**, 196) is described; its principal advantages are its high resolving power even at very low numerical apertures, and its possible use in recording emission phenomena. The metallographic and histological applications of the instrument are described and illustrated.—P. M. C. R.

The Electronic Optics of Centred Systems. Emile Henriot (*Rev. d'Optique*, 1935, **14**, 146–158).—The possibility of substituting electronic radiation for ordinary light, as in the electron microscope, points to a close analogy between the two types of radiation, a theoretical analysis of which is presented. —P. M. C. R.

*A Semi-Automatic Potentiometer for Thermal Analysis. R. J. M. Payne (*J. Sci. Instruments*, 1935, **12**, 348–355).—A mechanically-driven potentiometer for use in conjunction with an inverse-rate recorder for making thermal curves of metals and alloys is described. The instrument operates normally as a null-method potentiometer; the galvanometer used experiences no large deflections, and errors due to creep do not occur. It is intended to make the working of the instrument wholly automatic.—J. S. G. T.

A Simple Thermo-Regulator. H. P. Bloxam (*J. Sci. Instruments*, 1935, **12**, 361–363).—A bi-metallic type of thermo-regulator, which can be made either as a portable or built-in instrument, for controlling temperatures up to 300° C., constant to within $\pm$ 3° and 0·1° C., respectively, is described.—J. S. G. T.

An Improved Thermo-Regulator and Circuit for D.C. Supply. S. J. Folley and P. L. Temple (*J. Sci. Instruments*, 1935, **12**, 392–393).—A form of d.c. electric thermo-regulator having a large surface/volume ratio of toluene bulb and a mercury seal at either end is described. The electric circuit includes a pentode valve used in conjunction with a relay to reduce sparking at the mercury surface in the regulator. A water-bath is easily maintained at ordinary temperatures to within 0·01° C.—J. S. G. T.

*A Variable Temperature X-Ray Powder Camera. W. H. Barnes and W. F. Hampton (*Rev. Sci. Instruments*, 1935, [N.S.], **6**, 342–344).—Describes an X-ray camera, designed for obtaining X-ray diffraction patterns by the mono-chromatic pin-hole method at temperatures (constant to within 0·1°–0·2° C.) between about − 60° and 0° C. The crystal is mounted on a copper block, the temperature of which is controlled by circulation of pre-cooled acetone.—J. T.

Spectroscope with Prism Objective. L. Herman and (Mme.) R. Herman (*Rev. d'Optique*, 1935, **14**, 203–207).—The use of a prism objective in conjunc-tion with an inclined spherical reflector obviates the use of a collimator and a slit screen. The optical system is described, and an account is given of the preparation of the series of mirrors employed : these were coated with platinum by cathodic projection. An example is given of the successful use of the spectroscope in metallurgical analysis.—P. M. C. R.

A Two-Crystal Spectrometer for X-Rays of Wave-Length $0·030 < \lambda < 0·215$ A. T. R. Cuykendall and M. T. Jones (*Rev. Sci. Instruments*, 1935, [N.S.], **6**, 356–361).—Describes a two-crystal X-ray spectrometer employing transmission and reflection of X-rays through the crystal.—J. S. G. T.

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

†The Testing of Engineering Materials. H. J. Gough and W. J. Clenshaw (*Trans. Inst. Marine Eng.*, 1935, **47**, 241–276).—A discussion of certain aspects of the testing of engineering materials deals with such subjects as the testing of materials at high temperatures, lubrication, lifting-gear components, con-tact corrosion, welded joints, fatigue of metals, failure of metals under complex stress distribution, corrosion-fatigue, and failures in service. Reference is made to the fatigue properties of single crystals of aluminium, iron, zinc, antimony, bismuth, and silver ; to the fatigue and corrosion-fatigue of such non-ferrous alloys as Duralumin and a magnesium alloy containing 2·5% aluminium ; to combined static tension–torsion tests on aluminium and copper ; and to the failure of bronze condenser tubes in service.—J. W. D.

†Special Apparatus Used for Testing Aluminium Alloys. E. John Pike (*Metallurgia*, 1935, **13**, 35–37).—The testing apparatus which has been designed to give an idea of the behaviour of aluminium alloys under working conditions, such as high stresses, is discussed and includes the repeated-impact fatigue testing machine, the rotating fatigue testing machine, a machine for testing bearing and frictional properties at elevated temperatures, and the use of the X-ray spectroscope for charting internal stresses which will result not in the total elimination of internal stress or its counteraction by thickening of parts of the section, but in the use of these stresses to counteract applied stresses. Test results for the different types of testing apparatus described are given for various aluminium alloys.—J. W. D.

†General Review of the Experimental Methods of Determining the Tensile Properties of Aluminium Castings. A. von Zeerleder (*Aluminium*, 1935, **17**, 570–574).—Read before the Congrès International des Mines, de la Métallurgie, et de la Géologie Appliquée, Paris, Oct. 1935.—Methods for casting test-pieces simultaneously with the casting and the appropriate dimensions to obtain comparable results are critically discussed.—A. R. P.

C

Mechanical Testing Machine. Tensometer, Ltd. (*J. Sci. Instruments*, 1935, **12**, 366–367).—A testing machine in which the movement of a mercury column actuates mechanism for recording the load applied to the test-piece is described. Extensions are recorded as abscissæ on a graph in which the loads are represented by abscissæ. A simple zero-adjustment is provided.—J. T.

*Abrasion at High Temperatures [New Abrasion Tester]. Yoshiro Fujii (*Tetsu-to-Hagane (J. Iron Steel Inst. Japan)*, 1935, **21**, 656–660).—[In Japanese.] By means of a new abrasion tester, various metals used for internal combustion engine cylinder liners and piston rings were tested in lubricating oil at 200° C.
—S. G.

*On Avoiding the Effect of Sheet Thickness on the Values Obtained in the Erichsen Test. A. von Vegesack (*Z. Metallkunde*, 1935, **27**, 227–235).—Mathematical analysis of the Erichsen test shows that the depth of penetration (T) of the standard Erichsen tool is related to the thickness of the sheet by the expression $T = T_{n1}\sqrt[4]{S/1.0743}$ where T_{n1} is the depth of penetration of a sheet of normal thickness (1·0743 mm.), and S is the thickness of the sheet under test. This expression is in close agreement with the results obtained on soft-iron strip.—A. R. P.

RADIOLOGY.

†**State and Problems of Radiology.** Herbert Graf (*Elektrotech. Z.*, 1935, **56**, 1047–1050).—A review.—B. Bl.

Separate Determination of Principal Elastic Stresses by Means of X-Rays. R. Glocker and E. Osswald (*Z. tech. Physik*, 1935, **16**, 237–242).—The application of X-rays for the determination of principal component stresses in test-pieces is described. The method is illustrated by its application to the cases of a tube subjected to internal pressure and a twisted rod.—J. S. G. T.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

Aluminium Fluxes. —— (*Amer. Metal Market*, 1935, **42**, (228), 5).—A very brief note of a new series of fluxes for use in casting aluminium and its alloys. They are said to be free from disadvantages such as the too rapid release of chlorine, objectionable vapours, and hygroscopicity. They consist of a mixture of zinc chloride and sodium fluoride, with or without potassium fluoride, water being present. Flux melting points of about 650° C. are claimed.—L. A. O.

The Special Brasses. —— (*Machines*, 1935, (Nov.), 17–20).—An account of the commercially useful ranges of the copper–zinc alloys is followed by a discussion of the " zinc equivalent " of common metallic additions to brass. The pre-alloying required for the convenient introduction of such additions (nickel, manganese, aluminium, iron) is described, as is the casting, remelting, and final pouring of the desired product.—P. M. C. R.

†**Recent Developments in the Manufacture and Applications of Magnesium and Magnesium Alloys.** W. C. Devereux (*Metallurgia*, 1935, **13**, 47–49).—A review of recent developments in the production and use of magnesium alloys deals with the preparation of high-purity magnesium by a direct reduction and distillation process; with the use of inhibitors such as sulphur, boric acid, and ammonium bifluoride in moulding material to prevent reaction between the metal and moisture; with the exclusion of air from the mould prior to pouring; with the working of ingots at temperatures of 380°–420° C., and the effect of such working on the mechanical properties and structure; and with the extrusion of magnesium alloys. The composition and mechanical properties of various alloys in the sand-cast and die-cast conditions and as forgings, extrusions, and sheets are given, and the influence of heat-treatment on the mechanical properties of typical heat-treatable magnesium-base alloys are

considered. Recent applications of magnesium alloy in aero-engine and aircraft construction, and the use of magnesium alloy sheets to replace aluminium sheets in metal-skin construction are also referred to.—J. W. D.

The Use of Synthetic Moulding Materials in Magnesium Foundry Practice. R. Jones (*Metallurgia*, 1935, 13, 49).—A brief note on the need for using dry silica sands moulded with suitable bonding agents and inhibitors to prevent the reaction which occurs with sand and with the steam generated in green-sand moulds, when the molten metal impinges on the mould face. It is stated that 5% by weight of pure clay binder to 95% by weight of sand with addition of 4–6% of water, together with the necessary inhibitor, provides a moulding material particularly suited to the casting of magnesium and its alloys.

—J. W. D.

XV.—FURNACES AND FUELS

Progress in Design and Application of Electric Furnaces. H. Knight (*Metallurgia*, 1935, 13, 53–56).—Brief descriptions are given of some recent developments in electric melting furnaces and include a large H.-F. furnace installation, " double-furnace " melting, and the rocking-resistor furnace suitable for the melting of high melting-point alloys such as brass and bronze. Recent developments in heat-treatment furnaces both of the batch-type and continuous-type for heat-treatment and bright-annealing are also dealt with. Reference is made to a new application of H.-F. induction heating known as high-frequency hardening, and to a new high-temperature thermo-couple which will withstand successfully for long periods temperatures of 1500° C. and above, and at the same time provide a thermo-electric power of measurable magnitude.—J. W. D.

†**The Importance of Large Electrical Heating Apparatus in Technique and Economy.** C. T. Buff (*Elektrotech. Z.*, 1935, 56, 1147–1148, 1192–1195, 1221–1225, 1239–1241).—A review of the whole field of the industrial use of electric heat.—B. Bl.

†**The Development and Future Possibilities of Gas as an Industrial Fuel.** Joseph E. White (*Gas World, Indust. Gas Suppt.*, 1935, 7, (12), 7–11 ; discussion, 12–13).—Read before the North-Western Section of the Institute of Fuel and the Manchester District Association of Gas Engineers. Applications of towns' gas in semi-rotary brass and aluminium melting furnaces, for rolling non-ferrous strip and sheet, for brass annealing, carburizing, flanging, and annealing loco-motive boiler plates are described and illustrated.—J. S. G. T.

†**British Coals ; Their Analyses and Uses.** —— (*Fuel Economist*, 1935, 11, 82–84).—Analyses are given of seven coals and one coke marketed by Dorman, Long, and Co., Ltd.—J. S. G. T.

XVI.—REFRACTORIES AND FURNACE MATERIALS

†**Refractoriness and Its Determination.** F. H. Clews and A. T. Green (*Trans. Ceram. Soc.*, 1935, 34, 467–499).—The subject is critically reviewed with special reference to standard German and American testing methods. A *bibliography* of 43 references is appended.—A. R. P.

*The Action of Alkalis on Refractory Material. I.—The Action of Potash Vapour on Refractory Materials at 900° and 1000° C.** F. H. Clews, A. Green, and A. T. Green (*Trans. Ceram. Soc.*, 1935, 34, 436–455).—Aluminous fireclay brick is more readily corroded by potash vapours and absorbs more potash at 900° C. than do normal fireclay, silicious fireclay, or silica-bricks on which a viscous protective film of silicate forms.—A. R. P.

Experiments on the Grading, Porosity, and Permeability to Air of Silica Bricks. F. H. Clews and A. T. Green (*Trans. Ceram. Soc.*, 1935, **34**, 457–466). —The pressure under which silica bricks are formed affects the permeability to air considerably, values of about 0·04 being obtained with 6·75 tons/in.^{2}. Bricks made under pressures of 2·25 tons/in.^{2} are not markedly less permeable than those made by hand-tamping. Addition of 0·5% of cellulose liquor slightly reduces the permeability. Pressure has much less effect on porosity than on permeability.—A. R. P.

*The Effect of the Water Content of Silica Brick Batches on the Porosity of the Fired Brick. T. R. Lyman and W. J. Rees (*Trans. Ceram. Soc.*, 1935, **34**, 500–506).—Numerous test results show that it is necessary to control within narrow limits the moisture content of the batch in the manufacture of silica bricks, the best results in standard practice being obtained with about 7·5% of moisture. If pressure is used in forming the bricks, the porosity and the permeability can be further reduced by using a drier batch, but naturally the weight of the fired brick will be greater.—A. R. P.

XVII.—HEAT-TREATMENT

Heat-Treatment of Aluminium Alloys. J. Towns Robinson (*Nickel Bull.*, 1935, **8**, 138–139).—The heat-treatment of the " R.R." series of aluminium alloys and of Silumin and " Y " alloy, and the structures and properties resulting from such heat-treatment are discussed.—J. H. W.

XVIII.—WORKING

On the Manufacture of Aluminium Foil. W. Frölich (*Metall-Woche*, **1935**, 157–158).—A brief account is given of modern methods of rolling aluminium ingots into foil for insulating and packing purposes.—A. R. P.

The Drawing of Square and Rectangular Aluminium Vessels. Gerhard Henker (*Illust. Zeit. Blechindustrie*, 1935, **64**, 1382–1383).—Illustrated instructions for the drawing of aluminium cups and hoods, especially of the type employed in wireless apparatus, include a discussion of the relation between size and number of draws, drawing speed, dimensions of plate, and probable output.—P. M. C. R.

Precautions to be Observed in Changing the Type of Oil Used in the Cutting and Plastic Deformation of Metals. K. Krekeler (*Z. Metallkunde*, 1935, **27**, 262–263).—The more expensive vegetable and animal oils previously used as lubricants in the working of metals are now being satisfactorily replaced by the cheaper mineral oils. Examples of the use of the latter are given with practical hints.—A. R. P.

The Choice of Suitable Cutting Metals. —— (*Werkstatt u. Betrieb*, 1935, **68**, 242–243, 289–290).—A table shows the approximate composition of the various groups of tool materials, and the properties of each type are discussed. Non-ferrous materials of this nature include the Stellite group, and the " carbide " materials. A description of the carbide group includes a summary of the properties of " Alloy 548," an iron–tungsten–cobalt carbide having properties similar to those of entirely metallic cutting alloys. The mechanical properties of the tool materials are tabulated and the relation between hardness and brittleness is discussed. The relative cutting speeds of 5 typical materials are tabulated for bronze, brass, copper, aluminium, and 4 steels.—P. M. C. R.

XIX.—CLEANING AND FINISHING

Cleaning Metal Surfaces Before Finishing Them. C. F. Scribner (*Indust. Finishing* (*U.S.A.*), 1934, **10**, (8), 12–14).—The uses of abrasives, solvent degreasers, acid pickling, and alkaline cleaners are discussed.—C. E. H.

*New Knowledge in the Colouring of Metals. G. Gross (*Z. Metallkunde*, 1935, **27**, 238–241).—A common method of colouring metal surfaces comprises immersion in hot (80°–95° C.) solutions containing sodium thiosulphate 124 and lead acetate 38 grm./litre; this solution colours copper dark blue, zinc a brownish-bronze, and iron a steel-blue colour, and produces various shades on brass according to the conditions. G. has examined the effects of ageing, temperature, concentration of the constituents, and time of immersion on the colour and nature of the films produced on steel and brass. At 80° C. the time required to produce a definite tint decreases with increase in the concentration of thiosulphate when the lead content is kept constant, and with increase in lead content when the thiosulphate is kept constant. Ageing of the bath reduces the time required to about half that of a new bath and addition of argol to an old bath develops the same colour in 5 seconds as is produced in 27 seconds without argol. The most rapid action is obtained with a bath containing sodium thiosulphate 240, lead acetate 25, and argol 30 grm./litre at 80°–90° C., but equally good results can be obtained at room temperature with a longer period of immersion (12 minutes instead of 5–10 seconds); at the same time the adhesion, thickness, and resistance to corrosion of the coloured films are materially increased.—A. R. P.

Surface Colouring of Metals. Georg Buchner (*Chem.-Zeit.*, 1935, **59**, 841–843).—A general review of the principles and methods of producing artistic and protective surface films on metals.—A. R. P.

XX.—JOINING

The Packing of Socket Joints Without the Use of Lead. —— (*Illust. Zeit. Blechindustrie*, 1935, **64**, 1237–1238).—Excerpts are given from the German Standard Specification (DIN 2435 U) for packing materials to be used in place of lead in making socket joints in cast-iron or steel tubes. The use of aluminium wool is recommended, and the method of packing described.—P. R.

*Welding of Wire of Chromium–Nickel and High Heat-Resistant Alloys by Condenser Discharge. T. Wrana (*Elektrotech. Z.*, 1935, **56**, 991–993).—Mechanical and electrical tests of the joint in wires welded by a condenser discharge indicate that this method of welding is suitable for joining resistance wires of Nichrome, Megapyr, and Kanthal.—B. Bl.

Modern Methods of Welding. R. S. Kennedy (*Trans. Inst. Marine Eng.*, 1935, **47**, 295–299).—A short description of various methods of welding, forge welding, resistance, or flash welding, spot and seam welding, gas welding, and electric welding with special reference to the electric welding of iron and steel, refers to the welding of cracks in gun-metal and aluminium by the oxy-acetylene method.—J. W. D.

XXI.—INDUSTRIAL USES AND APPLICATIONS

*Investigations on Metallic Contamination of Foods. H.—Effect of Cooking and Storage of Foodstuffs in Aluminium Vessels. N. C. Datta (*Proc. Indian Acad. Sci.*, 1935, **2**, (3B), 322).—Aluminium vessels are well suited for the storage and boiling of milk and milk products. Fruit and vegetable juices dissolve only a small amount of aluminium from utensils during storage. The amount dissolved possibly depends on the organic acid present and the buffer-

ing capacity of the food material. The corrosive action of acid foods on aluminium is increased by the presence of salt; the amount of aluminium dissolved by tamarind solution containing salt during storage is very nearly equal to the amount of aluminium dissolved by acid and salt taken separately, so that each seems to act independently of the presence of the other. The amount of aluminium dissolved in the ordinary process of cooking is very small, but in cases when acidic foods containing salt are cooked and stored for fairly long periods in aluminium vessels, the maximum of aluminium added to the daily diet from utensils is about 50 mg. Acid foodstuffs containing salt should not be left long in the same aluminium vessel after boiling. Feeding experiments with rats show that food prepared in aluminium vessels has no harmful effect on growth, reproduction, and general well-being of the animals.—J. S. G. T.

Aluminium Caps for Milk Bottles. —— (*Light Metals Rev.*, 1935, 2, 185–186).—A development report. Describes the method of attaching the cap to the bottle, and the cost as compared with the cardboard discs previously used in sealing the bottles.—L. A. O.

The Standardization of Aluminium Bars for Electrical Switchgear. K. Kupper and F. Streiff (*Aluminium*, 1935, 17, 579–585).—Tables and graphs are given for calculating the permissible loading of aluminium bars of various dimensions with d.c. and with a.c. of various frequencies under different electrical arrangements.—A. R. P.

Light Metal Traffic Signs. Fritz Rendel (*Aluminium*, 1935, 17, 568–569).—The high reflectivity and resistance to weathering of certain aluminium alloys render them eminently suitable as bases for traffic signs. The desired lettering can be applied to anodized surfaces and does not deteriorate in brightness or colour by the action of dust and rain and the signs show clearly at night since the light of car lamps is brilliantly reflected from the bright aluminium background.—A. R. P.

Aluminium Trusses and Floor for Brooklyn Bridge. —— (*Eng. News-Record*, 1935, 114, 547–550).—S. G.

Adhesives for Aluminium [Foil]. —— (*Light Metals Rev.*, 1935, 2, 182–185).—A development report. Discusses the types of glues most suitable for attaching various kinds of paper to aluminium foil. No adhesive has yet been found capable of permanently attaching two aluminium surfaces to each other; the most satisfactory substances for this purpose are gutta-percha (for thin foils), a mixture of beeswax and resin, bitumen, and cellulose nitrate.—L. A. O.

Copper Developments—A Review of Recent Work. —— (*Metallurgia*, 1935, 13, 46, 57–60).—A review of some of the more recent electrical, architectural, and metallurgical developments of copper. Recent developments in the electrical applications of copper are the use of cadmium–copper conductors, steel-cored and hollow copper conductors, copper oxide rectifiers, and copper conduits. In architecture there is an extended use of copper for tubes and pipes, for sheets and strips for roofing, for copper boilers, cylinders, and tanks, and for moulding and decorative purposes. Metallurgical applications include its more general use as an alloying element both in cast and wrought steels and in cast iron, and in the manufacture of copper moulds and stools for casting steel.—J. W. D.

Copper Dampcourses. Building Research Station (*Roy. Inst. Brit. Arch. J.*, 1935, 42, 382–383; *Build. Sci. Abs.*, 1935, 8).—The physical and mechanical properties of soft-temper copper are considered favourable to the use of this metal for damp-proof courses. A search has been made of the literature to discover information bearing on the durability of copper from the point of view of corrosion as a damp-proof course; none bearing directly on the behaviour of copper in this respect has been obtained, but observations on the effect of lime and cement solutions on the behaviour of copper embedded in cement

suggest that lime and Portland cement will not be destructive. Copper for use in damp-proof courses should be soft-temper material, complying with clause 2 of British Standard Specification No. 61, and with a minimum weight of 16 oz./ft.^{2}. Joints should be made by lapping the sheets to a distance of 3 in.—S. G.

New Use for Beryllium–Copper. —— (*Amer. Metal Market*, 1935, **42**, (207), 2).—A very brief note. The use of beryllium–copper for dies used in the manufacture of Bakelite products, has been commercially developed. The die is made by casting the alloy in a plaster mould.—L. A. O.

Gold and Gold Substitutes in Dental Practice. J. Dresel (*Metall-Woche*, 1935, 118–119).—Suitable alloys for dental plates generally consist of 18-ct. gold containing copper and platinum or palladium, but recently several white alloys have been introduced with satisfactory results. The cheapest of these consists of gold 25, platinum 41·7, and palladium 33·3%. All dental gold alloys are wrought into the finished shape after quenching from 900° C. and are finally tempered by slow heating to 350°–400° C. followed by slow cooling. As substitutes for gold alloys various stainless steels and silver–platinum metal alloys have found increasing use.—A. R. P.

Lead and Its Uses in the Mineral Industries. Felix Edgar Wormser (*Min. and Met.*, 1935, **16**, 493–497).—The use of lead for storage battery plates, electrical cable coverings, the lining of sulphuric acid chambers, covering benches and floors in chemical works, and for the preparation of bearing metal alloys and the manufacture of pipes, &c., is briefly reviewed.—A. R. P.

The Use of Lead in Sound-Proofing. J. Mahul (*Bull. tech. Suisse Romande*, 1935, **61**, 282–285).—Lead reflects a high proportion of any incident sound-waves, the production of secondary vibrations being obviated by the low elasticity of the metal. M. describes comparative tests made by Cellerier on the sound-insulating properties of sheet lead, concrete, cement, various woods, plaster, brick, &c. It is stated that the sound-insulating power of lead sheet 1 mm. thick is equivalent to that of " cellular " concrete 100 mm. thick. The efficiency of the lead is increased by a backing of porous material: the combination has been successfully used at the National Broadcasting Station, New York, and at a factory in Paris. Both instances are described and illustrated. —P. M. C. R.

*Tungsten Alloy and the Treatment of Cancer by Radium Rays. —— (*Science-Supplement*, 1935, [N.S.], **82**, (2133), 6–7).—A new tungsten alloy, containing 5–10% of copper or nickel, and having a density of about 17, makes possible the use of a radium bomb only about 64% as large as the lead bombs previously used for shielding large packs of radium. Patients can thus be placed closer to the source of radium rays. The alloy was invented by McLennan and Smithells.—J. S. G. T.

*A New Magnetic Alloy for Loud Speakers. —— (*Science-Supplement*, 1935, [N.S.], **82**, (2131), 9).—A new alloy, originally developed as a heat-resisting alloy which did not deteriorate at high temperatures, composed of aluminium, cobalt, nickel, and iron, capable of lifting (by reason of its permanent magnetization) sixty times its own weight, is briefly referred to. The alloy must be cast in the required shapes and finished by grinding.—J. S. G. T.

XXII.—MISCELLANEOUS

75 Years Verein deutscher Eisenhüttenleute 1860–1935. —— (*Stahl u. Eisen*, 1935, **55**, 1253–1450).—The entire number is an account of the inception, history, and work of the Verein deutscher Eisenhüttenleute, to celebrate the seventy-fifth year of its existence.—L. A. O.

New Research Laboratory of the London, Midland and Scottish Railway Company. —— (*Iron Coal Trades Rev.*, 1935, **131**, 987).—Includes a plan showing the general lay-out of the laboratory.—L. A. O.

Research and Technical Development in the Tin Industry. —— (*Metallurgia*, 1935, **13**, 61–62).—Recent research work on tin includes investigation into the manufacture and properties of tinplate and other tin coatings, and into certain advances in electrodeposition. Investigations are also in progress to improve tin-base bearing metals, to overcome porosity in bronze, and to develop new tin-base alloys which may be improved by heat-treatment. Technical developments include an extended use of solder, a revival in the use of pewter, the application of pure solid tin in the form of pipe in the food and fine chemical industries and for the manufacture of foil and collapsible tubes. In the form of tin oleate, tin has recently been added to the extent of 0·1% to lubricating oil for motor-cars as an anti-oxidant.—J. W. D.

Material Problems of the Last Twenty-Five Years and Their Solution in Railway Practice. R. Kühnel (*Glasers Ann.*, 1935, **117**, 135–137).—The development of the uses of bearing metals, red brass, bronze, and copper on the German railways since 1919 is discussed.—B. Bl.

The Electrical Equipment of Schools and Research Institutes. H. Häder and W. Jaeckel (*Elektrotech. Z.*, 1935, **56**, 993–996).—B. Bl.

XXIII.—BIBLIOGRAPHY

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

---

*American Society for Testing Materials. *Report of Committee B–3 on Corrosion of Non-Ferrous Metals and Alloys.* (Reprinted from Proceedings of the American Society for Testing Materials, Volume 35, Part I, 1935.) Med. 8vo. Pp. 35. Philadelphia, Pa. : The Society, 260 S. Broad St. (50 cents.)

[Contains the Report of Sub-Committee VI on Atmospheric Corrosion of Non-Ferrous Metals and Alloys; Report of Sub-Committee VII on Corrosion in Liquids, and Report of Sub-Committee VIII on Ga[vanic and Electrolytic Corrosion.]

*American Society for Testing Materials. *Report of Committee B–6 on Die-Cast Metals and Alloys.* (Reprint from Proceedings of the American Society for Testing Materials, Volume 35, Part I, 1935.) Med. 8vo. Pp. 46. 1935. Philadelphia, Pa. : The Society, 260 S. Broad St. (75 cents.)

[Contains in addition to the brief report, Appendix I, " An Investigation of Aluminium Die-Casting Alloys, Nos. IVa and Va "; and Appendix II, " Report of Sub-Committee V on Exposure and Corrosion Tests."]

*American Society for Testing Materials. *Symposium on Spectrographic Analysis.* Med. 8vo. Pp. 51, illustrated. 1935. Philadelphia, Pa. : The Society, 260 S. Broad St. (65 cents.)

[Reprinted from *Proc. Amer. Soc. Test. Mat.*, 1935, **35**, (II). Contains : W. R. Brode, " Spectroscopic Analysis of Steels.—The Influence of Non-Homogeneous Samples "; H. E. Stauss, " The Use of the Spectrograph in the Platinum Industry "; J. S. Owens and T. M. Hess, " Quantitative Spectrographic Analysis of Magnesium Alloys for Manganese and Silicon "; F. W. Lamb, " Spectrographic Determination of Impurities in Commercial Cadmium "; G. W. Standen and L. Kovach, Jr., " The Purification of Graphite Electrodes for Spectrochemical Analysis "; R. A. Wolfe, " Quantitative Analysis of Non-Ferrous Alloys by Spectroscopic Methods " ; together with the discussion that took place on each.]

*Anderson, E. A., and G. L. Werley. *Zamak Alloys for Zinc Alloy Die-Castings.* 8½ in. × 11 in. Pp. 42, illustrated. 1935. New York : New Jersey Zinc Co., 160 Front St.

*Baier, S., and D. J. Macnaughtan. *The Electrodeposition of Bronze Using Bronze Anodes.* (Technical Publications of the International Tin Research and Development Council, Series A, No. 27.) · Med. 8vo. Pp. 14, with 10 illustrations. 1935. London : International Tin Research and Development Council, 378 Strand, W.C.2. (Gratis.)

[Read before the Electrodepositors' Technical Society.]

*Bauer, O., H. Arndt, and W. Krause. *Chromium Plating, with Special Reference to its Use in the Automobile Industry.* Translated from the German by E. W. Parker. With Introductory Chapter : " Electroplating Practice and the Properties of Chromium and Nickel Coatings," by A. W. Hothersall. Med. 8vo. Pp. vii + 266, with 194 illustrations. 1935. London : Edward Arnold and Co. (25s. net.)

*Béchard, C. *The Electrodeposition of Bronze Using Bi-Metallic Anodes.* (Technical Publications of the International Tin Research and Development Council, Series A, No. 28.) Med. 8vo. Pp. 8, with 2 illustrations. 1935. London : International Tin Research and Development Council, 378 Strand, W.C.2. (Gratis.)

[Read before the Electrodepositors' Technical Society.]

*Becker, Karl. *Hartmetallwerkzeuge. Wirkungsweise, Behandlung, Konstruktion und Anwendung.* 15 cm. × 21 cm. Pp. 215, with 100 illustrations. 1935. Berlin : Verlag Chemie G.m.b.H. (Geb., R.M. 18 ; ausl. Preis, R.M. 13.50.)

*Boston, Orlan W. *A Bibliography of the Cutting of Metals.—Part II.* Demy 8vo. Pp. 202. 1935. Ann Arbor, Mich. : Edwards Bros., Inc. ($2.25.)

*Campbell, William. *An Outline of Metallography.* Med. 8vo. Pp. 46. 1932. New York : School of Mines, Columbia University.

*Chalmers, Bruce, and W. D. Jones. *Striations in Tin Coatings on Copper.* (Technical Publications of the International Tin Research and Development Council, Series A, No. 23.) Med. 8vo. Pp. 8, with 7 illustrations. 1935. London : International Tin Research and Development Council, 378 Strand, W.C.2. (Gratis.)

[Reprinted from *Trans. Faraday Soc.*, 1935, 31, 1299–1303; see *Met. Abs.*, 1935, 2, 520.]

*Cleaves, H. E., and J. G. Thompson. *The Metal Iron.* Med. 8vo. Pp. xii + 574, with 113 illustrations. 1935. New York : McGraw-Hill Book Co., Inc. ($6.00); London : McGraw-Hill Publishing Co., Ltd. (36s. net).

*Copper Development Association. *Bearing Bronzes.* (C.D.A. Publication No. 15.) Fcap. 8vo. Pp. 31, illustrated. 1935. London : The Association, Thames House, Millbank, S.W.1. (Gratis.)

*Department of Scientific and Industrial Research. *Report for the Year 1934–1935.* Med. 8vo. Pp. iv + 185. 1935. London : H.M. Stationery Office. (3s. net.)

*de Fleury, R. *Le Magnésium dans les Constructions Aéronautiques.* (Publications scientifiques et techniques du Ministère de l'Air, No. 75.) 18 cm. × 27 cm. Pp. 112, with 61 illustrations. 1935. Paris : Gauthier-Villars et Cie. (20 francs.)

*Haring, H. E., and U. B. Thomas. *The Electrochemical Behaviour of Lead, Lead–Antimony, and Lead–Calcium Alloys in Storage Cells.* (Bell Telephone System Technical Publications, Chemistry, Monograph B–883.) Med. 8vo. Pp. 14, with 7 illustrations. 1935. New York : Bell Telephone Laboratories, Inc., 463 West St.

[Read before the Electrochemical Society; see *Met. Abs.*, 1935, 2, 528.]

*Hassel, O. *Crystal Chemistry.* Translated from the German by R. C. Evans. Demy 8vo. Pp. xi + 94, with numerous illustrations. 1935. London : William Heinemann, Ltd. (6s. net.)

*Hedges, Ernest H., and C. E. Homer. *The Functions of a Technical Information Bureau.* (Miscellaneous Publications of the International Tin Research and Development Council, No. 3.) Med. 8vo. Pp. 8. 1935. London : International Tin Research and Development Council, 378 Strand, W.C.2. (Gratis.)

[Read before the Association of Special Libraries and Information Bureaux.]

*Hothersall, A. W., and W. N. Bradshaw. *Improvement in the Quality of Tinplate by Superimposed Electrodeposition of Tin.* (Technical Publications of the International Tin Research and Development Council, Series A, No. 22.) Med. 8vo. Pp. 16, with 16 illustrations. 1935. London : International Tin Research and Development Council, 378 Strand, W.C.2. (Gratis.)

[Reprinted from *J. Soc. Chem. Ind.*, 1935, **54**, 320–326T.]

*Imperial Institute. *The Mineral Industry of the British Empire and Foreign Countries. Statistical Summary (Production, Imports and Exports), 1932–1934.* Med. 8vo. Pp. 424. 1935. London : H.M. Stationery Office. (7s. 6d. net.)

*International Acetylene Association. *Official Proceedings. Thirty-Fifth Annual Convention of the International Acetylene Association, Pittsburgh, Pa., November 14, 15, 16, 1934.* Med. 8vo. Pp. xi + 290, illustrated. [1935.] New York : The Association, 30 East 42nd St.

[Contains : Report of the Oxy-Acetylene Committee ; T. R. Moxley, " Oxy-Acetylene Cutting and Welding in Making and Marketing Steel " ; G. V. Slottman, " The Comparative Efficiency of Fuel Gases for Welding and Cutting Steel " ; L. G. Firth and L. B. Knox, " The Oxy-Acetylene Flame Cutting of Wing Type Ingots " ; E. E. Le Van, " Hard Facing—The Application of Wear-Resistant Alloys to Steel Mill Equipment " ; J. J. Crowe, " Welds and Weld Metal " ; J. H. Critchett, " Metallurgy of Oxy-Acetylene Welding of Steel " ; J. H. Zimmerman, " A Comparative Study of Cutting Methods as Applied to Structural Steel " ; C. O. Obert, " Advantages of Flame-Cut Surfaces for Welding " ; J. W. Owens, " Commercial Methods of Testing Welds and Welded Products and the Dependability of Such Methods " ; G. E. Deatherage and J. L. Latterner, " Production Methods Used on Welding for Constructional Purposes " ; J. Zink, " Fair Trade Practices in Pipe Welding " ; G. O. Hoglund, " Gas Welding of Aluminium Tank Structures " (1935, **2**, 313) ; D. C. Reid, " Administrative Problems in Connection with the Application of the Oxy-Acetylene Welding and Cutting Processes in the Railroad Shop " ; G. M. O'Rourke, " Track Welding " ; C. H. R. Howe, " Oxy-Acetylene Process in Railway Maintenance-of-Way Work " ; R. L. Spencer, " What the Young Engineer Should Know about Welding " ; E. F. Blank, " Safe Practices in Oxy-Acetylene Cutting and Welding " ; W. D. Keefer, " How Common Safe Practices Reduce Unnecessary Hazards in the Application of Oxy-Acetylene Welding " ; W. K. Estep, " Prevention of Fires Resulting from the Use of the Oxy-Acetylene Process."]

*International Acetylene Association. *Tests for the Selection of Operators of Welding Equipment (Tentative).* Compiled and presented by the Oxy-Acetylene Committee. Med. 8vo. Pp. 18, with 7 illustrations. [1935.] New York : The Association, 30 East 42nd St. (20 cents.)

*Kautny, Theo. *Leitfaden für Azetylenschweisser (Verschmelzen und Durchbrennen von Metallen).* Elfte, erweiterte Auflage. Herausgegeben von H. Holler. Cr. 8vo. Pp. viii + 284, with 364 illustrations. 1935. Halle a. S. : Carl Marhold. (Geb., R.M. 4.50.)

*Kenworthy, L. *The Atmospheric Corrosion and Tarnishing of Tin.* (Technical Publications of the International Tin Research and Development Council, Series A, No. 24.) Med. 8vo. Pp. 15, with 6 illustrations.

1935. London : International Tin Research and Development Council, 378 Strand, W.C.2. (Gratis.)

[Reprinted from *Trans. Faraday Soc.*, 1935, **31**, 1331–1345; see *Met. Abs.*, 1935, **2**, 516.]

*Köster, W. *Der metallische Werkstoff. Seine Vervollkommnung durch Technik und Wissenschaft.* (Deutsches Museum Abhandlungen und Berichte.) Demy 8vo. Pp. 107, illustrated. 1935. Berlin : V.D.I.-Verlag G.m.b.H.

*Lampitt, Leslie H. *Laboratory Organization.* Pp. 26, with 8 illustrations. 1935. Demy 8vo. London : Institute of Chemistry of Great Britain and Ireland, 30 Russell Sq., W.C.1.

*Lincoln Electric Company. *Procedure Handbook of Electric Welding.* Third Edition. Med. 8vo. Pp. x + 596, with 714 illustrations. 1935. Cleveland, O. : Lincoln Electric Co. ($1.50.)

*Macnaughtan, D. J. *Tin and Civilization.* (Miscellaneous Publications of the International Tin Research and Development Council, No. 5.) Med. 8vo. Pp. 9. 1935. London : International Tin Research and Development Council, 378 Strand, W.C.2. (Gratis.)

[Address of the Institute of Metals Division, American Institute of Mining and Metallurgical Engineers.]

*Macnaughtan, D. J. *Tin and Its Uses.* (Miscellaneous Publications of the International Tin Research and Development Council, No. 4.) Med. 8vo. Pp. 16. 1935. London : International Tin Research and Development Council, 378 Strand, W.C.2. (Gratis.)

[Reprinted from " Modern Uses of Non-Ferrous Metals " (New York : A.I.M.M.E.).]

*Macnaughtan, D. J., and B. P. Haigh. *The Mechanical Properties of Tin-Base Alloys.* (Technical Publications of the International Tin Research and Development Council, Series A, No. 26.) Med. 8vo. Pp. 12, with 5 illustrations. 1935. London : International Tin Research and Development Council, 378 Strand, W.C.2. (Gratis.)

[Read before the International Congress on Mining, Metallurgy, and Applied Geology, Paris, 1935.]

*Monk, R. G., and H. J. T. Ellingham. *Electrodeposition of Tin Alloys from Alkaline Stannate Baths.* (Technical Publications of the International Tin Research and Development Council, Series A, No. 25.) Med. 8vo. Pp. 10, with 1 illustration. 1935. London : International Tin Research and Development Council, 378 Strand, W.C.2. (Gratis.)

[Reprinted from *Trans. Faraday Soc.*, 1935, **31**, 1460–1468; see *Met. Abs.*, 1935, **2**, 606.]

*New Jersey Zinc Company. *Zinc Alloy Die-Castings.* 8½ in. × 11 in. Pp. 80, illustrated. 1935. New York : The Company, 160 Front St.

*Rimarski, W. *Forschungsarbeiten auf dem Gebiete des Schweissens und Schneidens mittels Sauerstoff und Azetylen.* Zehnte Folge. 21 cm. × 30 cm. Pp. 104, illustrated. 1935. Hall a. S. : Carl Marhold. (R.M. 4.)

[Contains : H. Frankenbusch : " Hochwertige Gasschmelzschweissung und ihre Anwendung in der Praxis "; H. A. Horn : " Schweissung von Zinkblechen "; F. Schulze u. J. Staebler : " Bleischweissen mit der Azetylen-Sauerstoff-Flamme "; H. Holler u. —— Maier : " Beiträge zu den Untersuchungen der Autogenverbindungen von Aluminium mit anderen Metallen "; —— Krüger : " Welche Anforderungen sind an die Schweissung von Dampfkesseln und Dampf- und Druckfässern zu stellen ? "; K. Kohrs : " Behebung schwerer Kesselschäden durch die Gaschmelzschweissung "; K. L. Zeyen : " Schweissung legierter Stähle "; E. Streb u. H. Kemper : " Leuchtgaszusatz zum Azetylen beim Schweissen von Eisenblech "; H. Frankenbusch : " Autogenes Schweissen im Kunsthandwerk "; L. Hunsicker : " Zahlenmässige Entwicklung von

Schweisszeitfunktionen und ihre Übertragung in Nomogramme "; K. L. Zeyen : " Versuche mit Schweissdrähten für Auftragschweissungen "; H. Becker : " Über die Schmiedbarkeit von Schweissverbindungen "; W. Grimm : " Röntgenuntersuchungen an gasgeschweissten kupfernen Lokomotiv-Feuerbüchsen "; H. Holler u. R. Schneider : " Neuerungen auf dem Gebiete des Autogenschneidens"; E. Sauerbrei u. W. Scheruhn : " Spezifisches Gewicht und Litrigkeit technischen Kalziumkarbides "; W. Rimarski u. H. Friedrich : " Gasaufnahme in Azetylenflaschen in Abhängigkeit von der Azetonmenge "; A. Krauss : " Einige Explosionsversuche mit flüssigem Azetylen "; W. Rimarski u. H. Friedrich : " Elektrostatische Aufladung durch fliessende Gase."]

*Royal Mint. *Sixty-Fifth Annual Report of the Deputy Master and Comptroller of the Royal Mint, 1934.* Med. 8vo. Pp. iv + 166, with 3 plates. 1935. London : H.M. Stationery Office. (3s. 6d. net.)

*Royal Technical College, Glasgow. *Annual Report on the One Hundred and Thirty-Ninth Session.* Demy 8vo. Pp. 83. 1935. Glasgow : Royal Technical College.

*Schumacher, Earle E., and Lawrence Ferguson. *Utilization of Electrical Resistance Measurements for Controlling the Composition of Alloys, with Special Reference to the Determination of Antimony in Lead.* (Bell Telephone System Technical Publications, Metallurgy, Monograph B–885.) Med. 8vo. Pp. 8, with 3 illustrations. 1935. New York : Bell Telephone Laboratories, Inc., 463 West S.

[Reprinted from *Metals and Alloys*, 1935, **6**, 150–152; see *Met. Abs.*, 1935, **2**, 390.]

*Schumacher, Earle E., and G. S. Phipps. *Some Physical and Metallurgical Properties of Lead–Calcium Alloys for Storage Cell Grids and Plates.* (Bell Telephone System Technical Publications, Metallurgy, Monograph B–884.) Med. 8vo. Pp. 8, with 5 illustrations. 1935. New York : Bell Telephone Laboratories, Inc., 463 West St.

[Read before the Electrochemical Society ; see *Met. Abs.*, 1935, **2**, 507.]

*Scientific and Learned Societies. *The Official Year-Book of the Scientific and Learned Societies of Great Britain and Ireland.* Compiled from Official Sources. Demy 8vo. Pp. vii + 169. 1935. London : Charles Griffin and Co., Ltd.

*Spiers, H. M. Edited by. *Technical Data on Fuel.* Fourth Edition. Cr. 8vo. Pp. xvi + 358, with 66 illustrations. 1935. London : British National Committee, World Power Conference, 36 Kingsway, W.C.2. (12s. 6d.)

*Turner, C. A. P. *Elasticity, Structure, and Strength of Materials Used in Engineering Construction.* Part II.—*The Equations of Physical Properties and Constants Developed from Molecular, Atomic, Mass, and Gravitational Relations and Relations of Variations in State and Conductivity Equations.* Med. 8vo. Pp. 50. 1935. Minneapolis, Minn. : The Author. (Sold as addenda to Part I without extra charge.)

*Verein deutscher Eisenhüttenleute. *75 Jahre Verein deutscher Eisenhüttenleute.* 21 cm. × 30 cm. Pp. 200, illustrated. 1935. Düsseldorf : Verlag Stahleisen m.b.H.

*Williams, Robert S., and Victor O. Homerberg. *Principles of Metallography.* 5½ in. × 8 in. Pp. ix + 313, with 302 illustrations. 1935. New York : McGraw-Hill Book Co., Inc. ($3.50) ; London : McGraw-Hill Publishing Co., Ltd. (21s. net).

THESIS.

*Girard, André. *Les Constituants de la Rouille.* Imp. 8vo. Pp. 72, with 49 illustrations. 1935. Lille : Faculté des Science, Université de Lille.

NEW PERIODICAL.

Metall Woche. Band I. (October 12, 1935.)