METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

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Part 7

I.—PROPERTIES OF METALS

(Continued from pp. 193-197.)

*Colloid Chemical Phenomena in Metals. I.—Gases in Aluminium. J. A. Kliachko (Kolloid-Zeit., 1935, 73, (11), 226–236; and (summary) Light Metals Research, 1935, 4, (19), 314–316; Sci. Abs., 1936, [A], 39, 9).—The system gas-metal is studied as a problem in colloid chemistry. The general laws which are valid for a gas-metal system are briefly summarized, followed by a description of results of earlier workers on the interaction of gas and aluminium and its alloys. The amount of gas which dissolves in aluminium (chiefly hydrogen) differs according to whether the determination is made by analysis after extraction by heat or by the equilibrium method. Suggestions are made to account for this discrepancy. The origin of the gas is shown to be due to the reaction between the metal and the water vapour adsorbed in its porcs.—S. G.

Study of the Manufacture, Properties, and Uses of Refined Aluminium. Robert Gadeau (Congrès internat. Mines Mét. Géol., Section de Métallurgie, 1935, 1, 85–90; and J. Four élect., 1936, 45, (1), 17–22).—[In French.] See Met. Abs., this vol., p. 69.—S. G.

*On the Atomic Weight of Cadmium. O. Hönigschmid and R. Schlee (Z. anorg. Chem., 1936, 227, (2), 184–192).—Analysis of the bromide and chloride obtained from metal which had been fractionally distilled in vacuo gave the value Cd = 112.41.—A. R. P.

*On the Passivity of Chromium. IV.—The Electrolytic Behaviour of Chromium Amalgam. Erich Müller (Z. physikal. Chem., 1936, [A], 176, (4), 273–288). —Compact chromium remains permanently active in M-hydrochloric acid at 20° C., but chromium amalgam under the same conditions undergoes a continuous cycle of changes from the active to the passive condition alternately. Both the compact metal and the amalgam are normally passive in M-sulphuric and M-perchloric acids, but the former can be made permanently and the latter transiently active by feeble cathodic polarization. The amalgam can be rendered active in M-sulphuric acid merely by shaking, and the return to the passive state is accompanied by periodic variations, a phenomenon which is not observed with chromium powder. Strong cathodic polarization renders the amalgam passive in all three acids; the activation potential is lower for the amalgam than for the compact metal.—B. Bl.

Thermo-E.m.f., Peltier Effect, and Photo-E.m.f. in the Cell Copper-Cuprous Oxide-Copper. G. Mönch (Z. tech. Physik, 1935, 16, (11), 361-363).—See Met. Abs., this vol., p. 31.—J. S. G. T.

*Peltier Effect in the Element Copper-Cuprous Oxide-Copper. G. Monch (Z. Physik, 1936, 100, (5/6), 321-325).—Cf. abstract above. The Peltier effect at a copper-cuprous oxide interface, is, in accordance with theory, found experimentally to be proportional to the absolute temperature of the interface.—J. T.

The Properties and Uses of Lead. R. S. Russell (Met. Ind. (Lond.), 1936, 48, (21), 585-590).—From a series of articles in Modern Engineer; see Met. Abs., this vol., p. 193.—J. E. N.

*The Effect of Absorbed Hydrogen on the Magnetic Susceptibility of Manganese. Mary A. Wheeler (*Phys. Rev.*, 1936, [ii], 49, (8), 642).—Abstract of a

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^{*} Denotes a paper describing the results of original research.

[†] Denotes a first-class critical review.

paper read before the American Physical Society. Manganese which had been purified by distillation was heated in hydrogen at various temperatures. The susceptibility at room temperature was decreased to 9.28(10)⁻⁶ from a normal value of $9.60(10)^{-6}$ when the absorption took place at 400° C., a temperature at which the α form is stable. When the hydrogen was absorbed in the β form at 850° C. the susceptibility became $9.36(10)^{-6}$. The decreased susceptibility can be due to the adsorption of diamagnetic hydrogen. When the hydrogen was absorbed by the γ form at 1220° C. or by the melted manganese, however, the susceptibility was increased to $10.42(10)^{-6}$ and $10.00(10)^{-6}$. While α - and β -manganese have complicated structures, γ -manganese is a simple face-centred tetragonal form. Thus in γ -manganese the hydrogen is probably inserted interstitially and increases the lattice constant. This could cause a narrowing of the energy bands of the collective electrons and an increase of the susceptibility. No trace of ferromagnetism was found.—S. G.

*Absorption of Gases by Mercury. S. Ptizin (*Tech. Physics U.S.S.R.*, 1935, 2, (1), 66–78; *Sci. Abs.*, 1936, [A], 39, 25).—[In English.] The absorption of gases, whether air or organic vapours, is studied, and the question of freeing mercury from absorbed gases is also dealt with. Hydrogen distilled in a vacuum gives off but little air, 130 mm.³ of mercury giving off only 0.5 mm.^3 of gas measured at 1 mm. pressure, even after being stored for some time open to the air, while cleaned mercury only absorbs atmospheric gases for a few hrs. It was also shown that much of the gas liberated comes from the decomposition of organic compounds absorbed in the mercury.—S. G.

*The Density of Mercury at 0°. T. Batuccas and F.-L. Casado (J. chim. phys., 1936, 33, 41-50; C. Abs., 1936, 30, 3287).—About 29 kg. of carefully purified mercury from Spain was used. The density at 0° was determined by the pycnometer method. The average of 22 determinations was $d_4^0 = 13.59539 \pm 0.00001$ grm./ml.—S. G.

*The Diffusion of Gases Through Metals. III.—The Degassing of Nickel and the Diffusion of Carbon Monoxide Through Nickel. C. J. Smithells and C. E. Ransley (*Proc. Roy. Soc.*, 1936, [A], 155, (884), 195–212).—Apart from easily detachable surface gas, the gas evolved from commercial nickel by heating *in vacuo* or in hydrogen is mainly carbon monoxide. The measured rate of diffusion of the gas is far too small to account for the rate at which gas is evolved from the metal in the usual degassing processes. It is suggested that the carbon monoxide is generated from uncombined carbon and oxygen contained in the metal. Experiments supporting this hypothesis are described, and it is likely that the rate of evolution of carbon monoxide is controlled by the rate of diffusion of carbon in the metal.—J. S. G. T.

Note on the Curie Point of Nickel. Edmund C. Stoner (*Proc. Leeds Phil. Lit. Soc.*, 1936, 3, (3), 127–131).—The conventional Curie point is reduced from the results of Weiss and Forrer for nickel. The value of 0 (in ° C.) obtained by extrapolation of the steepest part of the σ , T curve is given closely by $0 = 361\cdot5 + 1\cdot6 \times 10^{-3} H$. Extrapolation of the steepest part of the σ_0^2 , T curve gives approximately $0 = 357\cdot5 + 0.8 \times 10^{-3} H$. The form of the σ_0^2 , T' curve giving the variation with temperature of the intrinsic magnetization in zero field (deduced by extrapolation, using the magneto-caloric results) is discussed. It is shown that the experimental results do not enable a unique Curie temperature to be deduced such as is indicated by the idealised theory. S. emphasizes the need for indicating clearly the method used in deducing Curie temperatures when these are given on the basis of experimental results; particularly in connection with possible differences in the Curie temperatures of materials of nearly the same composition.—S. G.

*The Internal Energy of Ferromagnetics [Magnetic Constants (and Specific Heat) of Nickel]. Edmund C. Stoner (*Phil. Trans. Roy. Soc.*, 1936, [A], 235, (750), 165–193).—Theoretical. Estimates of the specific molecular field coeff.

 $N\rho$ for ferromagnetics (N = the formal molecular field coeff., ρ = the density) differ widely not only for different temperatures but for the same temperature when derived from different sets of data. A detailed examination is made of the experimental results for the magnetization, magneto-caloric effect, and specific heat of nickel, and the assumptions of the calculations by the different methods are discussed. The results as a whole indicate values of $N\rho$, not varying appreciably with the specific (intrinsic) magnetization σ , of about 11.7×10^4 above 500° C., and not less than 9.5×10^4 and 7.4×10^4 at 350° C. and room temperature, respectively. Evidence is given for the existence of a magnetic "domain" structure. This usually corresponds with the mosaic structure of metals, but may sometimes be distinct and either larger or smaller. —W. H.-R.

*The Change of Magnetization of Nickel, Permalloy, and Nickel Single Crystals in Strong Fields. Gerd Gerloff (Z. Physik, 1936, 99, (9/10), 585-594).—The magnetic susceptibility of nickel and of Permalloy attains, at room temperature, a constant value in fields of strength about 4000 Oerstedt, and this value changes by less than 6% for fields of strength up to 5500 Oerstedt.—J. S. G. T.

*The Freezing Point of Palladium. F. H. Schofield (*Proc. Roy. Soc.*, 1936, [A], 155, (885), 301-308).—The freezing point of palladium, determined from measurements of brightness ratio, for a certain wave-length of black body radiators held at the freezing points of palladium and gold, is found to be $1554 \cdot 4^{\circ} \pm 1^{\circ}$ C. on the International Temperature Scale. The value recommended in the specification of that scale is 1555° C.—J. S. G. T.

*Paramagnetism of Platinum Colloidal Powders. Noboro Takatori (Kinzoku no Kenkyu (J. Study Metals), 1936, 13, (5), 161–172).—[In Japanese.] Measurements were made of the paramagnetic susceptibilities of platinum colloidal particles and of those which had been annealed at 800° -1000° C. It was found that the specific susceptibility of platinum colloidal particles with diameters of 2–3·10⁻⁵ mm. decreases by 21% as compared with those which have been annealed and by 29% as compared with the massive state. The magnetic susceptibility of very minute platinum particles which were observable only with high magnifications was also studied; the susceptibility decreases with size.—S. G.

*Alkali Films of Atomic Thickness on Platinum. Herbert Mayer (Z. tech. Physik, 1935, 16, (11), 451-454).--See Met. Abs., this vol., p. 32.--J. S. G. T.

*The Theoretical Constitution of Metallic Potassium. E. Gorin (*Physikal. Z. Sowjetunion*, 1936, 9, (4), 328–344).—[In English.] A theoretical discussion of the constitution of metallic potassium, based on the theories of Wigner, Seitz, and Hartree, and on wave mechanics is presented. The final results are that the binding energy and lattice constants are, respectively, 20.4 kg. cal. and 4.80 A., compared with the experimental values 22.6 kg. cal. and 5.20 A.—J. S. G. T.

*The Magnetochemistry of Rhenium : Metallic Rhenium and Septivalent Rhenium. N. Perrakis and L. Capatos (*Praktika* (*Akad. Athenon*), 1934, 9, 121-125; *C. Abs.*, 1936, 30, 3289).—[In Greek.] Cf. *Met. Abs.*, 1934, 1, 551. Metallic rhenium and the septivalent compounds of the element, viz. Rc_2O_7 , KReO_4 , NH_4ReO_4 , were studied for paramagnetism. Septivalent rhenium possesses a paramagnetism independent of the temperature, $\chi = 0.04 \times 10^{-6}$ for osmium. Reduction with hydrogen gives a very pure rhenium from the ammonium salt, with a value of $\chi = 0.037 \times 10^{-6}$ per grm.—S. G.

*The Atomic Weight of Rubidium. E. H. Archibald, J. Gilbert Hooley, and Norman Phillips (J. Amer. Chem. Soc., 1936, 58, (1), 70–72).—Re-investigation of the atomic weight of rubidium by determination of the silver-rubidium chloride ratio gave a slightly higher value for this constant (85·482) than that accepted by the International Committee. Cf. following abstract.—S. G. *The Atomic Weight of Rubidium. E. H. Archibald and J. Gilbert Hooley (J. Amer. Chem. Soc., 1936, 58, (4), 618-619).—Cf. preceding abstract. The nephelometric determination of the rubidium bromide-silver ratios gave a value of 85-483 for the atomic weight of rubidium and the gravimetric estimation of the ratios rubidium bromide-silver bromide gave 85-478. When these values are combined with that obtained from the rubidium chloride analyses, the average value 85-481 is obtained.—S. G.

*Germicidal Properties of Silver in Water. J. Just and A. Szniolis (J. Amer. Water Works Assoc., 1936, 28, (4), 492-506).—The addition of silver to water in amounts between 25 and 600 y per litre destroys bacteria, microfauna and microflora, and acts within a short time on organisms such as daphnia and fishes. The action is identical whether the silver is added as a soluble salt or is dissolved by electrolysis by the "electrocatadynization" process. The amount of silver dissolved in this process is shown to depend not only on the current but also on the mineral content of the water. Experiments showed that B. Coli added to tap-water were killed within 2-3 hrs. by a dose of 100 γ of silver per litre, but that it required 5-7 hrs. when the same number of B. Coli were added to polluted water. Rats fed for 100 days with water containing up to 1000 y of silver per litre showed no obvious symptoms of poisoning, but pathological changes were found in liver, kidney, and spleen. Constant use of water disinfected by silver thus cannot be considered quite innocuous. For determining (with an accuracy of 2.5γ) small quantities of silver in water, 2-10 drops of 1: I hydrochloric acid and 2 drops of 1: 10 potassium iodide are added to 100 ml., the solution filtered through a membrane filter in a Kolkwitz filtration apparatus, and the filter moistened with H2S water. The disc is dried and its colour compared with standards. A bibliography of 19 references is appended. -J. C. C.

*Transition of a Monocrystalline Tin Sphere from the Superconductive into the Non-Superconductive State. W. J. de Haas and O. A. Guinau (*Physica*, 1936, 3, (3), 182–192; and K. Onnes Lab. Leiden Comm. No. 241a; Sci. Abs., 1936, [A], 39, 416).—[In English.] The study of the penetration of a magnetic field into a superconductive tin cylinder (*Met. Abs.*, 1935, 2, 277) is extended to monocrystalline spheres, for which the demagnetization factor is known. A magnetic field was applied to the sphere and its intensity increased at constant temperature until superconductivity was entirely disturbed. It was concluded that the apparent permeability of the sphere is zero so long as the applied field strength is lower than $\frac{2}{3}$ of the field which disturbs superconductivity entirely. The permeability increases linearly until it reaches the value unity when the applied field attains its critical value. The transition was also studied in a constant external field while the temperature was being increased.—S. G.

*The Thermal Conductivity of Tungsten. Walter C. Michels and Martha Cox (*Physics*, 1936, 7, (4), 152-155).—The theory of the heat losses from an electrically-heated wire, as given by Roberts and Kannuluik, has been extended to include a wire supported by springs. The results obtained were used in a measurement of the thermal conductivity of commercial tungsten wire in the range 78° - 273° K. There are definite indications that the Wiedemann-Franz law breaks down badly in this region.—S. G.

*Thermionic Emission from Barium-Coated Tungsten. L. N. Dobretzow and G. A. Morozow (*Physikal. Z. Sowjetunion*, 1936, 9, (4), 352-361).—[In English.] The emission of electrons and positive ions from tungsten in a stream of barium vapour is investigated. The emission of electrons depends on temperature in the same manner as that from tungsten in alkali vapours. The presence of a positive-ion current produced by surface ionization of barium on tungsten is established. The heat of evaporation of barium atoms from tungsten is found to be 151,000 \pm 10,000 cal./mol. for the range of activation (as defined by Langmuir) 0 = 0.3-0.7 and decreases with increasing 0.—J. S. G. T.

The Dissociation Equilibrium of Hydrogen and Its Adsorption on Tungsten. J. K. Roberts (Proc. Cambridge Phil. Soc., 1936, 32, (1), 152-157).-The various processes occurring at the surface when hydrogen is adsorbed on tungsten are considered together with the dissociation equilibrium of hydrogen in the gas phase. The form of the adsorption isotherm is deduced from the principle of detailed balancing, and is in agreement with that obtained by Fowler using a statistical method. A detailed interpretation of the experimental results now available shows that either (a) measurements of the rate of removal of the adsorbed film of oxygen on tungsten do not measure the rate of evaporation of oxygen atoms; or (b) it is not possible to obtain a general first approximation formula giving the rate of evaporation of adsorbed atoms in terms of the heat of desorption. The desorption of hydrogen from tungsten is discussed, and it is shown that the agreement between the temperature at which the film evaporates at an appreciable rate and that deduced from a desorption formula of the type mentioned in (b) assuming that the hydrogen evaporates as atoms must at present be regarded as a coincidence .- S. G.

*Cæsium-Oxygen Films on Tungsten. J. H. Lees (*Phil. Mag.*, 1936, [vii], 21, (144), 1131-1139).—The mode of formation of the oxygen layer is investigated, the effects of pressure, temperature and time of activation, time for adsorption being examined.—J. S. G. T.

*Disintegration of a Monatomic Layer of Thorium on a Tungsten Cathode in a Mercury Discharge. N. Morgulis and M. Bernadiner (*Tech. Physics U.S.S.R.*, 1935, 2, (4), 333–352).—[In English.]—S. G.

*The Dependence of Cathode Sputtering on Temperature [Tungsten]. N. D. Morgulis, M. P. Bernardiner, and A. M. Patiocha (*Physikal. Z. Sowjetunion*, 1936, 9, (4), 302-316).—[In German.] It is shown experimentally that the critical potential for the sputtering of thoriated tungsten by mercury ions at 1350°-1750° K. and the amount of sputtering of pure tungsten by mercury ions at 800°-2000° K. are practically independent of the anode temperature.—J. T.

*On the Creep of Zinc. N. N. Davidenkov and I. N. Mirolubov (Zhurnal Tehnicheskoy Fiziki (J. Tech. Physics), 1936, 6, (1), 60–77).—[In Russian.] An apparatus is described by means of which specimens of zinc single crystals can be stretched at a constant rate of $5 \cdot 10^{-3}$ mm./hr. Stress-flow diagrams for several zinc single crystals were found to be identical with those obtained at usual rates, both as regards the limit of flow and the occurrence of discontinuities. An explanation of these discontinuities is advanced, and their occurrence at constant load is compared with that at constant rate of deformation.—N. A.

*The Free Energies and Vapour Pressures of the Alkali Metals. A. R. Gordon (J. Chem. Physics, 1936, 4, (2), 100-102).—The free energies of the diatomic alkali vapours, K_2 , Na_2 , and Li_2 are calculated from spectroscopic data, and the equilibrium constants for the dissociation into the monatomic form are computed. With the aid of these constants, equations are deduced from the observed vapour pressures obtained by other investigators, which give the partial pressures of atoms and molecules in the saturated vapours for temperatures up to the normal boiling point. In the cases of sodium and potassium the entropy of the solid metal is computed from the vapour pressure equation, and is compared with that predicted by the third law of thermodynamics.—S. G.

The Atomic Frequencies of the Alkali Metals. Binayendra Nath Sen (Gazz. chim. ital., 1935, 65, 907–908; C. Abs., 1936, 30, 3288).—The formula of S. for calculating the vibration frequencies of atoms (cf. J. Indian Chem. Soc., 1934, 11, 243) gave results close to the experimental values and to those obtained by other formulæ, except for sulphur and selenium. This might be explained by the allotropy of sulphur and selenium or by their photoelectric properties, especially

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with selenium. Corresponding calculations with the new formula of other clements with photoelectric properties, viz. sodium, potassium, lithium, rubidium, and cæsium, give results which agree with those obtained by other formula (except for lithium). Accordingly the discordances in the calculated atomic frequencies of selenium and sulphur are attributable to their allotropy rather than to their photoelectric properties, which sulphur possesses to an insignificant degree.—S. G.

*Photo-Effects of Thin Adsorbed Films of the Alkali Metals. V. Gey and J. Truten (Zhurnal eksperimentalnoy i teoreticheskoy Fiziki (J. Exper. and Theoret. Physics), 1936, 6, (1), 30-36).—[In Russian.] By adsorption of the vapours of alkali metals, films with a thickness of several atomic layers have been obtained. The electrical conductivity of these films obeys Ohms' law. The relative photo-current curves obtained from them do not reveal selective maxima.—N. A.

Ultimate Strength of Metals. E. N. da C. Andrade (Science Progress, 1936, 30, (120), 593-610; C. Abs., 1936, 30, 3757).—A consideration of the fundamental problems of metallic strength and of yield under stress, with 28 references.—S. G.

First Report on Viscosity and Plasticity. Committee for the Study of Viscosity of the Academy of Sciences, Amsterdam (Verhandel. Akad. Wet. Amsterdam, Afdeel. Natuurkunde, 1st Scet., 1935, 15, (3), 256 pp.; C. Abs., 1936, 30, 3692).—The basic mechanical relations, the experimental investigation of flow properties, the measurement of viscosity, viscosity and plasticity from a technical point of view, the plasticity of metals and other crystalline substances, &c., are discussed.—S. G.

The Deformation, Recovery, and Recrystallization Behaviour of Metals. R. H. Hobrock (J. Aeronaut. Sci., 1936, 3, (6), 191–199).—The behaviour of single-crystal structures under mechanical stress is contrasted with that of the finely polycrystalline materials in ordinary technical use. "Recovery" from work-hardening is distinguished from "temper-relief," which is defined as a heating and cooling operation intended to bring the properties of an alloy as near as possible to those of its predominating metallic constituent. This can be effected without achieving "recovery," or the relief of stresses in the lattice. The mechanism of grain-growth is discussed, and the three-dimensional recovery-recrystallization diagram of an alloy of the Duralumin type is reproduced. The annealing temperature necessary for the relief of internal stresses may come within the recrystallization range, and grain-growth may thus be set up : some means of prevention are suggested.—P. M. C. R.

*The Thermal Stress in a Strip Due to Variation of Temperature Along the Length and Through the Thickness. (Goodier.) See p. 278.

*On the Sticking of Two Metal Surfaces to One Another in a Vacuum and the Reduction of Sticking by Various Gases. Ragnar Holm and Bernhard Kirschstein (Wiss. Veröff. Siemens-Werken, 1936, 15, (1), 122-127) .- Cylinders of nickel, platinum, and graphite with a small axial hole drilled in them were threaded on stout nickel or platinum wires to give a very loose fit, and the angle at which slip occurred was determined in vacuo and in various gas atmospheres after previous annealing in vacuo to remove all trace of surface films. The results show that in vacuo and in an inert gas atmosphere (nitrogen or argon) severe sticking of the metals to one another occurs, so that no slip takes place even when the wire is vertical unless it is shaken; this is attributed to a kind of cold-welding by simple pressure and occurs only with perfectly clean surfaces. In hydrogen, steam, air, or the vapour of hydrocarbons slip occurs when the wire is inclined at 15° -62° to the horizontal according to the metals in contact and the atmosphere; this effect is attributed to the formation of invisible films on the metal surface which allow slip to occur. The presence of such films accounts for the contact resistance in electric switchgear, &c.

-A. R. P.

*Experiments on Two Thin Metal Films Pressed Together. Alexander Deubner (*Naturwiss.*, 1935, 23, 557).—The non-linear relationship between the physical properties and the thickness of the metal films cannot be explained by the fact that the real film thickness is not identical with the theoretical value derived from the weight of the deposited metal, but the phenomenon is an actual property of thin metal films.—B. Bl.

*Diffusibility of Deuterium in Metals. T. Franzini (Nuovo cimento, 1936, 13, (2), 74–78; Sci. Abs., 1936, [A], 39, 580).—Experiments were made to determine whether deuterium diffuses through metals, palladium being used as it is known that hydrogen is occluded by this metal. The presence of hydrogen and deuterium was determined spectroscopically. The work showed that occluded hydrogen is removed by an electric field, but no evidence for this was obtained in the case of deuterium.—S. G.

Adsorption Isotherms. Critical Conditions. R. H. Fowler (Proc. Cambridge Phil. Soc., 1936, 32, (1), 144-151).—S. G.

Sixth Report of the Committee on Atomic Weights of the International Union of Chemistry. G. P. Baxter, O. Hönigschmid, and P. Lebeau (J. Amer. Chem. Soc., 1936, 58, (4), 541-548).—See Met. Abs., this vol., p. 144.—S. G.

*†The Measurement of Contact Potential Difference. C. W. Oatley (*Proc. Roy. Soc.*, 1936, [A], 155, (885), 218–234).—Methods of measuring contact potential differences hitherto used are critically reviewed and a new method is described, dependent on the known relation between anode voltage and critical magnetic field in a magnetron, when electrons from the filament just fail to reach the anode. Results relating to the contact potential differences of molybdenum, zinc, and platinum relative to a hot tungsten filament are briefly discussed.—J. S. G. T.

*Influence of Electron Reflection on Photoelectric Emission. W. B. Nottingham (Phys. Rev., 1936, [ii], 49, (8), 646).-Abstract of a paper read before the American Physical Society. Electrons emitted thermionically from tungsten and thoriated tungsten filaments are distributed in energy as though they suffered a reflection at the barrier given by $R(p_x) = \exp(-p_x^2/2m\omega)$, where $\omega = 3.05 \times 10^{-13}$ erg and $p_x =$ momentum in excess of that required to go over the barrier. Du Bridge and others have shown that Fowler's photoelectric theory which assumes reflection constant (or zero) fits the experimental data. This reflection may be incorporated into the theory. The new function is nearly identical in form with the Fowler curve over the experimental range. If the reflection hypothesis be assumed to be correct, all previous determinations of photoelectric work-functions are too high by an amount given approximately by $\Delta \phi = 8 + 0.138T' - 5 \times 10^{-5}T^{\pm}$ mv. Whereas the Fowler analysis gives work-functions for clean surfaces practically independent of temperature, the new method when applied to Du Bridge's data on palladium yields a negative temperature coeff. of the work-function of $(4.5 \pm 1) \times 10^{-5}$ v. per degree. This is consistent with a thermionic constant A of 60 amp./ cm.²/degree², if it be assumed that only 40% of the apparent surface emits, as is thought to be the case for pure tungsten, and includes the effect of reflection. -S. G.

On the Theory of the Photoelectromotive Force in Semi-Conductors. L. Landau and E. Lifshitz (*Physikal. Z. Sowjetunion*, 1936, 9, (5), 477-503).---[In English.] The e.m.f. that appears in a circuit containing a semi-conductor illuminated from one side is calculated. Two cases are considered: a semiconductor with conducting electrons and a semi-conductor with conducting electrons and a semi-conductor with conducting electrons and a semi-conductor with conducting electrons and "holes."-S. G.

*Action of Periodically Varying Light on a Metallic Plate. Q. Majorana (Atti R. Acad. Lincei (Roma), 1933, 17, 255-256; Sci. Abs., 1933, [A], 36, 795).— Deals with the action of interrupted light on a lamp-blackened disc, which may be partly due to heat, and describes a new method for compensating the photoelectric action. (See also following abstracts.)—S. G. *Action of Light on Thin Metallic Lamine. Q. Majorana (Nuovo cimento, 1933, 10, (4), 261–285; Sci. Abs., 1934, [A], 37, 212).—Continuing previous work (see preceding abstract) it is found that the electrical resistance of a thin lamina of platinum, silver, gold, and tin is increased when the lamina is strongly illuminated. The effect is very small with aluminium and zine and is non-existent with sodium. Besides varying with the nature of the metal, the magnitude of the effect depends on the thickness of the lamina and the frequency of interruption of the light. If the lamina is immersed in running water the effect is unaltered, but in still water it is sensibly reduced. There is always a phase lag in the effect of about 45° when pulsating light is used; in some circumstances this may be reduced to about 35°. The experiments seem to show the existence of a new type of direct action of light on electrical resistance. Unlike the photoelectric effect, it is not manifested immediately the light.—S. G.

*Photo-Resistance of Metals. Q. Majorana (*Nuovo cimento*, 1935, 12, (7), 409-417; *Sci. Abs.*, 1936, [A], 39, 78).—An account is given of further investigations of the metallic photo-resistance found by M. (see preceding abstract). After reference to facts which distinguish it from a purely thermal action of pulsating light acting on the metallic lamina and the resistance of the latter are described. It is found that for metallic lamina fixed on glass ϕ amounts to about 45°, but may in exceptional cases be as low as 16°; whilst for lamina free in air it may be very nearly 90°, but sometimes only 65°. Moreover, ϕ increases on decrease of the frequency of the light, and this variation is strongest for light from a mercury lamp. The results confirm the supposition of the ordinary photoelectric effect, is in its nature rather slow in its manifestation.—S. G.

*Electric Equilibrium and Permanent Thermoelectric Currents in a Metallic Conductor. F. Odone (Nuovo cimento, 1935, 12, (8), 522-530; Sci. Abs., 1936, [A], 39, 207).—The thermodynamic theory of phenomena relating to electric equilibrium and the passage of permanent currents in a metallic conductor is considered. Using the idea of an electrochemical potential, a parameter introduced by Duhem to explain the action between electric charges and material masses, is shown the existence of a potential difference between the interior and the surface of a metal, of an internal and external Volta effect. The c.m.f. of a thermoelectric current and the coeffs. of the Peltier and Thomson effects in terms of the e.m.f. of the thermocouple are calculated. It is found that the well-known theory due to Kelvin is based on contradictory hypotheses and cannot be accepted.—S. G.

*Permanent Thermoelectric Currents in Metallic Conductors. F. Odone (Nuovo cimento, 1936, 13, (1), 11-15; Sci. Abs., 1936, [A], 39, 567).—Continuing previous work (preceding abstract) it is shown that the thermal phenomena that are produced in a metallic circuit in which a permanent current is flowing do not modify the free energy in the conductor, but cause instead a modification of the energy in the surroundings, with which the conductor itself exchanges energy.—S. G.

*Further Experiments on Metallic Conduction. Ernst Weber (*Phys. Rev.*, 1936, [ii], 49, (8), 643).—Abstract of a paper read before the American Physical Society. The experiments previously described (*Phys. Rev.*, 1933, [ii], 44, 318; and *Met. Abs.*, 1934, 1, 560) have been continued. The distribution of large d.c. in a flat copper conductor in a strong magnetic field perpendicular to the flow of current was investigated, and its relation sought with the experiments of Kapitza on the increase of resistance in a magnetic field (*Note*: No details are given in the abstract).—S. G.

Incandescence Electron Emission and Electron Conduction in the Case of Solids. A. Gehrts (Z. tech. Physik, 1935, 16, (11), 370-373).—See Met. Abs., this vol., p. 34.—S. G.

*Does Metallic Conduction Occur in Highly Compressed Metallic Vapours? Werner Braunbek (Z. tech. Physik, 1935, 16, (11), 497-498).—See Met. Abs., this vol., p. 34.—J. S. G. T.

The Change of the Electrical Resistance and of the Reflecting Power of Metallic Mirrors Condensed at Low Temperatures. R. Suhrmann and G. Barth (Z. tech. Physik, 1935, 16, (11), 447–451).—See Met. Abs., this vol., p. 34.—S. G.

*The [Electrical] Resistance of Very Thin Layers of Impurities in Metallic Contacts. R. Holm and B. Kirschstein (Z. tech. Physik, 1935, 16, (11), 488-494).—See Met. Abs., this vol., p. 34.—J. S. G. T.

Relaxation Phenomena in the Transition from the Superconductive into the Non-Superconductive State. W. H. Keesom and P. H. van Laer (*Physica*, 1936, 3, (3), 173-181; and K. Onnes Lab. Leiden Comm. No. 240e). --[In English.] The transition from the superconductive to the non-superconductive state takes place, as revealed by experiments on tin, with a relaxation of several seconds, if it is caused by an increase of temperature of the substance, while a constant magnetic field is applied. No such relaxation (at least not to an amount of seconds) occurs if the transition is the consequence of an increase of the external magnetic field. These experimental facts are in harmony with the views that, the threshold value curve being reached, there is a weak coupling between the atomic lattice and the system of superconductive electrons, and that there is a strong coupling between the external magnetic field and the system of superconductive electrons as well as between the non-superconductive electrons and the atomic lattice.--S. G.

*An Experimental Examination of the Electrostatic Behaviour of Superconductors. H. London (*Proc. Roy. Soc.*, 1936, [A], 155, (884), 102–110).— It is shown experimentally that the lines of electric induction in a superconductor terminate discontinuously in surface charges and do not penetrate a thin layer of the superconductor.—J. S. G. T.

Electron Configuration in the Superconducting Metals. U. Dehlinger (Z. tech. Physik, 1935, 16, (11), 498-499).—See Met. Abs., this vol., p. 35.—J. T.

[†]Investigations in Strong Magnetic Fields. O. v. Auwers (*Naturwiss.*, 1936, 24, (5), 65–73).—Reviews recent work of Kapitza on the magnetic behaviour of nickel, manganese, bismuth, gallium, tin, beryllium, magnesium, and tungsten in strong magnetic fields.—B. Bl.

*An Elementary Theory of the Change of Resistance in a Longitudinal Magnetic Field. A. Sommerfeld and B. W. Bartlett (Z. tech. Physik, 1935, 16, (11), 500).—See Met. Abs., this vol., p. 35.—J. S. G. T.

Estimation of the Maximum Temperature in the Neighbourhood of a Cross-Sectional Constriction of an Incandescent Wire in an Inert Gas. Leopold Prasnik (Z. Physik, 1936, 99, (9/10), 710-713).—The analysis already given for an incandescent wire in vacuo (Z. Physik, 1933, 86, 253) is here extended to the case of an incandescent wire having a cross-sectional constriction and heated in an inert gas. The results are compared with data derived from the filaments of gas-filled lamps.—J. S. G. T. *Theory of Metallic Linking.—I. Paul Gombás (Z. Physik, 1936, 99, (11/12),

*Theory of Metallic Linking.—I. Paul Gombás (Z. Physik, 1936, 99, (11/12), 729–742).—A mathematical theory of interatomic forces in metals, employing Hartree's eigen-functions, is developed and applied to derivo values of the physical constants of the potassium atom. The following values of the physical constants are derived; for comparison the experimental values are given in brackets: lattice constant, 5.37 A. (5-15 A.); lattice energy, 111-1 k.cal./mol. (126-2 k.cal./mol.); heat of sublimation, 11-4 k.cal./mol. (26-5 k.cal./mol.); compressibility, $2\cdot 6 \times 10^{-11}$ em.²/dyne ($2\cdot 0 \times 10^{-11}$ em.²/dyne).

-J. S. G. T.

II.—**PROPERTIES OF ALLOYS**

(Continued from pp. 198-202.)

Structural Aluminium and Fatigue. F. H. Frankland. Henry D. Johnson. R. L. Templin (*Eng. News-Record*, 1936, 116, (20), 709–710).—Cf. Met. Abs., this vol., p. 133. In a letter, F. suggests that aluminium alloys are particularly susceptible to reduction of fatigue-strength by notch effects, and directs attention to their low endurance limit. Replies by J. and T. include data on the fatigue limits of "27 ST" alloy at 10×10^6 cycles (19,000 lb./in.²) and $500 \times$ 10^6 cycles (13,000 lb./in.²). Attention is directed to the advantages of this alloy's low modulus of elasticity and to the value of precise knowledge of the properties of materials in engineering design.—J. C. C.

The Endurance Limit of Aluminium Alloys. R. Irmann (Congrès internat. Mines Mét. Géol., Section de Métallurgie, 1935, 1, 435–440; and Rev. Mét., 1936, 33, (4), 231–236).—[In French.] See Met. Abs., this vol., p. 113.—S. G.

*Magnetic Investigation of Precipitation-Hardening [of Aluminium-Copper Alloys]. Hermann Auer (Z. tech. Physik, 1935, 16, (11), 486–488).—See Met. Abs., this vol., p. 36.—J. S. G. T.

[†]Improvement of Aluminium Alloys. M. I. Zaharova (Metallurg (Metallurgist), 1936, (2), 92-101).—[In Russian.] A survey of the ageing of aluminium-copper alloys, aluminium-magnesium-silicon alloys, Duralumin, and aluminium-silicon alloys, and of the influence of plastic deformation on the disintegration of solid solutions.—N. A.

*Aluminium-Magnesium Alloys. Pierre Vachet (Congrès internat. Mines Mét. Géol., Section de Métallurgie, 1935, 1, 175–187; also (in English) Light Metals Research, 1936, 4, (23), 411–414; and Aluminium and Non-Ferrous Rev., 1936, 1, (7), 301–309).—[In French.] See Met. Abs., this vol., p. 73.—S. G.

A Quaternary Aluminium-Silicon Alloy. Development and Properties of Cetal. G. Welter (*Met. Ind.* (*Lond.*), 1936, 48, (23), 627-634).—An account of the properties of an alloy consisting essentially of copper 3, zinc 10, silicon 6.5%, aluminium remainder. Comparisons are made with the usual standard alloys (see J. Inst. Metals, 1926, 36, 325).—J. E. N.

[†]Beryllium. Robert Gadeau (Congrès internat. Mines Mét. Géol., Section de Métallurgie, 1935, 1, 189–199; and Aluminium and Non-Ferrous Rev., 1936, 1, (8), 353–360.)—[In French.] See Met. Abs., this vol., p. 74.—S. G.

*The Electrical Resistance of Bismuth Alloys. N. Thompson (Proc. Roy. Soc., 1936, [A], 155, (884), 111–123).—The electrical resistances of single crystals of bismuth containing small proportions of lead, tin, germanium, selenium, and tellurium were determined at 14°–400° K. Lead, tin, and germanium dissolve in the bismuth lattice and produce an alloy having a large negative temperature coeff. of resistance parallel to the principal axis of the crystal. The effect is similar, but small, perpendicular to the axis. Selenium and tellurium dissolve in bismuth, reducing its specific resistance both parallel and perpendicular to the axis except at low temperatures. They give no negative temperature coefficient. The results are explained qualitatively in terms of Jones's theory of bismuth.—J. S. G. T.

*On the Magnetic Behaviour of the System Chromium-Sulphur. Haakon Haraldsen and Anna Neuber (*Naturwiss.*, 1936, 24, (18), 280).—Susceptibility measurements in the range $Cr_S-Cr_sS_3$ show that within a small concentration range the system becomes markedly ferromagnetic but at 165° K. an unexpected sharp decrease in the magnetism occurs such as is not found in other ferromagnetic materials at temperatures below the Curie point.—B. Bl.

*On the Lower Sulphides of Cobalt. The Equilibrium Diagram of the System Cobalt-Cobalt Sulphide. Otto Hulsmann and Friedrich Weibke (Z. anorg. Chem., 1936, 227, (2), 113-123).—Thermal, micrographic, and X-ray examina-

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tion of the system cobalt-cobalt sulphide shows that the solubility of sulphur in cobalt is almost zero at room temperature. The eutectic occurs at 874° C. and 26.4% sulphur. The β -phase (Co₄S₃) has a homogeneous range of 1.3% cobalt and is stable only above 787° C., below which it decomposes into the cobalt- γ eutectoid. The γ -phase, which has a face-centred cubic structure is formed by a peritectic reaction at 928° C. and has the composition Co₅S₅. The δ -phase is homogeneous only at the composition CoS_{1.05}.—A. R. P.

Definite Compounds in Alloys [Copper-Aluminium]. E. Amic (Rev. Fonderie moderne, 1936, (Feb. 2), 71).—R. Thews (*ibid.*, 1935, (Apr. 25)), stated that in preparing binary master alloys of copper and aluminium, an increase in temperature of 280° - 330° C. occurs, "which has not been completely explained." A. states that this exothermic reaction is due entirely to the successive formation of the intermetallic compounds CuAl₂ and CuAl. [It has long been proved that the heat comes from reduction of the oxide in the copper by aluminium.—*Ed.*]—J. E. N.

*The Effect of Iron Impurities on the Annealing of High Brass. (Gibson and Doss.) See p. 274.

*The Recrystallization of Copper-Zine Alloys with Zine Contents up to 7 Per Cent. Al. Kitaigorodski (*Tech. Physics U.S.S.R.*, 1936, 3, (1), 39-50; *Sci. Abs.*, 1936, [A], 39, 579).—[In German.] Alloys were prepared containing up to 7% zine by melting copper and zine together (*a*) in purified nitrogen, and (*b*) under charcoal in air, with subsequent deoxidation. Recrystallization was determined on a 97-98% cold-worked strip by an X-ray method. At about 2% zine the rate is a minimum as shown both by time and by temperature curves. The speed is not affected by 0.2-0.4% phosphorus nor by cuprous oxide which markedly inhibits recrystallization in pure copper. The oxide is apparently immediately reduced by zine. Theoretically, recrystallization depends on the number of nuclei and rate of growth, so that it is unnecessary to assume the formation of a special constituent at 2% zine. Theoretical investigation of recrystallization is very difficult. The practical rule (reerystallization temperature/melting point) = const. has no theoretical or experimental basis for the alloys investigated.—S. G.

*Influence of Impurities on the Properties of Magnesium Alloys. N. W. Ageew, M. I. Zamotorin, and D. N. Shoyket (Metallurg (Metallurgist), 1936, (3), 27-38; (4), 48-59).-[In Russian.] The influence was studied of silicon (up to 2%), iron (up to 0.18%), nitrogen (up to 1%), sodium (up to 0.98%), potassium (up to 0.72%), calcium (up to 0.99%), magnesium oxide (up to 1.0%), and chlorides (up to 0.51% Cl) on cast Elektron alloys containing aluminium 6-10, manganese 0-0.18, zine 0 and 2.98, and copper 0 and 1.04%, and on rolled alloys containing aluminium 1.5-6, zinc 1-4.5, manganese 0-0.2, and copper 0-0.75%. Silicon causes strong absorption of gases, increase in porosity, greater tendency to segregation, increased contraction, greater hardness and brittleness, lower resistance to impact, and smaller clongation and reduction in area, but the change in mechanical properties with temperature is less the higher the % silicon, and there is a greater tendency to age-harden. Iron dissolves up to 0.2% reducing the contraction and increasing the hardness and tensile strength; it has no effect on ageing or rolling. Nitrogen reduces contraction, increases porosity, and lowers the mechanical properties at all temperatures. Sodium intensifies liquation, increases porosity, causes the formation of cracks in the liquation zone, and seriously affects the mechanical properties, the plasticity disappearing entirely with 0.9% sodium at room temperature and with only 0.3% sodium at 150°-300° C., while the tensile strength, elongation, and reduction in area decrease at high temperatures. Even as little as 0.09% sodium prevents hot extrusion of Elektron. Potassium has a similar effect to sodium, but does not impede rolling. Calcium is a good deoxidizer for magnesium and its alloys. Cast Elektron alloys even with 0.3% calcium have a clean surface free from oxide and nitrides. Calcium increases the density and, up to 1%, does not affect the mechanical properties, ageing, or rolling. Magnesia reduces liquation and shrinkage and prevents the development of transcrystallization. With 0.1% magnesia the mechanical properties are unaffected, but with 1% they all decrease.—N. A.

*Age-Hardening of Magnesium-Aluminium Alloys. A.M.Talbot and John T. Norton (*Metals Technology*, 1936, 3, (2), 13 pp.; *A.I.M.M.E. Tech. Publ.* 692).— The age-hardening of a magnesium-aluminium alloy containing 9.6% aluminium was studied by measurements of hardness, dilation, and electrical resistance; lattice parameter measurements were also made by a back-reflection camera on a flat surface of a block, the same surface being used subsequently for etching and microscopic examination. All the observations are accounted for by the simple precipitation theory, and no evidence for pre-precipitationhardening was obtained. The fact that no appreciable change in lattice parameter occurs until after considerable increase in hardness is due to the precipitation taking place very unevenly, so that the main bulk of the alloy may be unchanged whilst small areas show complete precipitation. Under such conditions X-ray diffraction pictures may show only lines due to the unchanged solid solution, but by careful control two sets of lines may be obtained, one corresponding to the precipitated and the other to the unchanged areas.

-W. H.-R.

*Stress-Relief Annealing High-Strength Monel Metal Plate. (Kosting.) See p. 274.

The Change of Magnetization of Nickel, Permalloy, and Nickel Single Crystals in Strong Fields. (Gerloff.) See p. 239.

*Magnetic Powder Experiments on Rolled Nickel-Iron. J. L. Snock (*Physica*, 1936, 3, (2), 118-124; *Sci. Abs.*, 1936, [A], 39, 429).—[In English.] The magnetic powder patterns obtained by Bitter (*Met. Abs. (J. Inst. Metals*), 1933, 53, 8) on the surface of molten unstrained ferromagnetic bodies are briefly described and their origin discussed. It is suggested that two phenomena are present—one due to inhomogeneities in the magnetization process. The latter is investigated by studying the powder figures and the magnetization curves of a 50% nickel-iron alloy in the annealed state ("isotropic" specimen) and in the unannealed condition ("anisotropic" specimen). Marked differences are observed between the two. The general properties of the Bitter patterns are described; the most important of these is that the lines are parallel to the direction of easiest magnetization.—S. G.

*Apparatus for the Determination of Length Variations of Invar Wires 24 m. Long. P. Werkmeister (Z. Instrumentenkunde, 1935, 55, (12), 499-501; Sci. Abs., 1936, [A], 39, 102).—Describes a method for determining the variations in length of 25 m. Invar wires. Three wires are individually compared with 24 m. bases set up on a suitable wall of a 3-storey building, one base being arranged on each floor. The average accuracy of comparison is between ± 0.02 and ± 0.03 mm., and it is established that in the case of the 3 wires used no changes greater than 0-1 mm. take place within 5 years. This is confirmed by standardization of the wires at the Physikalisch-Technische Reichsanstalt.—S. G.

*Photoelectric Sensitivity of Palladium–Silver Alloys Saturated with Hydrogen. F. Krüger and W. Kallenbach (Z. Physik, 1936, 99, (11/12), 743–750).— Palladium–silver alloys, saturated with hydrogen, show a principal maximum photoelectric sensitivity in the case of alloys containing 20% of silver and a lower maximum for alloys containing 60-65% of silver. These compositions correspond very closely with the composition of the alloys absorbing a principal and secondary maximum proportion of hydrogen. These results are discussed in connection with the results obtained by Schniedermann.—J. S. G. T. *Binary Systems of Alkali Metals.—I [Rubidium–Potassium; Rubidium– Sodium]. Carlo Goria (Gazz. chim. ital., 1935, 65, 865–870; C. Abs., 1936, 30, 3305).—The systems rubidium–potassium and rubidium–sodium were studied. The thermal diagram of the system rubidium–potassium indicates a limited range of solid solutions, the absence of any compounds, but the formation of a euteetic at 34° C. with 15% of potassium. The rubidium–sodium diagram indicates the absence of solid solutions and of compounds, but shows a eutectic at $-5 \cdot 2^\circ$ C. with $92 \cdot 0\%$ rubidium. The results confirm those of Rinck (Met. . Abs. (J. Inst. Metals), 1933, 53, 495; Met. Abs., 1934, 1, 75; 1935, 2, 283). The technique of preparation of the alloys is described.—S. G.

[†]The Mechanical Properties of Tin-Base Alloys. D. J. Macnaughtan and B. P. Haigh (Congrès internat. Mines Mét. Géol., Section de Métallurgie, 1935, 1, 235-241; and Rev. Mét., 1936, 33, (1), 7-13).—[In French.] Sec Met. Abs., this vol., p. 38.—S. G.

*The Effect of the Addition of Lead on the Endurance Limit of a Certain Tin-Base Bearing Alloy. John N. Kenyon (Amer. Soc. Test. Mat. Preprint, 1936, 4 pp.; and Met. Ind. (Lond.), 1936, 49, (2), 33-34).—Continuation of an investigation commenced several years ago to determine the effect of the addition of lead to certain tin-antimony-copper Babbitt metals (Met. Abs. (J. Inst. Metals), 1933, 53, 495). The addition of 4% of lead has little effect on the endurance properties of a tin-base bearing alloy (tin 80, antimony 15, copper 5%); if lead has any effect at all it is to improve the material. A peculiar form of bearing failure was found to occur after the alloy has been in service for a long time and an explanation of this failure is offered.—S. G.

*Spectral Emissivities, Resistivity, and Thermal Expansion of Tungsten-Molybdenum Alloys. P. N. Bossart (*Physics*, 1936, 7, (2), 50-54).—The spectral emissivities of 3 different tungsten-molybdenum alloys were determined; the emissivities of tungsten and molybdenum were also measured. The resistivity-temperature and thermal expansion-temperature relations are given for the alloy containing 46-5 atoms-% tungsten. The resistivity relation is compared with those of its constituents and discussed with reference to the theory of Bragg and Williams.—S. G.

*Investigations on the Wear of Metals in Sliding Friction. Bruno Kehl and Erich Siebel (Arch. Eisenhüttenwesen, 1935–1936, 9, (11), 563–570).—The wear, friction, and tendency to seize of cast bronze, leaded bronze, and white metal bearings in contact with steel shafts was determined, using pure oil and oilemery mixtures as lubricants. Under oil the tendency to seize increases with increasing surface roughness and in pure oil the wear decreases with increasing time of test owing to the gradual increase in smoothness which occurs. With constant load the speed of rotation has no influence on the wear in oil-emery mixtures, but with increasing load the wear increases at first proportional to the load and then as seizure occurs to several hundred times the normal value. Leaded bronze had the smallest coeff. of friction of the alloys tested.—A. R. P.

*Irreversible Transformations in Solid Solutions. J. B. Fridman (Zhurnal Tehnicheskoy Fiziki (J. Tech. Physics), 1936, 6, (1), 78-82).—[In Russian.] In binary nickel- and manganese-iron alloys the hysteresis of the α - γ -transformation is a linear function of the concentration, the effects of the nickel and manganese being proportional to their atomic radii. In ternary nickelchromium-iron alloys, and in the separation and redissolution of carbides in nickel-chromium steel, hysteresis increases approximately directly with the concentration. The combined effect of temperature and deformation in nickel-iron and nickel-chromium-iron alloys is to reduce the hysteresis by 17-25%.—N. A.

Equation of State and Heat of Phase Transformations in Solids. Y. A. Trotzkiy (*Zhurnal Tehnicheskoy Fiziki* (J. Tech. Physics), 1936, 6, (1), 125– 136).—[In Russian.] From the equation of state of a solid, and taking into account its crystalline structure, its heat of transformation (Q) is given by the expression: $\dot{Q} = 9RT^2(n_2\alpha_2 - n_1\alpha_1)$, where T is the temperature and α_1 and α_2 are the coeff. of expansion and n_1 and n_2 constants characterizing the crystal lattice before and after transformation.—N. A. *Representation of Ternary Systems. Erich Scheil (Arch. Eisenhüttenwesen,

*Representation of Ternary Systems. Erich Scheil (Arch. Ersenhüttenwesen, 1935–1936, 9, (11), 571–573).—To facilitate the reading of ternary diagrams it is suggested that they should be accompanied by plans showing the 3- and 4phase equilibria in the system and their relations to one another. Examples of the following systems are given *inter alia*: iron-cobalt-tungsten, iron-Fe₃Ccopper, iron-chromium-carbon, iron-manganese-carbon, and iron-zirconiumearbon.—A. R. P.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 202-203.)

*On Grain-Size in Metals. M. G. Oknov (Metallurg (Metallurgist), 1936, (3), 3-8).—[In Russian.] From experiments on the effects of up to 1% of numerous metals on the crystallization of pure zinc, the reduction in grain-size caused by certain impurities is attributed to the formation of a disperse oxide phase (e.g. magnesia, alumina, or lime) which promotes the formation of numerous crystallization nuclei but this theory alone is insufficient to explain all cases of grain-size reduction; thus when mercury is added, the wide temperature interval within which separation of excess zinc takes place may be considered as one of the factors.—N. A.

*Grain Changes in α -Copper Solid Solutions in the Cast Condition Produced by Annealing. M. P. Slavinskiy, O. S. Malhasjan, and L. R. Edelson (Metallurg (Metallurgist), 1936, (3), 8-15).—[In Russian.] Tests on brass with 30, 37, and 40% zinc, and on phosphor-bronze with (a) tin 4.5, phosphorus 0.02% and (b) tin 6, phosphorus 0.2% showed that α -solid solutions of copper can be recrystallized in the cast state provided that the annealing is prolonged to overcome the effects of segregation. Alloys near the limit of the solid solution range recrystallize more rapidly due to volume changes in the segregated regions between the grains. Brass shows a greater grain-growth than bronze.—N. A.

*Dependence of Diffusion Velocity in Metals on Crystallographic Orientation (Anisotropic Diffusion). W. Bugakow and N. Breschnewa (*Tech. Physics* U.S.S.R., 1935, 2, (5), 435–443; *Sci. Abs.*, 1936, [A], **39**, 225).—[In German.] An investigation was made of the velocities of diffusion of mercury into cadmium and into zinc single crystals in different crystallographic directions. In both cases the diffusion velocity is greatest in the direction parallel to the base plane and least perpendicular to this plane. Increase of temperature decreases the importance of the crystallographic direction for the velocity of the process, *i.e.* it decreases the degree of anisotropy of the diffusion. The diffusion velocity of copper into zinc unit crystals was also investigated and analogous results obtained.—S. G.

*Diffusion Coefficients of Metals and Grain Magnitudes. W. Bugakow and F. Rybalko (*Tech. Physics U.S.S.R.*, 1935, 2, (6), 617-623; *Sci. Abs.*, 1936, [A], 39, 225).—[In German.] This investigation deals with the alteration in the diffusion coeffs. of brass on transition from single- to poly-crystals and for different grain magnitudes in the poly-crystal. The absolute value of the diffusion coeff. increases appreciably during the transformation from single- to poly-crystals. The heat of relaxation, which has been evaluated from the temperature curve of the diffusion coeff., decreases on transition from the single- to the poly-crystal, but remains constant during further diminution of the grain. An explanation of the results is based on the general theoretical presentation of diffusion phenomena. The results are compared with data obtained by electrolytic conductivity measurements.—S. G.

*Microscopic Study of Ancient Bronze and Copper [Corrosion of Ancient Bronze and Copper]. C. G. Fink and E. P. Polushkin (*Metals Technology*, 1936, 3, (2), 28 pp.; *A.I.M.M.E. Tech. Publ.* No. 693.—Microstructures of ancient objects of copper and bronze are described and illustrated. In general, where the metal is not corroded the structures are quite normal and can readily be explained in terms of known metallurgical operations. The microstructure of the corroded metal is described, and attempts made to interpret the corrosion process and the nature of patina. The ultimate product is always the basic carbonate, malachite, which is stable in the presence of carbon dioxide. This however, is never found in contact with the original metal; the corrosion process is very complex, and six types have been recognized, for details of which the original paper must be consulted.—W. H.-R.

[†]The Structure of Some Copper Alloys. W. Broniewski (Congrès internat. Mines Mêt. Géol., Section de Métallurgie, 1935, 1, 219–227).—[In French.] Sec Met. Abs., this vol., p. 76.—S. G.

*The Structure of the Electrolytical Oxide Layer on Aluminium. E. J. W. Verwey (Z. Krist., 1935, 91, (3/4), 317-320).--[In English.] In the electrolytic oxidation of aluminium in oxalic acid solution, the oxide consists of a cubic form (Burgers, Claasen, and Zernike, Met. Abs. (J. Inst. Metals), 1932, 50, 289) which V. terms γ' -Al₂O₃. The structure of this may be described as a simple face-centred cubic lattice of oxygen ions in which the Al³⁺ ions are distributed over all the available interstices in such a way that about 70% occupy an octahedron hole (co-ordination number 6), and 30% a tetrahedron hole (co-ordination number 4). The γ' -Al₂O₃ may be regarded as the first stage in the transition from the amorphous to the truly crystalline form.

-W. H.-R.

Electrolytic Conduction of a Solid Insulator at High Fields. The Formation of the Anodic Oxide Film on Aluminium. E. J. W. Verwey (*Physica*, 1935, 2, (10), 1059–1063).—[In English.] The mechanism of electrolytic oxide coating of aluminium is described in terms of a current of Al^{3+} -ions penetrating into a preformed lattice of oxygen ions. This picture explains the peculiar structure of $\gamma' Al_2O_3$ (average structure of the cations) and is in rather good agreement with considerations on the basis of lattice theory of the electrolytic conductivity of crystals at high fields (cf. Verwey, preceding abstract, and J. Chem. *Physics*, 1935, **3**, 592).—S. G.

*Investigation of Aluminium Oxides by Means of Electron Interference. E. Belwe (Z. Physik, 1936, 100, (3/4), 192–196).—Electrolytic aluminium oxide films are shown to be composed of very finely crystalline γ -Al₂O₃. The oxide produced on aluminium foil by heating in a flame is found to be composed of the same γ -oxide in the usual macrocrystalline form interspersed with thin aluminium single crystals.—J. S. G. T.

*X-Ray Diffraction Study of Liquid Sodium. L. P. Tarasov and B. E. Warren (J. Chem. Physics, 1936, 4, (4), 236–238).—S. G.

*Optical Investigation of Thin Gold Foils. R. Smoluchowski (*Phys. Rev.*, 1936, [ii], 49, (8), 649).—Abstract of a paper read before the American Physical Society. Measuring the light absorption in thin metal films, Smakula found consecutive maxima and minima of absorption coeff. which he indicated as connected with electronic levels (bands) in the metal lattice. Since this point of view does not seem to be satisfactory, new measurements were made on thin gold foils in order to find another possible explanation of the effect. Special care was taken to obtain reproducible foils, which were made by condensing gold vapour on thin glass plates. A special arrangement permitted the estimation of the thickness obtained. The measurements were carried out on

a series of foils, varying from "colloidal" foils to good developed crystal layers, the different structures of the foils appearing in the shape of the absorption curve. The dependence of the observed maxima and minima of absorption of light in the wave-length region 4800–6800 A. on the thickness of the foils and the angle of transmission of the light beam scems to indicate that the origin of this effect is to be looked for in the grain structure of the surface of the foils, the grains themselves, however, being very different from uniform spheres as it was supposed in Mie's theory of optical effects in colloids.—S. G.

*The Diffraction of Electrons by Amalgam Films. A. E. Aylmer, G. I. Finch, and S. Fordham (*Trans. Faraday Soc.*, 1936, 32, (6), 864–871).—Examination of the effect of mercury vapour on gold and silver leaf by the electron diffraction method revealed a large number of amalgam structures; both metals form simple cubic amalgams with a = 17.81 and 17.94 A., respectively. Two other face-centred tetragonal silver amalgams were also identified. Copper behaves similarly to gold and silver, but the structure of none of the resulting amalgams has been identified. Palladium is only slightly attacked by mercury. The bearing of these results on electron diffraction examination in general is discussed at some length.—A. R. P.

*An Electron Diffraction Study of the Structure of Electrodeposited Metals. G. I. Finch and C. H. Sun (Trans. Faraday Soc., 1936, 32, (6), 852-863).-Examination of the structure of thin films of various metals deposited on discs of other metals from standard types of plating baths showed that the structure of the substrate nearly always affects that of the deposit so that the orientation of the crystals in the former determines that of the crystals in the latter. In cases where this does not occur the deposits generally are very poorly adherent. When zinc is deposited on polished copper, the first layers appear to enter into solid solution, but this is not the case with a crystalline copper substrate. When the substrate consists of fairly large (50-100 A.) crystals randomly oriented the first thin films of some metals deposited on them are unoriented, but these display their normal characteristics when they become sufficiently thick; generally the effect of the substrate extends to layers up to 1000 A. thick, and is most marked on nickel deposits on gold. Iron as a substrate has no influence on the structure of nickel or copper deposits. Metal films formed by chemical displacement, e.g. platinum by silver or copper, are shown by electron diffraction methods to be alloys .- A. R. P.

*The Röntgenographic Study of Zinc and Cadmium Films Deposited in the Presence of Colloids. L. Palatnik (*Trans. Faraday Soc.*, 1936, 32, (6), 939– 941).—The degree of orientation of the crystals of zinc and cadmium deposits obtained from baths containing colloids depends on the concentration of the latter and on the current density. The effective concentration of the colloid in a plating bath can be determined by comparing the degree of orientation of the deposits obtained from the bath with that of deposits obtained from a bath containing a known amount of freshly added colloid. The brightening effect of colloids in zinc and cadmium plating baths is ascribed to their promotion of the growth of crystals in a single crystallographic direction perpendicular to the surface of the cathode.—A. R. P.

Contribution to the X-Ray Examination of Light Metals. Fritz Regler (*Mitt. tech. Versuchsamtes*, 1935, 25, 20–28).—Laue diagrams of the fracture of light metal alloys give information not only on the grain-size but also on the size and shape of the macroscopic particles of the precipitated phase and on the distribution of porosity. The full beneficial effect of the precipitated phase is exerted only when it is nuch a disperse form that it cannot be detected by the Laue method; 10 photographs of characteristic structures are given and discussed.—A. R. P.

*Al Kβ-Bands from Al-Cu Alloys. Sanae Yoshida (Sci. Papers. Inst. Phys. Chem. Res. Tokyo, 1936, 28, (617), 245-248).--[In English.] The form of the

Al $K\beta$ emission bands was studied, using targets of pure aluminium and of aluminium-copper alloys containing from 5 to 90 wt.-% copper. With pure aluminium the width of the band agrees with that calculated for three free electrons per atom. Application of the theory of Jones (*Met. Abs.*, 1934, 1, 237) suggests that the free electrons in aluminium must overlap from the first Brillouin zone into the second, but in the α -solid solution in copper, and also in the $\gamma'(Cu_{9}Al_{4})$ phase the overlapping into the second zone is small.

-W. H.-R.

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*Lattice Constants and Refractive Indices of Crystals of Bismuth and Antimony. E. Rosa (Nuovo cimento, 1935, 12, (7), 448–454; Sci. Abs., 1936, [A], 39, 9).—The spacings of the (111) planes of bismuth and antimony crystals were measured, using Adinolfi's method. This reduces the errors and simplifies the Bragg method. The mean values (for Cu and Fe K_a and K_β radiations) are 3-957 and 3-754 A. for bismuth and antimony, respectively, as compared with 3-92 and 3-77 found by Ogg using Pd and Rh K-radiations.—S. G.

*The Crystal Structure of CdSb. Arne Ölander (Z. Krist., 1935, 91, (3/4), 243-247).—[In German.] The crystal structure of the compound CdSb is orthorhombic, with a = 8.492 A., b = 8.320 A., c = 6.390 A.; the unit cell contains 16 atoms. The symmetry belongs to one of the following space groups: $V_{h}^{1.5,13}$, $V_{1.2,3,4}^{1.2,3,4}$, or $C_{2\nu}^{1.2,4,7}$. Both powder and rotation photographs were taken, but the positions of the individual atoms cannot yet be determined. —W. H.-R.

*Precision Measurement of the Lattice Constant of Very Pure Niobium. M. C. Neuburger (Z. Krist., 1936, 93, (1/2), 158-159).—[In German.] Very pure niobium was found to have a body-centred cubic structure with $a = 3\cdot2941 \pm 0\cdot0003$ A. at 20° C. The closest interatomic distance is $2\cdot852(7)$ A., and the ideal density is $8\cdot56(9)$.—W. H.-R.

*The Crystal Structure of Gallium. A. J. Bradley (Z. Krist., 1935, 91, (3/4), 302-316).—[In English.] The crystal structure of gallium was re-determined by the powder method, with accurate photometer measurements of the intensities of the lines. The results confirm Laves' orthorhombic structure (*Met. Abs. (J. Inst. Metals*), 1933, 53, 440) except that all three axes are different in length, whereas Laves gave equal values for the *a* and *b* axes. The lattice constants are $a = 4.5167 \pm 0.0001$ A., $b = 4.5107 \pm 0.0001$ A., $c = 7.6448 \pm 0.0002$ A. The space group is V_{λ}^{18} , and the atomic co-ordinates are $(m \ 0 \ p), (m + \frac{1}{2}, \frac{1}{2}, \overline{p}), (\overline{m} + \frac{1}{2}, \frac{1}{2}, p), (\overline{m} \ 0 \ \overline{p}), (m, \frac{1}{2}, p + \frac{1}{2}), m + \frac{1}{2}, 0, \overline{p} + \frac{1}{2}), (\overline{m} + \frac{1}{2}, 0, \overline{p} + \frac{1}{2}), (\overline{m} + \frac{1}{2}, -\overline{p}, \overline{p} + \frac{1}{2}), where <math>m = 0.0785 \pm 0.0005$ and $p = 0.1525 \pm 0.0005$ A.—W. H.-R.

Correction to the Paper "X-Ray Analysis of the Structure of the Homogeneous Phases in the Magnesium-Nickel System." E. Bachmetew (Acta Physicochimica U.R.S.S., 1935, 3, (4), 531).—[In German.] See Met. Abs., 1935, 2, 513. The number of MgNi₂ molecules per elementary cell is only 8 in place of 16 as previously reported.—S. G.

*X-Ray Studies on Heat-Treatment of Nickel-Iron-Aluminium Magnetic Alloys. L. Werestschiagin and G. Kurdjumow (*Tech. Physics U.S.S.R.*, 1935, 2, (5), 431-434; *Sci. Abs.*, 1936, [A], 39, 326).—[In German.] The crystal structure of iron-nickel-aluminium alloys and their alteration with thermal treatment were studied by means of X-rays. A cubic body-centred lattice with a regular atomic arrangement was observed. The alteration in coercivity does not depend on the separation of dispersed particles from the supersaturated solid solutions but is governed by the reactions which occur within the solid solution before the separation of the γ -phase.—S. G.

*Lattice Distortion and Coercive Force in Single Crystals of Nickel-Iron-Aluminium. W. G. Burgers and J. L. Snoek (*Physica*, 1935, 2, (10), 1064– 1074; C. Abs., 1936, 30, 1344).--[In English.] A report on preliminary results obtained in a correlated investigation of the ageing characteristics of alloys of the system nickel-iron-aluminium, wherein a simultaneous study of the ferromagnetic and X-ray diffraction properties is being made. Single crystals 1 mm. square and 10-20 mm. long were made of the alloy nickel 28.3, alu-minium 12.6, iron 59.1%. Three methods of heat-treatment were used : (a) the sample is quenched and reheated to the desired temperature; (b) the sample is quenched to the desired temperature and held there; and (c) the sample is quenched at varying cooling rates. In agreement with Glocker (Arch. Eisenhüttenwesen, 1935, 8, 561), it was found that lines of the y-phase are only visible after cooling rates which are considerably slower than those required to produce the maximum coercive force (590 gauss after cooling from 1200° to 700° C. in 45 seconds) and superlattice lines of the FeAl type were always obtained in almost constant relative intensity. Line-broadening results do not agree with those of Glocker. Marked line-broadening ((310)) CoK_a radiation) occurs wherever the coercive force differs much from zero. When the coercive force has reached its maximum value and is decreasing the usual type of line broadening occurs. Previous to this value, the photometer curves show an increasing blackening of background with no loss in definition of the doublet. The latter type of line broadening is thought to be due to the formation of regions of slightly larger and slightly smaller spacing in the matrix lattice which has not lost its coherence. A number of possible explanations are given, tentatively, for the behaviour of coercive force and line broadening. -S. G.

*On Osmiridium.—III. O. E. Zviaginzew and B. K. Brunowsky (Z. Krist., 1936, 93, (3/4), 229–237).—[In German.] Cf. Met. Abs. (J. Inst. Metals), 1933, 53, 352. Single crystals of osmiridium were examined by the rotation and Laue methods. They show a fibre structure (*Faserstruktur*) in which the orientation of different parts may vary by amounts up to $\pm 10^{\circ}$. The reason for this is to be found in the geological processes during and after the solidification of the naturally occurring metal.—W. H.-R.

*Precision Measurement of the Lattice Constant of Very Pure Tantalum. M. C. Neuburger (Z. Krist., 1936, 93, (3/4), 312-313).—[In German.] Very pure tantalum, free from hydrogen, was found to have a body-centred cubic structure with $a = 3.2959 \pm 0.0003$ A. at 20° C. The smallest interatomic distance is 2.854_4 A., and the ideal density $\rho_x = 16.655$, assuming the atomic weight to be 180.89, or 16.702 if the atomic weight is 181.4.—W. H.-R.

*Precision Measurement of the Lattice Constant of Pure Vanadium. M. C. Neuburger (Z. Krist., 1936, 93, (3/4), 314-315).—[In German.] Very pure vanadium (free from oxygen, hydrogen, and nitrogen) was found to have a body-centred cubic structure with $a = 3.0338 \pm 0.0003$ A. at 25° C. The closest interatomic distance is 2.6274 A.—W. H.-R.

*Lattice Constants of Five Elements Possessing Hexagonal Structure [Zinc, Magnesium, Ruthenium, Osmium, Beryllium]. E. A. Owen, Llewelyn Pickup, and I. O. Roberts (Z. Krist., 1935, 91, (1), 70-76).—[In English.] The following lattice constants were determined by the powder method in a precision camera at 18° C.: zine (99.9%), $a = 2.6591 \pm 0.0005$ A., c = 1.8560; magnesium (99.9%), $a = 3.2020 \pm 0.0005$ A., c = 1.6240; ruthenium (99.9%), $a = 2.6987 \pm 0.0005$ A., c = 1.5785; beryllium (99.8%), $a = 2.2812 \pm 0.0005$ A., c = 1.5785; beryllium (99.8%), $a = 2.2812 \pm 0.0005$ A., c = 1.5585. The values are in fair agreement with those found by other observers except for beryllium, for which Neuburger (Met. Abs. (J. Inst. Metals), 1932, 50, 615) gave a = 2.2680, and axial ratio 1.5847 at 20° C. [Note by Abstractor : It must be emphasized that, in contrast to most papers, c (as given above) is not the second lattice constant, but is the axial ratio, which is usually denoted c/a. The confusion is aggravated by the fact that O., P., and R. give their values of c in A., whereas since c is the axial ratio the values are dimensionless numbers.]—W. H.-R.

*On the Theory of Superlattice Structures in Alloys. William Hume-Rothery and Herbert M. Powell (Z. Krist., 1935, 91, (1), 23-47).--[In English.] Theoretical. Data on superlattice structures are reviewed with special reference to those in iron-aluminium alloys. In any given crystal structure each atom has definite numbers of neighbours at fixed distances. These are called zones of neighbouring atoms, and are numbered outwards so that the elesest neighbours occupy the first zone, the next closest the second zone, and so on. The following hypotheses are suggested : (1) the formation of a normal superlattice takes place so that the solute atoms occupy the highest zone possible relative to one another; (2) when compared with a purely random arrangement, the relativo stability of a superlattice decreases rapidly as its zone number increases; (3) other things being equal the tendency to form a superlattice becomes greater with increasing difference between the atomic diameters of solvent and solute atoms. The underlying idea is that the ideal structure stable at low temperatures is that in which the strain in the lattice is relieved by the solute atoms keeping as far away from one another as possible. This theory is applied in detail to the compositions over which the different superlattice structures are stable in iron-aluminium alloys .- W. H.-R.

Solid Solutions with a Varying Number of Atoms in the Unit Cell. Gunnar Hägg (Z. Krist., 1935, 91, (2), 114–122).—[In English.] Refers almost exclusively to salts, but some points are of great general interest. H. discusses the formation of solid solutions by addition or subtraction of one kind of atom to or from a lattice. The interstitial solid solution of carbon in γ -iron is an example of a solid solution formed by addition. The solid solution in FeS containing more sulphur than required by the formula FeS is not, however, produced by the addition of sulphur atoms to the FeS lattice, but by the falling out or subtraction of iron atoms, so that there are vacant spaces in the lattice. —W. H.-R.

Condition of Electrons in Crystal Lattices. F. Hund (Z. tech. Physik, 1935, 16, (11), 494–497).—Cf. Met. Abs., this vol., p. 119. An approximate calculation is given of the position of the energy bands in some simple crystal lattices. —J. S. G. T.

Lattice Constants for the Year 1936 [1935]. M. C. Neuburger (Z. Krist., 1936, 93, (1/2), 1-36).—[In German.] The title of this paper is misleading, since the lattice constants included are those determined up to the end of 1935. Tables are given showing the crystal structures of the elements with lattice constants, interatomic distances, atomic volumes, and related constants together with the purity of the samples used. The interatomic distances given for α -manganese appear to be incorrect, and reference should be made to the original paper of Bradley and Thewlis (*Proc. Roy. Soc.*, 1927, [A], 115, 456). The reader is advised to refer to the previous tables of this type for definitions of "Volumen pro Atom," "Atomraum," and "Atomvolumen," since these are casily confused (Neuburger, Z. Krist., 1931, 80, 103; 1933, 86, 395).—W. H.-R.

The Application of Plane Groups to the Interpretation of Weissenberg Photographs. M. J. Buerger (Z. Krist., 1935, 91, (3/4), 255-289).—[In English.] —W. H.-R.

[†]Study of Metallic Crystals. E. Schmid (Congres internat. Mines Met. Geol., Section de Métallurgie, -1935, 1, 207-217).—[In French.] See Met. Abs., this vol., p. 77.—S. G.

The Structure of Plastically Deformed Crystals According to Laue Patterns. —I. A. P. Komar (*Physikal. Z. Sowjetunion*, 1936, 9, (5), 413–432).—[In English.] K. reviews briefly and critically the various conceptions of the structure of plastically deformed crystals as based on experimental data obtained by the Laue method. A graphical analytical method for calculating Laue patterns of plastically deformed crystals is proposed. Experimental are compared with calculated results.—S. G. Ideal and Real Crystals. Discussion. — (Z. Krist., 1936, 93, (3/4), 161– 228).—[In English or German.] The papers read at the conference on ideal and real crystals (*ibid.*, 1934, 89, 193) have already been abstracted (*Met. Abs.*, 1935, 2, 225–226, 289–201, 344). In the present discussion, A. Goetz, W. Kleber, H. E. Buckley, D. Balarew, E. Orowan, M. J. Buerger, A. H. Jay, A. Smekal, L. Royer, G. Kalb, M. Straumanis, and P. Niggli criticize each other's papers, and reply to the criticisms. The contributions are essentially argument and counter-argument, and are unsuitable for abstracting, but reference may be made to discussion on the structure and properties of bismuth (pp. 167–173), and a modification of the dislocation theory of G. I. Taylor (pp. 188–191).

-W. H.-R.

Guide for Crystal Drawing. Wallace M. McNabb and Josephine McNabb (J. Franklin Inst., 1936, 221, (4), 539-546).—A guide, for student use, is presented for the drawing of a crystal using the gnomonic projection.—S. G.

IV.—CORROSION

(Continued from pp. 203-206.)

*Additions of Inhibitors to Solutions which Corrode Aluminium. Hans Röhrig (Congres internat. Mines Met. Géol., Section de Metallurgie, 1935, 1, 201-204).--[In French.] See Met. Abs., this vol., pp. 8 and 78.-S. G.

*Bimetallic Corrosion Promoted by Copper-Aluminium Contacts. P. Mabb (Metallurgia, 1936, 14, (80), 29-31).—A number of locking-nuts, of Duralumin, some anodized and some untreated, were submitted to the salt-spray test for 16 days, half of the specimens being in close contact with brass studs. The untreated specimens gradually corroded during the first few days of the test, while the anodized specimens were entirely unaffected at the end of the 16 days' period. In the cases of the nuts in contact with brass studs, the untreated nuts were exceptionally heavily corroded around areas of contact within 3 days; the anodized nuts blackened at the junction in 1 day, and were heavily corroded there in 5 days.—J. W. D.

Sheath Corrosion at Bond Straps Prevented. Edgar F. Wolf (*Elect. World*, 1936, 106, (9), 597-598, 645).—Sheath failures from electrolytic corrosion have been observed when copper bonding strips have been run parallel to a lead-covered cable before soldering, and have been in contact with a cement fire-proofing mixture which was applied over the sheath. To prevent electrolysis, the bonding strip should be brought out at right angles to the cable, and as a further measure an insulating coating of hot asphalt and muslin should be applied.—J. C. C.

The Dependence of the Corrosion Velocity of Copper on the Thermal and Mechanical Pretreatment of the Copper. — du Bois (Oberflächentechnik, 1933, 10, 235; C. Abs., 1934, 28, 731).—Preliminary results show that the corrosion of copper is influenced by the arrangement of the crystallites, but there is a difference between refined and electrolytic copper, and also between hard and soft electrolytic copper. X-ray tests revealed that soft annealed material has an orientated crystallite arrangement; hard material has an unorientated arrangement. Electrolytic copper showed less resistance to sulphuric acid than refined copper. Rolling produces differences in the crystallite arrangement and therefore different corrosion-resistance. It is proposed to use as a definition of the intensity of an attack by acid on a material not the % loss in weight, but the time required to corrode away 1 mm. thickness from the surface of the material by the corroding agent, and also to state previous thermal and mechanical treatment of the material.—S. G.

*Corrosive Action of Sulphur Against Metallic Copper During Vulcanization. Shozo Satake (*Rubber Chem. Tech.*, 1936, 9, 301–310).—See Met. Abs., this vol., p. 9.—S. G. Report of the Copper Pipe Committee. See p. 280.

*Microscopic Study of Ancient Bronze and Copper [Corrosion of Ancient Bronze and Copper]. (Fink and Polushkin.) See p. 251.

*Comparative Tests on the Attack on Hard Lead Tubes by Tap-Water. Erich Naumann (Gas- u. Wasserfach, 1936, 79, (14), 214-216).—Hard lead pipes with up to 1.5% antimony behave similarly to ordinary soft lead pipes in tap-water during the early stages of corrosion, but in water with a high content of carbon dioxide they cannot be used. In oxygenated waters the quantity of lead dissolved increases with decreasing carbonate hardness and with increasing content of free earbonic acid. Antimony cannot be detected in the water.

-B. Bl.

External Factors Leading to Corrosion of the Positive Grids of the Foré-Type Lead Battery Plates Under Conditions of Formation. A. B. Shakhkeldian (*Trans. Saratov Univ.*, 1934, 11, (2), 59–76; *C. Abs.*, 1936, 30, 3728).—Corrosion is reduced, and better contact of the paste with the lead grid is ensured, when the surface of the grid is covered with a layer of lead sulphate; this may be achieved by treating the grids separately, or by applying sulphuric acid containing neutral sulphates together with the paste. Other factors affecting corrosion of the grids (composition of the paste, temperature, & c., are discussed).—S. G.

*The Border Effect in the Solution of Metallic Magnesium in Aqueous Solutions of Organic Acids. Ya. V. Durdin and A. M. Markevich (Zhurnal Obstchei Khimii (J. General Chem.), 1935, 5, 1690-1695; C. Abs., 1936, 30, 3302).--[In Russian.] When a piece of magnesium in contact with an insoluble solid such as paraffin is placed in aqueous HCO₂H, AcOH, EtCO₂H, or PrCO₂H, the rate of solution of the magnesium in the acid is much greater at the 3-phase boundary magnesium-paraffin-acid than at other points on the magnesium piece. This " border effect " was not observed with hydrochloric acid or ammonium chloride solutions, or with the organic acids if the metal was covered with a film of iso-BuOH. The localized increase in rate of reaction depended directly on an increase in the rate of diffusion of the acid solution with respect to the metal surface. The active acid was adsorbed on the surface of the paraffin. The effect was intensified by the stirring action of the hydrogen evolved. When the whole body of aqueous acid was stirred mechanically the effect was obscured. The absence of the border effect with hydrochloric acid and ammonium chloride and in the presence of iso-BuOH is attributed to the absence of any differential local diffusion rate. The reservation is made that the observed phenomenon may not be due entirely to a difference in the diffusion rate.-S. G.

*On the Influence of Impurities in Mixtures of Ammonia and Air on the Corrosion of Platinum Gauze. I. E. Adadurov and P. D. Didenko (Zhurnal Prikladnoi Khimii (J. Applied Chem.), 1935, [B], 8, (5), 823-832).—[In Russian, with German summary.] The effect of additions of hydrogen, water vapour, oxygen, earbon monoxide, carbon dioxide, and nitrogen oxides to ammoniaair reaction mixtures on the surfaces of platinum-gauze catalysts was investigated, the corrosion of the surfaces being examined photomicrographically. It is concluded that the fundamental cause of the destruction of platinum gauzes is the change in structure of the surface. Hydrogen penetrates into the crystalline space-lattice of the metals, forming compounds which are easily sublimed. Addition, therefore, of hydrogen to the reaction mixture in order to increase the rate, as recommended by some investigators, causes increased corrosion of the gauze. Water vapour causes rapid disintegration of the gauze, and oxygen does likewise. Carbon monoxide increases the reaction temperature, and with it corrosion, while earbon dioxide and nitrogen oxides decrease it somewhat.—M. Z.

*Influence of Internal Diffusion on the Chemical Stability of Binary Solid Solutions. V. V. Skortcheletti (Soobshenia Zentralnogo Instituta Metallow (Communic. Central Inst. Metals), 1936, (17), 185–194).—[In Russian.] Corrosion tests on alloys of lead with up to 30 atomic-% mercury in 20% acetic acid at 20°, 13°, and 0° C. showed Tammann reaction limits at 0° C. due to restricted atomic diffusion in the solid solution at this temperature. At 20° and 13° C. no such limits occur owing to the active internal diffusion which removes the protective surface layer of noble metal.—N. A.

*Chemical Resistance of Two-Phase Alloys. V. V. Skortcheletti (Soobshenia Zentralnogo Instituta Metallow (Communic. Central Inst. Metals), 1936, (17), 195-208).—[In Russian.] The corrosion of chill-cast and of annealed leadbismuth and zine-cadmium alloys in 20% acetic acid $0\cdot 1N$ -sulphuric acid, and 5% sodium hydroxide solution follows one of three possible courses: (1) the potential set up between the constituents of the alloy is sufficient to cause prolonged galvanic action, (2) polarization rapidly occurs, (3) a passive film is formed on one of the components. Alloys of cutectic composition do not occupy a prominent position on the composition-corrosion rate curve. Nonhomogeneity in normally resistant alloys does not necessarily indicate a low resistance to corrosion.—N. A.

Hot-Water Corrosion and Its Prevention. L. W. Haase (Vom Wasser; Ein Jahrbuch für Wasserchemie u. Wasserreinigungstechnik, 1934, 8, 111-123; J. Amer. Water Works Assoc., 1935, 27, 1096).—Water in hot-water systems for domestic use is heated to from 50° to 85° C. and corrosion problems differ from those in boiler plant. Corrosion is promoted by electrochemical activity causing solution of metal, and is accelerated by unsuitable material, incorrect construction of plant, and wrong method of operation. The behaviour of iron, galvanized iron, copper, tinned pipes, and pipes with other protective coatings, in hot-water conditions, is exhaustively dealt with. Methods of operation, with illustrations of suggested plant, are given, and methods for deoxygenation of water, mechanically and chemically by sulphite addition, are described. —S. G.

*The Corrosion of Metals by Oil. P. J. Haringhuizen (Chem. Weekblad, 1936, 33, (22), 351-352).—Read before the Dutch Chemical Society. The corrosion of thin films of metal in oil is investigated by an optical method previously described by H. and D. A. Was (Proc. K. Akad. Wet. Amsterdam, 1936, 39, 201).—L. A. O.

Soil Corrosion Report. H. W. Clark (J. New England Water Works Assoc., 1935, 49, (1), 110-112; J. Amer. Water Works Assoc., 1935, 27, 158).— Discusses the data published in Bur. Stand. Research Paper No. 329 (see J. Inst. Metals, 1928, 40, 551) and No. 638.—S. G.

Some Corrosion Phenomena in Mechanically Stressed Metals. C. A. Lobry do Bruyn (*Chem. Weekblad*; 1936, 33, (22), 340-344).—Read before the Dutch Chemical Society. Corrosion is defined and the electrochemical theory and the effect of tension and deformation on corrosion are discussed. Season-cracking is described, with examples and illustrations, and the penetration of molten metals into strained metals, and the relation of corrosion to the wear of metals are discussed.—L. A. O.

Allotropy and Corrosion. Ernst Cohen (*De Ingenieur*, 1935, 50, Mk, 13–22; *C. Abs.*, 1936, 30, 3763).—Recent work on the allotropy of tin (*Met. Abs.*, 1935, 2, 415) is discussed. Experiments showing the influence of nuclei on the rate of transformation of white to grey tin at -50° C. were made by rolling, drawing, or bending tin wires at 15° and at -80° C., respectively. The crystal defects caused by the mechanical working act as crystallization nuclei for the transition and cause a more rapid conversion of the wires deformed at temperatures below the transition temperature of $13 \cdot 2^{\circ}$ C. The more intensive the deformation the more rapidly the conversion takes place. The same crystal defects also affect corrosion-resistance, and the latter can be improved by application of principles of allotropy.—S. G.

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Fundamentals of the Electrochemical Theory of Corrosion. A. H. W. Aten and H. W. Deinum (*Chem. Weekblad*, 1936, 33, (22), 331–337).—Read before the Dutch Chemical Society. A review of the electrochemical theory of corrosion. The factors which should be considered are the molarpotentials of the reactions involved in corrosion, the influence of concentration on the electrode potentials, and the velocity of the reactions. The latter factor can be taken into account by making use of the current-potential curves for the anodic process of the dissolution of metals, and for the cathodic process of oxygen reduction or evolution of hydrogen. This method is illustrated by application to the behaviour of iron and of copper in an aerated solution of potassium chloride.—L. A. O.

Relative Value of Accelerated Corrosion and Outdoor Exposure Tests [of Plated Coatings]. William Blum (Monthly Rev. Amer. Electroplaters' Soc., 1936, 23, (5), 8-13; discussion, 13-16).—A brief discussion of the value of the salt-spray test as an accelerated method of determining the relative merits of plated coatings as a protection from corrosion of steel.—A. R. P.

V.—PROTECTION

(Continued from pp. 206-208.)

*Oxide Films on Aluminium and Its Alloys; Their Production and Properties. A. G. C. Gwyer and N. D. Pullen (*Congrès internat. Mines Met. Geol., Section de Métallurgie*, 1935, 1, 243–252).—[In French.] See *Met. Abs.*, this vol., p. 80. —S. G.

Effective Corrosion Protection by Eloxal Films on Cupriferous Aluminium Alloys. Alexander Jenny (*Aluminium*, 1936, 18, (3), 97–99).—Duralumin treated by the Eloxal process withstands the salt-spray test considerably better than the untreated alloy, and a high degree of immunity from corrosion is afforded by subsequently impregnating the Eloxal film with wax or other sealing material.—A. R. P.

On the Use of Eloxal in Construction. K. Holzwarth (Werkstatt u. Betrieb, 1936, 69, (5/6), 69-71).—A discussion of the advantages and limitations of structural elements treated by the Eloxal process.—P. M. C. R.

†Some Problems of Technical Electrometallurgy. IV.—Anodic Treatment of Aluminium. (Masing.) See p. 264.

*The Structure of the Electrolytical Oxide Layer on Aluminium. (Verwey.) See p. 251.

Electrolytic Conduction of a Solid Insulator at High Fields. The Formation of the Anodic Oxide Film on Aluminium. (Verwey.) See p. 251.

*Investigation of Aluminium Oxides by Means of Electron Interference. (Belwe.) Sco p. 251.

*On the Action of Soda Solution Containing Sodium Silicate on Light Metals after Various Treatments. H. Bohner (Aluminium, 1936, 18, (3), 102-103).— Immersion of rolled sheet aluminium or Pantalin boiling 10% sodium carbonate solution containing 0-1% of sodium silicate results in the formation of a protective film almost immediately, provided that the metal has previously been dipped in hydrochloric acid for 2 minutes, or in hot caustic soda solution, or has been scrubbed with steel wool. After sand-blasting or pickling for longer than 2 minutes in hydrochloric acid, the protective film takes a very long time to form in the sodium carbonate solution.—A. R. P.

Aluminium Armour for Electric Cables. J. Bally (*Rev. Aluminium*, 1936, 13, (80), 159–163).—Describes the use and advantages of aluminium ribbon for protecting electric cables; the advantages over steel wire are: (1) lightness; (2) better corrosion resistance; (3) increased transport capacity; (4) higher current intensity can be carried in cases of short-circuiting; (5) aluminium

armour will act as a fuse at 650° C. in the case of very intense currents; (6) by interposing a thin ribbon of aluminium between the insulator and the armour, a hermetically sealed envelope is obtained in case of fire; (7) owing to its being non-magnetic, loss by Foucault currents is avoided in the case of aluminium; (8) owing to its higher conductivity, it is more effective in cutting down parasitic currents.—J. H. W.

*Copper Wire Tinning. Ch. Bernhoeft (*Draht Welt*, 1936, 29, (15), 231–233).—A detailed account is given of work the results of which have already been published (*Met. Abs.*, this vol., p. 10).—A. R. P.

Some Practical Aspects of Galvanizer Dross at High Temperatures. —— (Iron Steel Canada, 1936, 19, (1), 11–12).—In the hot-dip galvanizing process compounds of iron and zinc form dross. The compound formed at about 430° C. is rhombohedral, whilst that produced at 480° C. is hexagonal pyramid. The latter has a higher melting point, and a cycle of over-heating may be set up in an effort to maintain fluidity, since higher pot temperature increases the rate of iron pick-up. The remedy lies in dilution of the bath and lower temperatures. Correct bath temperature and galvanizing conditions are indicated by the rhomohedral form of dross crystal.—J. E. N.

Electro-Galvanizing of Round Wire. Arnold Weisselberg (*Iron Age*, 1936, 137, (21), 34–37, 106).—The history of wire-galvanizing is briefly reviewed, and the physical properties of wire before and after electro-galvanizing are tabulated. The technique of eleaning the wire and the practical operations of electro-galvanizing, the appearance of the finished wire, and the cost of the process are described. The operation advantages are that there are no zine losses, no losses during shut down, the plant can be started up and shut down quickly, the thickness of coating can be accurately controlled, and the operation of the plant is clean and not unhealthy. The quality advantages are that the physical properties of the wire are unaffected, the coating of pure zine is highly duetile and adherent, the coating surface is smooth, and defects of the wire are revealed.—J. H. W.

*Metallic Cementation. IX.-Cementation of Some Metals [Iron, Nickel, and Copper] by Means of Beryllium Powder. Tsutomu Kase (Kinzoku no Kenkyu (J. Study Metals), 1936, 13, (5), 173-188).-[In Japanese.] The cementation of iron, nickel, and copper by powdered beryllium was investigated between 600° and 1100° C. The surface layers were studied by hardness tests, measurements of depth of penetration, microscopic examination, and chemical analysis. Experiments were also carried out on corrosion in acids and oxidation at high temperatures. Beryllium diffuses into these three metals above 600° C., the rate of diffusion increasing with increase in temperature; the rate of diffusion into iron, however, increases more or less abruptly at the A_3 point (906° C.). The relation between increase in weight of the specimen (ΔW) or the depth of penetration (P) and the absolute temperature of cementation (T) or the time required for the treatment (0) is given by an exponential function ΔW (or P) = $ae^{-b/T}$, or ΔW (or P) = $ae^{b\theta}$, where a and b are constants variable in each ease. The hardness of the cemented surfaces is remarkably greater than that of the original materials, and some of them have a sturdy resistance to atmospheric oxidation and attack by certain fused salts at high temperatures. Iron surfaces cemented with beryllium are not easily attacked by concentrated nitric acid, but, in general, the surfaces of the metals cemented with beryllium have little advantages as regards resistance to corrosion by strong acids.—S. G.

*Corrosion-Protective Value of Electrodeposited Zinc and Cadmium Coatings. W. Blum, P. W. C. Strausser, and A. Brenner (*Met. Ind. (Lond.)*, 1936, 48, (21), 591-594; (22), 615-618; (23), 639-643).—Reproduced from J. Res. Nat. Bur. Stand., 1936, 16, (2), 185-212. See Met. Abs., this vol., p. 122.—J. E. N. The Development and Application of Metal Spraying. The Molten Metal

Process. A. E. Phipps (Met. Ind. (Lond.), 1936, 48, (20), 553-558).—The

development of the process since its introduction by Schoop in 1909 is described. The process is limited to the low melting point metals, tin, lead, zinc, cadmium, and aluminium; its applications are discussed, including experimental work on the spraying of bearing metals.—J. E. N.

Metallizing to Prevent Corrosion and Overcome Rust. C. J. Pott (Eng. Contract Record, 1934, 48, 277-278).—Discusses the process and summarizes its applications.—S. G.

Chlorinated Rubber as a Protective Paint for Aluminium. Guido Schultze (Aluminium, 1936, 18, (3), 107–111); and (summary) Light Metals Research, 1936, 4, (24), 451–452.—Chlorinated rubber is an effective protection against corrosion for pure aluminium, Hydronalium, and Elektron, and is more effective than resins and varnishes under strongly corrosive conditions, such as those in the chemical industry.—A. R. P.

To Make Paint Stick to Cadmium-Plated Steel. George A. Endern (*Indust. Finishing* (U.S.A.), 1936, 12, (5), 22–24).—Washing in 2% acetic acid immediately after plating is recommended to remove adherent films of various salts which cause the paint to flake.—A. R. P.

Coal-Resin Paint and Its Application in the Chemical Industries. Association of the Resin with Aluminium Powder. F. Delarozière (*Rev. prod. chim.*, 1935, 38, 710-711, 741-743; *C. Abs.*, 1936, 30, 4021).—Incorporation of aluminium powder with coal-resin paint yields a product which is remarkably resistant to atmospheric and chemical corrosion, and is recommended for a great variety of uses. The painted surface offers a bright metallic appearance. It has a high reflective power with low emissivity. A recommended mixture contains aluminium powder 12.5, resin varnish 62.5, and diluent 25%.—S. G.

Corrosion Studies [Protection of Metals Near Sewage]. James A. Meacham (Munic. Sanit., 1936, 7, 15–17; C. Abs., 1936, 30, 3558).—Bituminous enamel applied in two coats was found to be the only paint which resisted corrosion of metal surfaces near raw sewage.—S. G.

*Object and Significance of Ground Paints. J. van Loon (*Chem. Weekblad*, 1936, 33, (22), 345–351).—Read before the Dutch Chemical Society. Describes tests carried out on behalf of the Dutch Corrosion Committee on several iron and lead-base pigments, to evaluate their protective qualities. Iron test-pieces covered with the materials were exposed on the roof of the laboratory in Delft. The paints were also tested for permeability to water, swelling (% water absorbed by the paint films when immersed) and for wear by 2 methods: (a) in a specially constructed apparatus; and (b) by a sand test. Results are given in a table and permeability to water is shown by curves.—L. A. O.

VI.—ELECTRODEPOSITION

(Continued from pp. 208-210.)

*Iron in Chromium Plating Baths and Its Removal. E. Raub (Mitt. Forschungsinst. Edelmetalle, 1936, 10, (1), 1–7).—Troubles due to iron begin to appear when about 5% of iron, based on the chromic acid content, has accumulated in the bath, but not until more than 10% of iron is present are they so serious that the bath must be scrapped or purified. Deposits obtained from iron-rich baths consist of iron-chromium alloys and have a matt grey colour which cannot be buffed to a satisfactory finish. The purification of a bath contaminated with iron is very difficult and, unless large volumes of solution are available, is not worth the trouble and cost; it is far better to avoid contamination by taking care that no iron parts come into contact with the solution and that iron articles to be plated are immersed in the bath with the current already switched on.—A. R. P.

Important Factors Governing Cyanide Plating [of Copper]. Jacob Hay (Monthly Rev. Amer. Electroplaters' Soc., 1936, 23, (4), 31-37).—Some experiments on the throwing power of, and method of racking numerous small articles in, a copper cyanide bath are recorded. The original must be consulted for details of the results which do not lend themselves to abstracting.—A. R. P.

*On the Electrodeposition of Binary Alloys [Brass]. V. A. Sukhodskiy, V. L. Heyfez, and J. N. Chapurskiy (Soobshenia Zentralnogo Instituta Metallow (Communic. Central Inst. Metals), 1934, (17), 209–216).—[In Russian.] The cathode and anode potentials in the tartaric acid brass plating bath were measured at various concentrations and current densities. The difference between the deposition potentials of the copper and zine decreases with decrease in current density and with dilution, potential equalization occurring mainly at the expense of the copper potential.—N. A.

Gold and Silver Plating of Large Metal Surfaces. U. V. Baimakov (Metallurg (Metallurgist), 1936, (2), 3-8).—[In Russian.] The methods used in gold and silver plating the Soviet emblems on the towers of the Kremlin (total surface area about 100 m.², with individual sections of 3×2 m.) are described in detail.—N. A.

*On [Lead-]Plating. V. A. Sukhodskiy, V. L. Heyfez, and J. V. Wainer (Soobshenia Zentralnogo Instituta Metallow (Communic. Central Inst. Metals), 1936, (18), 231-239).—[In Russian.] In lead cresolsulphonate solutions the cathode polarization is determined by the presence of active tars introduced with the acid. Up to a definite concentration of lead ions, evolution of hydrogen occurs and a spongy deposit is formed at high current densities; with increase in current density a greater concentration of lead is necessary for smooth deposits. Cresol- and phenolsulphonate baths give good microcrystalline deposits with 100% current efficiency.—N. A.

Protection of Aluminium by Nickel. Giacomo Bionda (*Chimica*, 1935, 11, (6/7), 237-239; *C. Abs.*, 1936, 30, 3331).—The main difficulty in the nickelplating of aluminium is to obtain satisfactory adherence of the nickel to the aluminium. This has been solved by two methods: (1) a French process, in which the article is cleaned with organic solvents, washed in a soda solution and then in pure water and immersed in a nearly boiling solution containing 3.5% of ferric chloride solution ($d \ 1.42$) and 2.5% of 22 Bé hydrochloric acid; this covers the aluminium with a very adherent film of iron, and nickel-plating can then easily be effected electrolytically with baths containing nickel sulphate or chloride and another salt such as ammonium or magnesium sulphate. (2) an American process, in which the article is treated with hydrofluoric acid and/or nitric acid, washed and nickel-plated in the usual manner. The best results are obtained by (1).—S. G.

 \dagger^*A Critical Study of Bright Nickel. Lawrence E. Stout (Monthly Rev. Amer. Electroplaters' Soc., 1936, 23, (5), 25–29; and Met. Ind. (Lond.), 1936, 48, (26), 722–723).—The merits of various "brighteners" in a commercial nickelplating bath were critically investigated; the bath contained nickel sulphate 12, nickel chloride 4, and borie acid 2 oz./U.S. gall. Glucose (1.5–2 oz./gall.) produced a marked improvement in the brightness of the deposits; malic acid produced a brilliant shiny soft deposit at low current densities, but tended to form a black slime on the cathode with slight variation in the plating conditions, and lactic acid tended to produce yellow deposits of poor lustre. None of the numerous patented brighteners tested gave an absolutely perfect plate and were highly intolerant of variations in operating conditions.—A. R. P.

The Progress of Nickel in the Course of the Past Ten Years. John F. Thompson (Congrès internat. Mines Mét. Géol., Section de Métallurgie, 1935, 1, 91-99).—[In French.] Sec Met. Abs., this vol., p. 82.—S. G.

*Electroplating with the Alloy Iron-Nickel. D. Stepanow, F. Marshak, and E. Beliakov (Zhurnal Obstchei Khimii (J. General Chem.), 1935, [A], 5, (1), 30-33).—[In Russian.] Cf. Met. Abs., 1935, 2, 516, 626. A mixture of ferrous and nickel sulphates, with small quantities of ammonium sulphate, nickel chloride, and glue, was used as electrolyte, the anodes being strips of iron and nickel, and the cathode an etched strip of thin tinplate. The deposits are uniform, microcrystalline, adhere firmly, and are, in small thicknesses, elastic. During prolonged electrolysis, solutions low in nickel give an increasing nickel content in the deposits, and vice versa.—M. Z.

*On Electroplating of Metals [Tin]. V. L. Heyfez and J. V. Wainer (Soobshenia Zentralnogo Instituta Metallow (Communic. Central Inst. Metals), 1934, (16), 165–180).—[In Russian.] The cyanide, oxalate, and sulphate-sulphonate tin-plating baths were examined. In the cyanide and oxalate baths the anodes slowly become passive with a corresponding change in the composition of the bath; the sulphate bath is free from these defects and has a good throwing power, as shown by the cathode and anode potential curves and the electrical conductivity.—N. A.

[†]Zinc Plating. Oliver Sizelove (Monthly Rev. Amer. Electroplaters' Soc., 1936, 23, (5), 17–24).—Good bright deposits of zine can be obtained from an acid solution containing zine sulphate 50, aluminium sulphate 3, ammonium chloride 2, sodium acetate 2, and corn syrup 0.5 oz./U.S. gall. operated at $p_{\rm II}$ 4–4.5 with 15–25 amp./ft.², or from an alkaline bath containing zine cyanide 8, sodium cyanide 5, sodium hydroxide 10, and mercuric eyanide 0.25 oz./U.S. gall. operated with pure zine anodes at 25° C. with 10–20 amp./ft.². In using the alkaline bath the plated work is rinsed thoroughly then dipped for a few seconds in 0.5% nitric acid, again washed, and finally dipped in a 1.5% cyanide solution, rinsed in hot water, and dried. The behaviour and operation of various proprietary baths is also described.—A. R. P.

*Cathodic Current Distribution in Galvanic Electrolytes. I.-Investigation of Zinc Baths. E. Mantzell (Z. Elektrochem., 1936, 42, (6), 303-315).-The current distribution in six fundamental types of zine bath under practical conditions was determined, namely, acid zine sulphate-ammonium sulphate; acid zinc chloride-ammonium chloride; boric acid; neutral zinc chloridepyridine; alkaline zinc bath; and cyanide-alkali bath. In general, increasing the electrode interval to obtain uniform metal distribution is only of value when edge scattering is completely prevented, otherwise exactly the reverse occurs. There is a close reciprocal effect between polarization and bath conductivity. At the slight risk of affecting the polarization to some extent, an improvement of the current distribution can only be obtained by increasing the conductivity, either by the addition of conductivity salts or by increasing the temperature. The effect of the conductivity salt on the polarization is very small. The current distribution deteriorates with increasing current density in all baths, but an improvement is effected by reducing the zinc ion concentration, if the conductivity is kept constant. Such electrolytes are only of use if suitable precautions are taken to prevent sponginess. The effect of the acidity and of the addition of organic or inorganic reagents on the polarization and therefore on the current distribution is very small. Cyanide baths produce the best current distribution, that of alkali zine baths being relatively poor, because the cathode potential in the alkali zinc solutions alters very little with the current density. In acid baths, the metal distribution is almost identical in form with the current distribution, because the current efficiency approaches 100% over the whole cathode surface. With the other baths, the metal distribution is more or less evened, to the greatest extent in the cyanide baths. The structure of the metal undercoat has an appreciable effect on the distribution.

-J. H. W.

Electro-Galvanizing of Round Wire. (Weisselberg.) See p. 260.

New Zinc Coating Process Developed by Graselli Chemical Co. —— (Amer. Metal Market, 1936, 43, (99), 3).—A brief note. The zinc is deposited in a brilliant, dense, and ductile form. The process operates at room temperature, high current efficiencies, and high or low current densities, with a bright plating range from 15 to 100 amp./ft.².—L. A. O.

*Corrosion-Protective Value of Electrodeposited Zinc and Cadmium Coatings. (Blum, Strausser, and Brenner.) See p. 260.

*The Röntgenographic Study of Zinc and Cadmium Films Deposited in the Presence of Colloids. (Palatnik.) See p. 252.

The Mechanism of Electroplating. Hiram S. Lukens (Monthly Rev. Amer. Electroplaters' Soc., 1936, 23, (5), 30-40; discussion, 40-44).—Recent work of L. on the distribution of current in a plating bath is described in an educational lecture.—A. R. P.

*The Application of Mesle's Chord Method in the Measurement of the Thickness of Electrodeposits. W. Blum and A. Brenner (Monthly Rev. Amer. Electroplaters' Soc., 1936, 23, (4), 14–20).—An account is given of the results of work more fully reported in J. Res. Nat. Bur. Stand., 1936, 16, (2), 171–184. See Met. Abs., this vol., p. 125.—A. R. P.

Measuring the Thickness of Metal Coatings. F. C. Mcsle (Met. Ind. (Lond.), 1936, 48, (19), 544).—Abstract from J. Res. Nat. Bur. Stand., 1936, 16, (2), 171–184. See Met. Abs., this vol., p. 125.—J. E. N.

Relative Value of Accelerated Corrosion and Outdoor Exposure Tests [of Plated Coatings]. (Blum.) See p. 259.

Some Peculiarities in the Formation of Metallic [Electro-]Deposits. Jean Billiter (Congrès internat. Mines Mét. Géol., Section de Métallurgie, 1935, 1, 101-104).—[In French.] See Met. Abs., this vol., p. 84.—S. G.

*An Electron Diffraction Study of the Structure of Electrodeposited Metals. (Finch and Sun.) See p. 252.

Metal Rectifiers for Electroplating. —— (*Elect. Rev.*, 1936, 118, (3038), 242).—Metal rectifiers, made from copper strips oxidized on both sides, and provided with forced-air cooling, with outputs up to 12,000 amp. at 5 v., are available as a source of current for electroplating.—J. C. C.

[†]Some Problems of Technical Electrometallurgy. III.—Galvanotechnics. (Masing.) See abstract below.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition.)

(Continued from p. 210.)

[†]Some Problems in Technical Electrometallurgy. II.—Hydro-Electrometallurgy. III.—Galvanotechnics. IV.—Anodic Treatment of Aluminium. G. Masing (Z. Elektrochem., 1936, 42, (6), 325-327).—Discusses some of the difficulties encountered in the electrolytic extraction and purification of zinc, in electrodeposition, and in the Eloxal process of anodic oxidation of aluminium, and the means of overcoming them.—J. H. W.

Electrolytic Manufacture of Boron and Its Alloys. L. Andrieux (Congrés internat. Mines Mét. Géol., Section de Métallurgie, 1935, 1, 69–75; and J. Four élect., 1936, 45, (2), 55).—[In French.] See Met. Abs., this vol., p. 84.—S. G.

*The Mechanism of Electrolytic Processes. I.—The Anodic Oxidation of Some Metals of the Platinum Group. J. A. V. Butler and G. Drever (*Trans. Faraday Soc.*, 1936, 32, (2), 427–435).—On anodic polarization of palladium, rhodium, and iridium electrodes in acid or alkaline solutions an adsorbed layer of oxygen is formed on the metal surface prior to the establishment of the oxygen overvoltage as is the case with platinum. With the two first-named metals a second stage in the oxidation is observed with the slow formation of peroxide films which are reduced cathodically at a more positive potential than the absorbed oxygen. With rhodium the peroxide layer is a monomolecular film, but with palladium it is several molecules thick. A possible explanation of the formation of these layers is suggested.—A. R. P. Anodes for Oxidation Reactions. V. Čupr (*Chem. Listy*, 1936, 30, (2), 27-29; (3), 43-46; *C. Abs.*, 1936, 30, 3727).—Č. presents a detailed review of the construction and composition of anodes at whose surfaces oxidation occurs during the passage of an electric current; particular attention is devoted to a series of oxidations which take place at electrodes of iron, copper, cuprie oxide, Fe_3O_4 , platinum, and carbon.—S. G.

*Electro-Capillary Phenomena in Molten Salts. S. Karpatschoff and A. Stromberg (Z. physikal. Chem., 1936, [A], 176, (3), 182–186).—The electrocapillary eurves for tin, lead, cadmium, and thallium in molten alkali halide baths were determined; the original must be consulted for details of the results and methods used. The capacity of the electrolytic double layer of tin at the equilibrium potential in the electrolytes used was 90–100 μ F./cm.².—B. Bl.

VIII.—REFINING

(Continued from p. 210.)

Refining of Primary Aluminium in Melting and Casting. I. E. Gorshkov (Metallurg (Metallurgist), 1936, (1), 82–95).—[In Russian.] The main impurity which distinguishes raw from refined aluminium is sodium. Inclusions of electrolyte, alumina, carbides, nitrides, &c., appear only under abnormal conditions of electrolysis and melting. The presence of sodium in aluminium can be detected by (a) treatment of the metal with water containing phenolphthalein, (b) fusion of the bottom of the ingot and weighing of the resultant oxide film (this gives an indication of the purity of the aluminium), (c) measurement of the shrinkage of an ingot. The metal may be refined by remelting in furnaces with an inclined hearth.—N. A.

*Bismuth in Copper: Its Effects, Determination, and Some Experiments in Its Gaseous Elimination. C. O. Bannister and W. M. Doyle (*Trans. Inst. Min. Met. Eng.*, 1935, 44, 163–196; discussion, 196–226).—See *Met. Abs.*, 1935, 2, 106.—S. G.

IX.—ANALYSIS

(Continued from pp. 211-213.)

Quantitative Spectral Analysis Under Changeable Discharge Conditions. V. Naedler (Compt. rend. acad. sci. U.R.S.S., 1935, [N.S.], 4, (1/2), 23-26; C. Abs., 1936, 30, 3351).—[In German.] Considerable difficulty is encountered in spectroscopic analysis owing to the lack of constancy of the electric discharge. Such difficulty can be overcome by establishing empirically a curve showing the effects of such variation. The method is described and illustrated in the determination of small amounts of Pt and Rh in Ag.—S. G.

*The Quantitative Spectrum Analysis of Traces. W. Seith and A. Keil (Z. Elektrochem., 1936, 42, (6), 299–302).—In order to establish the amount of an impurity in a metal, a characteristic line of the impurity is compared with a suitable adjacent line of the metal. To render visible the faint line of the impurity, overexposure is often necessary, the metal line being then very heavy. It also frequently happens, for instance, in the case of light metals, particularly magnesium, that there is no suitable line due to the metal near to the impurity line. In this case, the comparison is made indirectly, known traces of another metal (or metals) being introduced into the metal, and the additional lines so obtained being used for comparison with those of the metal and the impurity.

The technique of this method is described and illustrated.—J. H. W. Detecting the Cobalt in the Presence of Other Cations. R. W. Woronizow (Zhurnal Prikladnoi Khimii (J. Applied Chem., 1935, [B], 8, (3), 555–556).— [In Russian, with German summary.] The solution to be examined is treated with HCl, decanted, and solid NH_4CNS added in slight excess of saturation. Crystals of $SnCl_2$ are then added, until reduction is complete. A mixture of amyl alcohol and acetone is then added, and the mixture well shaken : a blue coloration of the supernatant alcohol layer indicates Co.—M. Z.

*Fractional Detection of Potassium. H. N. Potchinok (Zhurnal Prikladnoi Khimii (J. Applied Chem.), 1935, [B], 8, (3), 524–527).—[In Russian, with German summary.] A new method of detecting K in the presence of all other cations, except Rb and Cs, is based on Na₃Co(NO₂)₆ together with HCHO and alkali (to remove the effect of NH₄OH). Up to 0.6 mg. of K in a dilution of 1/5000 can be detected.—M. Z.

The Analysis of Aluminium in the Presence of High-Chromium and Other Associated Alloys. A Short Process. A. McMurphy (Aluminium and Non-Ferrous Rev., 1936, 1, (7), 285-286).—To determine Al in magnet steels and heat-resisting materials, the sample is dissolved in HCl and, after oxidizing with HNO₃, the solution is added from a dropping funnel to boiling NaOH. The volume is made up to 500 c.c., 250 c.c. filtered off, and Al precipitated as phosphate.—J. C. C.

*Bismuth in Copper: Its Effects, Determination, and Some Experiments in Its Gaseous Elimination. (Bannister and Doyle.) See p. 265. *The Potentiometric Determination of Cobalt and Manganese with Potassium

*The Potentiometric Determination of Cobalt and Manganese with Potassium Ferricyanide in Steel and Alloys. Peter Dickens and Gerd Maassen (Arch. Eisenhuttenwesen, 1935–1936, 9, (10), 487–498).—See Mct. Abs., this vol., p. 166.—A. R. P.

*The Determination of Tin in Alloys with Antimony and Lead (Antimony Less Than 2 Per Cent.). H. F. Hourigan (Analyst, 1936, 61, (722), 328–333).— The method depends on the dissolution of the sample in HCl in a current of O_2 -free CO₂ and titration of the resulting SnCl₂ with KIO₃. If much Sb is present the alloy is dissolved in HCl and KClO₃ and the solution reduced with Al in a CO₂ atmosphere before titration. An apparatus is described in which the reduction or dissolution of the sample can be carried out, and by means of which the antimony residue may be filtered off before the solution is titrated, all the operations being done in CO₂ free from O₂.—A. R. P.

*Gravimetric Estimation of Vanadium with Ammonium Benzoate. F. M. Schemjakin and W. F. Tschapygin (Zhurnal Prikladnoi Khimii (J. Applied Chem.), 1935, [B], 8, (3), 536-542).—[In Russian, with German summary.] The method is based on reduction of V to tetravalent and its precipitation in the form of vanadyl benzoate, and subsequent weighing as V_2O_5 . V may be precipitated in acid solution from its ores and alloys in the presence of Mg, Al, Cu, Mo, W, and Ti, but Fe and Cr must be removed first. The method is stated to be somewhat quicker, simpler, and cheaper than that of Rose and Roscoe.—M. Z.

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

(Continued from p. 213.)

The Use of Ball-Bearings in the Construction of Microscopes. M. Wielding (J. Roy. Microscop. Soc., 1936, [III], 56, (1), 31-38).—Ball bearings in microscope construction enable heavy bodies, even when loaded eccentrically by such fittings as illuminators, to respond accurately to the micrometer movement without any fear of seizing. Examples are described of their use in fine adjustments and rotating and mechanical stages in Leitz instruments.—J. C. C.

X-Ray Interference Employing Contact Between the Source of Radiation and the Crystal. H. Scemann (Z. tech. Physik, 1935, 16, (11), 443–447).—A method of X-ray crystal analysis, mounting the crystal very close to the source of X-rays, e.g. an anti-cathode window, is described. The method presents advantages in the investigation of mosaic structures.—J. S. G. T.

Description of a New Laue Camera and the Accompanying Reflection Net (Reflexnetz). Erich Schmid (Z. Krist., 1935, 91, (1), 95–96).—[In German.] A Laue camera for the determination of the orientation of metallic crystals is described. The film is in a plane parallel to the primary beam, and with flat metal crystals the primary beam strikes the flat surface of the specimen at 45° C. Under these conditions the time of exposure is much less than in the usual arrangements.—W. H.-R.

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

(Continued from pp. 213-214.)

Mechanical Tests for Engineering Materials. A. M. Roberts (Assoc. Eng. Ship. Draughtsmen, 1935–1936, 89 pp.).—A comprehensive review of mechanical tests includes the tensile test, bend test, hardness, impact, transverse, and fatigue tests as well as high-temperature tests and tests on welds. The types of testing machine used in each case are described in brief detail, dimensions of test-specimens are given, and also various test data. Test procedure and the position of test-pieces are also considered with special reference to steels.—J. W. D.

Miniature Machines for Photographically Recording Mechanical Tests on Metals. P. Chevenard (Bull. Assoc. Tech. Fond., 1935, 9, (9), 308-311).— Abstract from Bull. Soc. d'Encour. Ind. Nat., 1935, 134, 59-73; see Met. Abs., 1935, 2, 392.—J. E. N.

Testing of Soft Solders. H. Hanemann (Z. Metallkunde, 1936, 28, (3), 68– 69).—A mechanical soldering machine is described by the aid of which it is possible to produce soldered joints in sheet metals under standardized reproducible conditions, especially as regards temperature, time of soldering, and solder consumed. A series of tests of solders and soldering conditions on brass, zine, galvanized iron, and tinplate is planned to determine the best solders and working conditions and the strength of the resulting joints. The tests contemplated include the following: (1) two strips are soldered together with an overlap of 5 mm., and the shear strength of the joint determined in the tensile machine; (2) torsion tests are made on butt-soldered rods prepared with a standard pressure during soldering; (3) the hot strength of joints is determined by hanging a 1 kg. weight on the lower of two strips of metal soldered together and observing the temperature at which the strips part; (4) corrosion tests are made in distilled water, tap-water, artificial sea-water, 10% tartaric acid solution, and 10% citric acid solution.—A. B. P.

10% tartaric acid solution, and 10% citric acid solution.—A. R. P.
Working Stresses. C. Richard Soderberg (J. Applied Mechanics, 1935, 2, (3), A106-108).—See Met. Abs., 1935, 2, 438.—S. G.

On the Dilatometric Method of Analyzing Materials. J. F. Afonskiy (Soobshenia Zentralnogo Instituta Metallow (Communic. Central Inst. Metals), 1935, (18), 186-201).—[In Russian.] Describes Chevenard's apparatus and a graphic method for calculating the differential curve for determining the true coeff. of expansion of metals.—N. A.

An Apparatus for Determining the Commencement of Permanent Set in Material Used for Flat Springs [Fatigue Testing]. E. V. Walker and K. L. Beak (J. Sci. Instruments, 1936, 13, (3), 96).—A note. A machine is described for determining whether material used for flat relay springs will take up a permanent set on being deflected as a cantilever for many millions of operations at stresses below the elastic limit of the material. The springs are deflected by means of revolving cams with arrangements for counting in multiples of 5000 deflections. The instrument can be stopped at any multiple of 5000 deflections when any permanent set is measured microscopically.—W. H.-R.

*Accelerated Method for the Determination of the Creep Limit at Various Temperatures. Max Schmidt and Helmut Krainer (*Mitt. tech. Versuchsamtes*, 1935, 24, 5-20).—Rohn's accelerated ercep test is described, and the results obtained by its use on a number of steels are analyzed mathematically. Since the logarithm of the rate of ercep is a linear function of the reciprocal of the absolute temperature, the ercep limit of a metal at any temperature may be calculated from the rate of ercep determined in a test extending over 30-48 hrs. —A. R. P.

Experience of Methods Adopted for the Systematic Long-Term Testing of Creep. P. B. Mihailov-Miheev and G. M. Denisov (Metallurg (Metallurgist), 1936, (3), 47-60).—[In Russian.] The methods and apparatus employed at the Leningrad Metal Works are described.—N. A.

*Slow-Bend and Impact Tests of Notched-Bars at Low Temperatures. H. F. Moore, H. B. Wishart, and S. W. Lyon (*Amer. Soc. Test. Mat. Preprint*, 1936, 6 pp.)—Results are given of slow-bend and impact tests of various metals (steels, cold-drawn 60:40 brass, cold-drawn copper, Duralumin 17 ST) at temperatures from room temperature to -40° F. The correlation between results from slow-bend and from impact tests over this range of temperature does not differ greatly from that found by Petrenko (*J. Inst. Metals*, 1925, 34, 547) for room temperatures. The autographic slow bend testing machine which was used is described. In a flexure test of a notched-bar specimen the friction of striking edge along the specimen seems to be rather a source of error, especially for specimens of metal so ductile that after the test they are not broken clean in two. Tension tests of notched specimens, both impact and slow-pull tests, are suggested as worthy of experimental study.—S. G.

*Similarity Between the Stress-Strain Diagrams Obtained from Impact Tensile and Torsional Tests. Mititosi Itihara (*Tech. Rep. Tôhoku Imp. Univ.*, 1936, 12, (1), 105–118).—[In English.] The static tensile and torsion diagrams for mild steel and brass are similar within 5–7% according to Ludwik's $R_{-\gamma}$ curve. A similar analogy within the same limits is observed between the impact tensile and torsion diagrams obtained at the same specific sliding speed.

-A. R. P.

General Review of Tests for Determining the Characteristics of Aluminium Castings. A. von Zeerleder (Congrès internat. Mines, Mét. Géol., Section de Métallurgie, 1935, 1, 229–234; and Rev. Mét., 1936, 33, (1), 1–6).—[In French.] See Met. Abs., this vol., pp. 17 and 168.—S. G.

*Variations of the Rigidity Modulus with Changes in Applied Stress. Gladys M. Francis (*Physics*, 1936, 7, (4), 160–162).—An attempt to determine by an interferometer method whether or not any variations occur in the modulus of rigidity similar to those which occurred in the Young's modulus in D. K. Froman's experiment (*J. Inst. Metals*, 1930, 43, 574). Any variations of more than 0.1 of a fringe could be detected readily. No such variations occurred.

-S. G.

*On the Determination of Elastic Limit in Impression Tests as an Adjunct to Hardness Measurements. G. Tammann and W. Müller (Z. Metallkunde, 1936, 28, (3), 49-54).—When a cone is impressed into a metal a ridge is formed round the impression beginning at a distance, a_0 , from the axis of the impression and increasing in height to the edge thereof. The stress along the circle of diameter a_0 is thus the elastic limit (E) in the impression test, and since a_0 is proportional to the square root of the load producing the ridge it follows that $E = Q/\pi a_0^2$, where Q is the load producing the impression. The value of a_0 can be determined by making the impression on a polished surface which has been slightly roughened by drawing it one way over coarse emery and then polishing the ridge away by rubbing in the direction perpendicular to the first with a fine emery paper; the diameter of the resulting circle round the impression is then equal to $2a_0$. Mathematical methods of calculating a_0 from the height of the ridge and the depth of impression are also given. For aluminium, copper, and electrolytic iron, *E* increases with the degree of rolling rapidly up to 10% reduction, then more slowly, the values for the annealed metals being 5, 6, and 14 kg./mm.²; after 10% reduction 8-5, 25, and 35 kg./mm.², and after 40% reduction 10, 30, and 41 kg./mm.², respectively.—A. R. P.

*On the Minimum Principles of Theory of Elasticity. Theodor Pöschl (Bauingenieur, 1936, 17, (17/18), 160-164).—Mathematical.—B. Bl.

A Simple Method for the Determination of Magnetization-Coercive Force. C. W. Davis and Max Hartenheim (*Rev. Sci. Instruments*, 1936, [N.S.], 7, (3), 147-149).—S. G.

RADIOLOGY.

Photography and Chemical Engineering Research. Walter Clark (Trans. Amer. Inst. Chem. Eng., 1934–1935, 31, 60–81; discussion, 81–82).—Recent developments in gamma radiology and in high-power magnification and photography as applied to steel examination are described inter alia.—A. R. P.

What X-Rays Can Do for Industry. Victor Hicks (*Physics*, 1936, 7, (3), 79-84).—X-ray radiography is industrially useful in the physical inspection of welded, cast, or assembled products. X-ray diffraction analysis contributes to the understanding of the details of the processes of manufacture and treatment of alloys and other materials. Both applications have led to the control and improvement of industrial processes and products.—S. G.

Use of X-Rays in Casting Control. K. V. Peredelskiy (Aviopromishlenost (Aircraft Ind.), 1936, (2), 32-35).—[In Russian.] A review.—N. A.

[Radiology in] Autogenous Welding. R. Schmidt (Usine, 1936, 45, (12), 29; C. Abs., 1936, 30, 3765).—The radio-metallography of welds and the application of X-rays for their examination is explained. A radiogram of a piece 20 mm. thick can be obtained with 100,000 v., of one 80 mm. thick with 200,000 v., and of one 140 mm. thick with 400,000 v.; the time of exposure is less than 1 minute. The limitations of the method in recognizing defects are discussed.—S. G.

*X-Ray Investigation of Fine Structure, and Its Value in the Practical Testing of Materials. A. Karsten (*Feuerungstechnik*, 1936, 24, (5), 78-80).—The use of X-ray analysis for the investigation of special steels and refractory materials is briefly referred to. A small X-ray apparatus suitable for the purpose is described and illustrated.—J. S. G. T.

Progress in Design of Shock-Proof X-Ray Tubes for Therapy and Industrial . Röntgenography. M. J. Gross (Amer. J. Roentgenology, 1935, 34, 518-522).

-S. G.

XII.—TEMPERATURE MEASUREMENT AND CONTROL

(Continued from p. 170.)

On a New Combined Colour Pyrometer with Comparative Lamp. Gerhard Naeser (Arch. Eisenhüttenwesen, 1935, 9, 483-485; and Mitt. K.-W. Inst. Eisenforschung, 1936, 18, (2), 21-25).—All the usual types of optical pyrometers yield uncertain results since the actual black body value of most industrial hot bodies is not known with accuracy. N. describes, with reference to diagrams and photographs, a new colour-brightness pyrometer which gives readings with an accuracy of $\pm 10^{\circ}$ for all hot bodies which are not selective radiators.—A. R. P.

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An Automatic Potentiometer for Thermal Analysis. R. J. M. Payne (J. Sci. Instruments, 1936, 13, (5), 158-161).—The thermal curve potentiometer previously described (*Met. Abs.*, this vol., p. 16) has now been made completely automatic by incorporating a photoelectric cell which operates suitable relays each time the spot of light from the galvanometer reaches the zero mark.

-W. H.-R.

*On the Construction of Platinum Thermometers and the Determination of Their Basic Points. W. H. Keesom and B. G. Dammers (*Physica*, 1935, 2, (10), 1051–1058).—[In English.] Full report of an investigation previously reported in summary (see *Met. Abs.*, this vol., p. 87).—S. G.

*Comparison of Some Platinum Thermometers with the Helium Thermometer Between 0 and — 183° C. W. H. Keesom and B. G. Dammers (*Physica*, 1935, 2, (10), 1080–1090).—[In English.] Full report of an investigation previously reported in summary (see *Met. Abs.*, this vol., p. 87).—S. G.

*Determination of Fixed Points in the Low Temperature with a Hydrogen Thermometer. Shin'ichi Aoyama and Eizô Kanda (Bull. Chem. Soc. Japan, 1935, 10, (10), 472–481).—[In English.] A constant volume hydrogen gas thermometer is described; its accuracy as a low-temperature standard was investigated. The accuracy is $\pm 0.036^{\circ}$ at 0° C. and $\pm 0.025^{\circ}$ at -200° C. The boiling points of liquid nitrogen and liquid oxygen and the sublimation point of solid carbon dioxide were determined with this instrument. It was also used for the calibration of a copper-Constantan thermocouple over the range 0° to -200° C.—S. G.

*Researches on Torsion-Pointer Thermometers. W. Grundmann (Z. Instrumentenkunde, 1936, 56, (1), 26-31; Sci. Abs., 1936, [A], 39, 171).—Thermometers composed of bimetallic strips in the form of an Archimedean spiral, in which the temperature is indicated by a pointer moving round a dial, have been described (*ibid.*, 1935, 55, 173-174). G. now describes further investigations into the performance of this type of instrument. Possible improvements are suggested, and it is concluded that a thermometer of this type can be developed into a useful instrument.—S. G.

Portable Pointer Galvanometer and Multi-Range Millivolt-Ammeter. ---- (J. Sci. Instruments, 1936, 13, (3), 100-101).—A note. A portable multirange millivolt-ammeter is described briefly. The voltage ranges give fullscale deflection for 12 and 120 mv., and 1.2 and 12 v.—W. H.-R.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 214-216.)

Developments in the Foundry Industry During Recent Years. J. E. Hurst (*Metallurgia*, 1936, 14, (80), 37–38).—Developments in the foundry during recent years are briefly reviewed, and include the production of castings of a greater degree of mechanical and metallurgical precision, a better knowledge of moulding sands and their influence on the quality of the final casting, mechanization and improvements in foundry plant, and the introduction of better and more efficient furnaces for all types of metals and alloys. Brief reference is also made to complex brasses and bronzes, nickel alloys, aluminium and magnesium light alloys, and the potential use of metals such as beryllium and lithium in the production of new alloys.—J. W. D.

Deoxidation and Degasification of Non-Ferrous Casting Alloys. I.—Deoxidation and Degasification of Nickel Silver Alloys. R. J. Keeley (Trans. Amer. Found. Assoc., 1935, 43, 251-255; discussion, 255-261; and Met. Ind. (Lond.), 1936, 48, (8), 232-233).—The successful production of nickel Silver castings, while difficult, may be satisfactorily accomplished by proper attention to detail. The two most common types of defect are porosity and tendency for dross inclusions; these can usually be attributed to faulty melting practice. K. cites instances of foundry difficulties and explains what was done to correct them. Sufficiently high pouring temperatures, proper deoxidation, and correct feeding are essential. Manganese and magnesium are recommended as deoxidizers when more than 3% lead is present, and silicon with less than 3%lead. Aluminium is undesirable in pressure castings, and silicon, magnesium, or aluminium is objectionable in rolling-mill alloys. In the discussion T. E.*Kihlgren* favours the restricted use of silicon. *Sam Tour*, on the effect of silicon on the contraction of the alloy, insisted that this is due to the degassing effect and not to the influence of silicon *per se*. The effect of sulphur in the fuel was discussed by several speakers and is being further investigated.—J. E. N.

Deoxidation and Degasification of Non-Ferrous Casting Alloys. II.-The "Modifying " Phenomenon and Its Probable Relation to Non-Ferrous Alloys. C. H. Lorig and R. W. Dayton (Trans. Amer. Found. Assoc., 1935, 43, 262-268; discussion, 269-273; also Met. Ind. (Lond.), 1936, 48, (9), 278-280; and (summary) Light Metals Rev., 1936, 2, (20), 347-348).—It is suggested that the "slag-cloud" hypothesis developed to explain graphite formation in cast iron may be applied to non-ferrous alloys. The authors review the work of various investigators in both the ferrous and non-ferrous fields and explain how the theories mentioned might be applied to non-ferrous cast alloys to explain why such alloys which are sound, reasonably free from contaminating metallic elements, and of good manufacture sometimes possess irregular if not totally dissimilar properties. The influence of nuclei on undercooling and speed of crystallization, the effect of superheating on dissolving or coalescing the nuclei, or varying their effectiveness, are discussed, and the theory is advanced that it may be possible to control the nuclei and their distribution, modifying the properties of many cast alloys when the conditions affecting each system have been individually investigated. In the discussion it is pointed out that, apart from their behaviour as nuclei for crystallization, small foreign particles may inhibit grain-growth .-- J. E. N.

On the Manufacture of Aluminium Pistons for Internal Combustion Engines. Keijo Works of the Railway Board, Chosen (Imono (J. Casting Inst. Japan), 1936, 8, (3), 145–149).—[In Japanese.] Although formerly aluminium-alloy pistons for internal combustion engines were purchased, as a result of research these are now manufactured at the Keijo Works at only one-sixth of the previous cost. Details are given of the composition of the alloy, melting operation, moulds, method of casting, and heat-treatment.—S. G.

Certain Peculiarities in the Manufacture of Aluminium Pistons. B. J. Ginzburg (*Izvestia NATI* (Bull. Inst. Auto-Tractor Ind.), 1935, (2), 45–48).— [In Russian.] Review, based on data from American motor-works.—N. A.

Casting Technique of a Condenser Cover. Naval Technical Department (Imono (J. Casting Inst. Japan), 1936, 8, (3), 141-144).—[In Japanese.] For a bronze casting, a condenser cover is one of considerable size. A standard practice has been established, based on many years of experience and research. The paper deals with patterns, moulds, sands, and melting and casting operations according to the specifications for standard practice.—S. G.

Judging the Temperature of Molten Bronze by Observation with the Naked Eye. Tsuncjiro Suwa (*Imono (J. Casting Inst. Japan)*, 1936, 8, (3), 165–167).—[In Japanese.] With training fairly accurate estimations may be made of the temperature of molten bronze by the naked eye. S. measured the temperatures of molten bronzes at various stages and prepared a standard for the estimation of temperature by means of the naked eye.—S. G.

Recommended Procedure for Analysis of Defects in Brass and Bronze Sand-Castings. Non-Ferrous Division Committee (Trans. Amer. Found. Assoc., 1935, 43, 247-250).—Possible defects are listed under 18 headings, with a

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brief description of each. To establish the connection between cause and effect, the various operations in the manufacture of castings where troubles may arise are divided under 9 main headings. This is intended to serve as an outline of the problem and the proposed method of attack; later work will be directed to defining the difficulties and prescribing remedies.—J. E. N.

50 Rules for the Treatment of Graphite Melting Crucibles in the Foundry. Edmund Richard Thews (*Giesserei-Praxis*, 1936, 57, (21/22), 230-231).—Conclusion of the article. See *Met. Abs.*, this vol., p. 215.—J. H. W.

The Drying of Moulding Sands in the Open Air. Troubles which may Arise from this Cause. M. Girault (*Rev. Fonderie moderne*, 1936, (Jan. 1), 4–5).— Skin defects appearing on certain castings were not avoided by applying the usual remedial measures. An investigation showed the cause to be surface drying, by exposure to sunshine and air currents, of green-sand moulds in which some time elapsed between moulding and casting. The local decrease in humidity reduced the bond and strength below that required to prevent erosion of the mould by the incoming metal.—J. E. N.

Die-Casting : Present Position. Paul Bastien (Congrès internat. Mines Mét. Géol. Section de Métallurgie, 1935, 1, 287–298; also Rev. Mét., 1936, 33, (1), 43–54; and (summary) Light Metals Rev., 1936, 2, (19), 329–330).—[In French.] See Met. Abs., 1935, 2, 718.—S. G.

Pressure-Casting of Light Alloys. K. V. Peredelskiy (Aviopromishlenost (Aircraft Ind.), 1936, (1), 20–25).—[In Russian.] Review.—N. A. Pressure Die-Castings in Brass. Herbert Chase (Iron Age, 1936, 137, (19),

Pressure Die-Castings in Brass. Herbert Chase (*Iron Age*, 1936, 137, (19), 40-41, 103-105).—Reviews the present production possibilities of pressure diecastings, involving light-colour alloys having basic metal other than aluminium and zinc. Such alloys are Doler brass containing about 1% silicon, Brastil containing about 5% silicon, and a white nickel-brass containing nickel 5 and manganese 12%.—J. H. W.

Pressure Casting of Magnesium Alloys of the Elektron Type. K. V. Peredelskiy (*Liteinoe Delo (Foundry Practice*), 1936, (1), 29-36).—[In Russian.] The following points in the pressure casting of magnesium alloys are discussed : suitable plant, selection of alloys and fluxes and their preparation, nature of rejects, solidity of castings, and their X-ray and metallographic examination. —N. A.

Die-Casting. Herbert Chase (Machinist (Eur. Edn.), 1936, 80, (19), 364-366E).—Describes the plant and operations of a large American die-casting works producing about 230,000 lb. of zinc alloy per day, and the subsequent treatment of the castings.—J. H. W.

Alloys for Pressure Casting. G. Delcroisette (*Rev. Fonderie moderne*, 1936, (Jan 1), 6–7).—In view of the increasing number of die-casting alloys which are being marketed attention is directed to the need for standardizing and reducing these to the minimum. Tentative specifications have been prepared in Germany for lead-, tin-, and zinc-base, and light aluminium- and magnesium-base alloys, to cover limits of chemical composition, mechanical properties, and tolerances, and these are reproduced. It is recommended that the same specifications be generally adopted.—J. E. N.

Die- and Pressure-Casting. Rudolf Schmitt (Anz. Masch., 1935, 57, (51), 42-44).—Alloys used in the processes are briefly discussed.—B. Bl.

Die-Casting Alloys. — (Machine moderne, 1936, 30, (128), 218-221).— An account of some of the principal die-casting alloys with a tabulated summary of the chemical analysis, melting-points, and mechanical properties of 25 alloys; the source of proprietary materials is indicated in several cases.

-P. M. C. R.

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

(Continued from pp. 123-129.)

The Importance of Secondary Metals. Elmer W. Pehrson (Amer. Metal Market, 1936, 43, (55), 5, 6; (57), 5).—Chiefly statistical.—A. R. P.

Utilizing Zinc and Lead Clippings, &c. C. Č. Downie (*Machinist (Eur. Edn.*), 1936, 80, (16), 263E).—The zinc and lead waste is placed in an open-hearth furnace fired with coke, and a higher temperature than that required to melt the metals is maintained. The two metals ignite, and the white fume is collected in cotton bags by suction fans. The scrap must be free from iron. The bag product is mixed with oil and passed through hydro-extractors in the usual manner for the production of white paint.—J. H. W.

XV.—FURNACES AND FUELS

(Continued from pp. 216-217.)

Heat Transfer in Continuous Reheating Furnaces. J. E. Eberhardt and H. C. Hottel (*Heat-Treat. and Forging*, 1936, 22, (3), 144–149).—The design and construction of new furnaces has in general been on the basis of known performance of previous similar installations, although predictions of performance based on knowledge of the mechanism of heat transmission in furnaces have been of some assistance. The factors determining the rate of heat transmission in continuous reheating furnaces are considered quantitatively: data on 6 furnaces operating under widely varying conditions are analyzed, and an equation is developed which fits the data and lends itself readily to use in design calculations.—J. E. N.

The Inductive Heating of Process Equipment. Robert C. Center (*Trans. Amer. Inst. Chem. Eng.*, 1934–1935, 31, 44–57; 'discussion, 57–59).—Applications of high- and medium-frequency inductive heating for vessels for carrying out chemical reactions, &c., are briefly discussed.—A. R. P.

New Developments in the Brass and Copper Industry. W. Wirt Young, Jr. (Gas Age-Record, 1936, 77, (17), 433–434, 438).—The use of towns' gas for melting brass in crucible furnaces, for preheating furnace linings, tube extrusion, bright-annealing of copper and brass, and tinning is briefly referred to.

—J. S. G. T.

Two-Stage Combustion of Natural Gas for Volume Loads. George M. Parker (Gas Age-Record, 1936, 77, (21), 563-566, 576).—The conversion of natural gas of calorific value about 1000 B.Th.U./ft.³ into a fuel-gas having substantially the same properties as producer gas, and its two-stage combustion in furnaces are briefly discussed.—J. S. G. T.

Coal and Coke : Occurrence, Testing, and Utilization. A. C. Fieldner and W. A. Selvig (Amer. Soc. Test. Mat. Symposium on Indust. Fuels, 1936, Jan., 1-28). Industrial Fuel Oils. H. V. Hume (*ibid.*, 29-45). Manufactured Gas. P. T. Dashiell and F. H. Trembly, Jr. (*ibid.*, 46-60). Liquefied Petroleum Gas. —— (*ibid.*, 61-70).—A series of four papers reviewing the availability of raw materials, the possibility of new processes, the tests applied to fuels and their significance, the utilization of the various fuels, and the general economic aspects of the products and their utilization.—J. W. D.

XVI.—REFRACTORIES AND FURNACE MATERIALS

(Continued from pp. 172-174.)

[†]New Developments and Trends in Refractories. Processes and Materials. Louis J. Trostel (*Trans. Amer. Inst. Chem. Eng.*, 1934–1935, **31**, 473–492; discussion, 492–493; and (summary) *Chem. and Met. Eng.*, 1935, **42**, (7), 363-367).—Recent advances in the mixing, pressing, and burning of refractory bricks are critically reviewed, and an account is given of the development, manufacture, and properties of new refractory materials based on crystalline aluminium silicates and spinels. The applications of the newer refractories to electric furnaces, cement kilns, and glass melting tanks are discussed and an indication given of the trend of future developments in the refractory industry. —A. R. P.

Recent Developments in Refractories. Christopher E. Moore (J. B'ham. Met. Soc., 1936, 16, (1), 16-29; discussion, 29-39).—See Met. Abs., this vol., p. 92.—S. G.

Modern Furnace Applications of Refractories and Insulations. J. L. Spence and J. W. Craig (*Iron Steel Canada*, 1936, **19**, (1), 3-9).—A general review of materials used in the construction of furnaces to resist the action of atmosphere and slag at high temperatures. The properties and applications of the common refractories and insulation are tabulated. The processes used in the manufacture of several types of refractory bricks are briefly described.—J. E. N.

Secondary Expansion of Flint Fireclays. J. O. Everhart (Eng. Exper. Sta. News, Ohio State Univ., 1936, 8, (2), 9–10).—The majority of flint fireclays possess abnormal shrinkage and expansion properties between 1200° and 1400° C.: an examination of 21 clays indicated a directional weakness in the larger clay grains, and it is suggested that adequate grinding of the raw material should eliminate or reduce the abnormal expansion.—P. M. C. R.

The Beneficiation of Ohio Fireclays. Myril C. Shaw (Eng. Exper. Sta. News, Ohio State Univ., 1936, 8, (2), 10-12).—A study of the refinement of the crude Laurentian clays by the film flotation method.—P. M. C. R.

XVII.—HEAT-TREATMENT

(Continued from p. 174.)

*Effect of Iron Impurities on the Annealing of High Brass. W. A. Gibson and J. H. Doss (Amer. Soc. Test. Mat. Preprint, 1936, 6 pp.).—The effect of 0·008–0·287% iron impurities on the annealing of "high" brass (copper 64·1– 66·4%) was studied for temperatures from 600° to 1200° F. (315°–649° C). Particular attention was devoted to the effect of annealing at 800° –900° F. (426°–482° C.), and iron impurities below 0·10%. The effect of time on the annealing of brass is discussed. It is found that: (1) in high brass, having lead and iron as the only impurities, as much as 0·09% iron is not harmful to annealing; (2) in such material a great discontinuity in annealing properties occurs between 0·09 and 0·118% iron; (3) more than 0·118% iron is not harmful to sheet high brass provided that proper allowance is made in processing and use for its annealing properties, but if these allowances are not made it is very harmful.—S. G.

*Stress-Relief Annealing High-Strength Monel Metal Plate. Peter R. Kosting (Amer. Soc. Test. Mat. Preprint, 1936, 9 pp.).—The effect of temperature of annealing and time at the temperature on the annealing of $\frac{1}{2}$ in. thick high-strength Monel metal plate is discussed. Plates from 4 heats were studied. All plates were hot-rolled but finished at a low temperature except some plates from one heat which were cold-rolled 10%. Extensometers of 0.0002 and 0.00002 in. sensitivity were used to determine yield-strength, 0.00% set. All plates showed a maximum increase in yield, 0.00% set, in the range 550°-600° C. Yield-strengths at higher % set reached maximum values at lower temperatures: the greater the effect of cold-work the lower was the annealing temperature at which maximum values were obtained. The value of the yield-strength, 0.00% set, is appreciably affected by internal strains. It is apparent that this Monel metal plate must be heated to 550°-600° C. to be stress-relieved.—S. G.

XVIII.--Working

XVIII.-WORKING

(Continued from pp. 217-219.)

[†]Photoelectric Cells in Rolling-Mills. K. Johannsen (*Elektrotech. Z.*, 1936, 57, (6), 150–152).—Two examples of the use of photoelectric cells in rollingmills are described: (1) regulation of a cutter to shear sections of definite length from the rolled metal; the radiation of the rolled metal cuts out the switch mechanism by means of a cæsium photo-cell; (2) as a means of testing eold-rolled thin sheets and foils for holes exceeding 0.3 mm. in diameter the light through which affects the cell and yields a current impulse which operates a signalling device.—B. Bl.

Bakelite Bearings [for Rolling Mills]. —— (Engineer, 1936, 161, (4194), 570). Bakelized Bearings. —— (Electrician, 1936, 116, (3028), 790), — The difficulties associated with the usual types of bearings for rolling mills are briefly reviewed. Bearings consisting of cloth bonded in a form of synthetic resin are described and their characteristics are outlined. Instructions for their use are included. By the use of these bearings in certain circumstances, power has been saved to the extent of 30–50% and bearing life increased by as much as 10 times.—R. Gr.

Manufacture of Nichrome Wire. J. S. Ginzburg and A. D. Goldberg (Soobshenia Leningradskogo Instituta Metallow (Communic. Inst. Metals Leningrad), 1936, (15), 70–78).—[In Russian.] Alloys with nickel 60, chromium 15–16, and manganese 2% are better prepared in crucible furnaces than in high-frequency furnaces without vacuum, since the latter method produces alloys with many impurities along grain-edges and therefore difficult to work. The ingots should be cleaned and forged at above 1000° C., preferably at 1200°–1220° C. prior to hot-rolling at 1150° C.—N. A.

Hot-Pressed [Extruded] Light Metal Parts. —— Reichenbach (Aluminium, 1936, 78, (3), 100–102).— Machines and methods for the extrusion of aluminium alloy parts are described, and the mechanical properties of the products obtained from several alloys are tabulated.—A. R. P.

Hot-Pressing [Extruding] of Light Metals into Dies. — Brunnkow (Anz. Masch., 1935, 57, (51), 38–40).—The properties of brass, aluminium, and magnesium alloy die-extruded articles are compared with one another.—B. Bl.

A New Lead Extruding Machine. R. E. Horley (G.E.C. Journal, 1936, 7, (2), 120–126; and Met. Ind. (Lond.), 1936, 48, (21), 577–581, 595).—A description of a new type of extrusion press designed to eliminate troubles due to pinholes, oxide inclusions, and weak seams. The article is illustrated with photomicrographs showing these various defects which are difficult to avoid with the older types of extrusion machines.—S. V. W.

Metallurgical Aspects of Deep-Drawing. III.—Desirable Qualities in Deep-Drawing Materials : Their Nature and Specification. J. D. Jevons (Met. Ind. (Lond.), 1936, 48, (20), 563-566 ; (22), 607-610, 619).—See also Met. Abs., this vol., pp. 175, 218. Apart from the undesirable negative properties already enumerated, the desirable positive properties are : (1) high ductility with high tenacity ; (2) smooth surface before and after drawing, and (3) very small variation in thickness. The effect on (1) of impurities and variation in composition is important. The benefit of uniform grain-size on both (1) and (2) is very marked. The selection of microsections and the interpretation of the observations are discussed at length, special attention being paid to directionality and orientation of "apparent greatest width" of crystals. No physical test has yet been devised which can form the basis of a specification now in use, J. concludes that, whilst most of these may reveal radically unsuitable metal, they are not sufficiently delicate to serve as reliable acceptance tests to indicate the behaviour of the metal in actual drawing operations, and suggests that correct microscopical observation coupled with Erichsen and tear length tests are at present the most valuable criteria. The closest collaboration between supplier and user is essential to establish mutually satisfactory specifications.—J. E. N.

The Use of Rubber and Wood in the Forming of Aeroplane Parts. C. O. Herb (Machine moderne, 1936, 30, (128), 181–186). The Use of Rubber and Wood as Die Materials. — (Machinery (Lond.), 1936, 48, (1238), 405–409).— See Met. Abs., this vol., p. 175.—P. M. C. R.

Production of a Seamless Brass Ring. B. Radford (*Machinist (Eur. Edn.*), 1936, 80, (16), 256–275E).—Describes the operation lay-out, tool design, and operations for the production of seamless brass rings of "difficult" design. —J. H. W.

Economical Working with Hard Metal Tools. W. Fleischhauer (Anz. Masch., 1935, 57, (51), 45-46, 59-64).—Detailed examples are given of the type of hard metal tool most satisfactory for different jobs.—B. Bl.

Metal Turning for Instrument Makers. A. S. Newman and R. S. Clay (J. Sci. Instruments, 1936, 13, (4), 109-114).—A general description of lathe work and the choice of tools.—W. H.-R.

XIX.—CLEANING AND FINISHING

(Continued from p. 219.)

Pickling of Non-Ferrous Metals. Otto Vogel (Anz. Masch., 1935, 57, (51), 74–76).—Pickling solutions are recommended for aluminium and its alloys, aluminium-bronze, lead, Britannia metal, copper and its alloys, nickel, Monel metal, zinc, and tin.—B. Bl.

Inhibitors: a Physicochemical Interpretation of Their Action. E. Jimino and I. Grifoll (Anales soc. españ, fís. quím., 1935, 33, (328), 947-951; C. Abs., 1936, 30, 3378).—An attempt is made to explain the inhibiting action of moderators in pickling. At the start this action may be due to adsorption phenomena. Its intensity effect is connected with the operation of local cells which probably cause the actual pickling. This explains why the inhibitor should preferably be retained with greater consistency in the cathodic regions. If the latter are covered by inhibitor there will be an increase in current density. This, or other physical effects inherent with local cells, causes a large hydrogen overvoltage, which prevents evolution of hydrogen. Therefore, acid is not spent uselessly. There is no obstacle to discharge of the necessary hydrogen ions, so that atomic hydrogen may reduce the higher oxides and thus cause pickling. In addition to electrochemical action, the inhibitor reduces the surface tension of the liquid, to assist which some substances may be added. Aqueous soap causes an analogous effect. The speed of hydrogen evolution is thus reduced only by mechanical means .--- S. G.

The Polishing of Metals. E. J. Dobbs (J. B'ham. Met. Soc., 1936, 16, (2), 46-53; discussion, 53-64).—See Met. Abs., this vol., p. 131.—S. G.

Coating Polishing Wheels with Abrasive. W. E. Warner (*Machinist* (*Eur. Edn.*), 1936, 80, (17), 275E).—Water used for soaking a mixing glue should have been distilled. Old and fresh glue should never be mixed. Old wheels should be preheated to 120° F. (49° C.), new wheels to 110° F. (43° C.). After glueing and coating with abrasive, drying for at least 5 hrs. at from 65° to 70° F. (18° – 21° C.) is necessary.—J. H. W.

Latest Equipment for Finishing Departments. — (Indust. Finishing (U.S.A.), 1935, 11, (4), 16-20, 22, 24, 26, 30, 32, 34-36).—Developments and improvements in apparatus made during 1934 are described and reviewed; the new apparatus includes spraying pistols, paint spreaders, vapour cleaners and degreasers, and enamelling devices.—A. R. P.

Gold and Silver Bronzes [Paints]. Herman Kahn (Indust. Finishing (U.S.A.), 1935, 11, (6), 9-12).—The composition, properties, and uses of bronze and aluminium paints are briefly discussed .- A. R. P.

Gold, Silver, and Aluminium-Bronze Powders. Otto A. Both (Indust. Finishing (U.S.A.), 1935, 11, (9), 9-11, 46-49) .- Methods of manufacture and testing of bronze powders and their uses in finishing metal and wood work are discussed.-A. R. P.

Metal Container Finishing. Henry F. Frank (Indust. Finishing (U.S.A.), 1935, 11, (6), 18-21).-Automatic apparatus and procedure for lithographing the outside of tooth-paste tubes and for varnishing the inside of cans for preserving food are briefly described.-A. R. P.

Major Review of Developments During 1935 in New Finishing Materials for Metal, Wood, Paper, Fibre, Leather, Fabrics, Rubber, &c. ---- (Indust. Finishing (U.S.A.), 1936, 12, (3), 19-30, 32, 37-38, 40, 42, 44, 46),-S. G.

XX.-JOINING

(Continued from pp. 219-222.)

*New Materials for Glass-Metal Seals. A. W. Hull, E. E. Burger, and L. Navias (Phys. Rev., 1936, [ii], 49, (8), 647) .- Abstract of a paper read before the American Physical Society. A careful study was made of the thermal expansion of iron-nickel alloys, and a successful search carried out for a glass to match one of these alloys. This new combination has certain advantages over the iron-nickel-cobalt combination previously described (Met. Abs., 1935, 2, 68) in that the alloy is less oxidizable, less difficult to make, and less expensive; and the glass is softer and more easily sealed, while maintaining an equally low coeff. of expansion.-S. G.

Notes on the Design of Vacuum Joints in Metal Apparatus. R. M. Archer (J. Sci. Instruments, 1936, 13, (5), 161-165).-A. describes the construction of joints designed for use with metallic Dewar vessels, but suitable for other vacuum apparatus. Joints between two metal tubes, a metal and glass tube, a ground flange on a glass tube, and a ground metal plate are described and illustrated, and also a strong equatorial joint between copper hemispheres, and a joint between a thin tube and a spinning. All these are strong and easy to make and open, whilst the soldering of one part is not apt to cause unsoldering of another. The technique of soldering for vacuum apparatus is discussed.

-W. H.-R.

Testing of Soft Solders. (Hanemann.) See p. 267.

Outline of the Recent Progress Made in the Welding of Aluminium and Its Alloys. Jacques Douchement (Congrès internat. Mines Mét. Géol., Section de Métallurgie, 1935, 1, 411-418; also Rev. Met., 1936, 33, (3), 189-196; and Aluminium and Non-Ferrous Rev., 1936, 1, (8), 391-396) .-- [In French.] See Met. Abs., this vol., p. 131.-S. G.

Autogeneous Welding of Aluminium and Magnesium and Their Alloys with the Use of Special Fluxes. L. Stiavelli (Alluminio, 1934, 3, (4), 195-201; Brit. Chem. Abs., 1935, [B], 808) .- The flux used is a mixture of alkali chlorides and fluorides, with added materials for cleaning. Details are not given.-S. G.

The Welding of Aluminium. G. O. Hoglund (Welding Eng., 1936, 21, (2), 26-30).—A "signal contribution" is said to have been made to the welding art when a flux for welding aluminium was developed in America, in 1910. Pure aluminium and the 1.25% manganese alloy are welded by gas, metallic and carbon arc, and resistance methods. Of the heat-treated alloys, "51 S" (Al + Si + Mg) and "53 S" (Al + Si + Mg + Cr) are recommended for welding, the former being used for furniture, and the latter for architectural work, beer-barrels, and milk cans. Arc-welding is advised for thick material where distortion is to be avoided. Tables are given of electrode size and current required for different thicknesses and of machine settings for resistance welding.

Gas Welding Aluminium and Its Alloys. G. O. Hoglund (Welding Ind., 1936, 3, (12), 430-433).—Brief particulars are given of the properties of welds in pure aluminium and some of its alloys, but the major part of the article deals with applications in architectural, brewery, dairy, transport, and chemical work.—H. W. G. H.

The Welding of Herculoy. R. Steinmetz (Welding Eng., 1936, 21, (4), 28– 31).—Herculoy (copper-silicon-tin) may be welded by carbon are (electrode negative), metallic are (electrode positive), oxy-acetylene, and resistance methods. For fusion welding, backing-plates are necessary, but preheating is not required even for thick material. The technique recommended is described, and full details are tabulated.—H. W. G. H.

Welding Magnesium Alloys. A. J. T. Eyles (Indust. Gases, 1935, 16, (4), 198-199).—Very eareful cleaning, prior to welding, is essential. For thin sheet, flanging of the edges is not recommended; for thicknesses from $\frac{1}{6}$ to $\frac{3}{6}$ in., the edges should be bevelled to an angle of 45° . Special fluxes (composition not stated) are recommended, and preheating is advised for castings. The blow-pipe flame should be carefully regulated (presumably neutral). Completed welds should be annealed, hammered at 300° C. if possible, cleaned, and pickled in potassium dichromate solution.—H. W. G. H.

Resistance Welding. L. H. Frost (Welding Eng., 1936, 21, (1), 44–47; (2), 38–40; (3), 32–33; (4), 34).—The developments in design of spot-welding machines to suit special alloys are described. Accurate adjustment of heat, pressure, and time are shown to be necessary, and some methods adopted in practice are discussed. The interdependence of electrode pressure and current is emphasized and curves are given, showing the transformer capacity, electrode pressure, and the effects of arm spacing and length, for welding various thicknesses of mild steel. Flash-welding, projection-welding, and some applications are also discussed.—H. W. G. H.

*The Thermal Stress in a Strip Due to Variation of Temperature Along the Length and Through the Thickness. J. N. Goodier (*Physics*, 1936, 7, (4), 156– 159).—The thermal stress developed by unequal heating of a flat strip is investigated, the temperature varying along the length and through the thickness, but not across the width. The problem is reduced to one of edge tractions only, for which general solutions are already known. From the properties of these solutions it is shown that for heating local to a narrow transverse band across the width, as might occur in welding processes, there is a concentration of stress near the edge of the strip, at the hottest part, and a maximum tensile stress of magnitude $E \alpha T_{max}$, when the temperature is constant through the thickness. The corresponding quantity is found also for temperatures varying through the thickness. For steel $E \alpha T_{max}$ is about $350 T_{max}$ lb./in.², the temperature being measured in °C. above that of the cool parts of the strip, and this approaches the yield-point of mild steel for a maximum temperature (increase) of the order 150° C. For a given maximum temperature the maximum stress is reduced by about 40% by keeping one face cold.—S. G.

The Toxicology of Oxy-Acetylene Welding. Zolton T. Wirtschafter and Edward D. Schwartz (J. Indust. Hyg. Toxicol., 1936, 18, (3), 158-162; C. Abs., 1936, 30, 2902).—The toxic products to which an oxy-acetylene welder may be exposed are carbon monoxide, acetylene, metal fumes, and impurities in commercial acetylene. Welders working in vats, &c., should be provided with forced ventilation.—S. G.

The Economy of Welding. C. W. Brett (*Fuel Technologist*, 1936, 11, (128), 316-317).—Recent progress in effecting repairs by welding, including the recent process of low-temperature welding, is briefly discussed.—J. S. G. T.

Electronic Welding Timers. Paul G. Weiller (*Electronics*, 1936, 9, (5), 26–28, 38).—Discusses the design of valve-controlled welding timers, and their characteristics.—J. C. C.

XXI.-INDUSTRIAL USES AND APPLICATIONS

(Continued from pp. 222-227.)

*A Comparison of Corrosion-Resistant Steel (18 Per Cent. Chromium-8 Per Cent. Nickel) and Aluminium Alloy (24 ST). J. E. Sullivan (*Teck. Notes Nat. Advis. Cttee. Aeronautics*, No. 560, 1936, 12 pp.).—Comparison of the relevant mechanical properties of stainless steel and aluminium alloy "24 ST" indicates that the latter has the better combination of properties for fabricated aircraft structures of stiffened sheet and for columns but that steel is preferable for highly stressed fittings carrying lugs and for wires and cables where pure tension is the primary controlling factor. Modern stainless steels are not so satisfactory as high-tensile steels.—A. R. P.

The Use of Aluminium in the Chemical Industry. Francis C. Frary (Trans. Amer. Inst. Chem. Eng., 1934–1935, 31, 3–16; discussion, 17–19).—See Met. Abs., 1935, 2, 58.—A. R. P.

*Light Metal Rotors for the Molecular Ultracentrifuge. J. Biscoe, E. G. Pickels, and Ralph W. G. Wyckoff (*Rev. Sci. Instruments*, 1936, [N.S.], 7, (6), 246-250).—Tests were made of the range of usefulness of light metal rotors in the ultracentrifuge for molecular sedimentation. These experiments prove that Duralumin 14 ST is definitely superior to the other aluminium- and magnesium-rich alloys tested. They also indicate a shape of 7 in. diameter rotor which if made of Duralumin 14 ST can be used safely for centrifuging at speeds up to 900 r.p.s. (field at centre of cell = 215,000 times gravity). For much more intense fields special steels must be used or the rotor diameter reduced.—S. G.

*The Use of Light Metal Rotors for the Ultracentrifuge. J. Biscoe (*Phys. Rev.*, 1936, [ii], **49**, (8), 643).—Abstract of a paper read before the American Physical Society; this appears to be published in full by Biscoe, Pickels, and Wyckoff, *Rev. Sci. Instruments*, 1936, [N.S.], **7**, (6), 246-250 (see preceding abstract).—S. G.

Light Alloys in Rotor Design. W. R. Needham (*Machinist (Eur. Edn.*), 1936, 80, (17), 278E).—Briefly describes the use of light alloys in rotor construction.—J. H. W.

The Standardization of Aluminium Rails for Electric [Traction] Installations. F. Streiff (Bull. Assoc. Suisse Élect., 1936, 27, (10), 265).—A summarized account is given of the recent recommendations issued by the Standardization Bureau of the Swiss Association of Mechanical Engineers regarding the mechanical and electrical properties of aluminium alloy rails. Tables show the principal requirements for hard, half-hard, and fully-annealed material which has received mechanical treatment by different methods.—P. M. C. R.

Light Metal Wheels for Road Vehicles. M. Koenig (Aluminium, 1936, 18, (3), 81-87).—Substitution of aluminium alloy segmented rims for steel rims in the wheels of heavy road vehicles effects a reduction of 15-20% in the weight of the wheels; if the whole wheel is made of aluminium the weight is 40-60% less than that of a similar steel wheel.—A. R. P.

Metal Coaches on the Algerian Railway. — Ducluzeau (*Rev. Aluminium*, 1936, 13, (80), 155–158).—Describes the use of Duralinox (aluminium containing 7% magnesium), Alpax, and a 1.25% manganese aluminium alloy for the construction of railway coaches in Algeria.—J. H. W.

Uses of Aluminium-Plated Aluminium-Zinc Alloys. J. F. Kesper (*Obst. Gemüse-Verwertgsind.*, 1934, 21, 547-549; C. Abs., 1936, 30, 3385).—Aluminium-zinc alloys have a high corrosion-resistance and good mechanical and working properties. They are suitable for the preserve industry.—S. G.

Aluminium Powder in Southern Paint Formulations. Robert I. Wray (Amer. Paint J., 1936, 20, (Mar. 30), 15-17; C. Abs., 1936, 30, 4023).— Aluminium priming paints give excellent results with Southern pine and other Southern woods. The vehicles ordinarily used in aluminium paints have sufficient body so that they do not penetrate too far into the wood and rob the primer of its binder. The flake-like particles of aluminium appear to reinforce the paint films. The vehicle should not dry too quickly. An aluminium paint for use on wood should set to touch within 6 hrs. and dry fairly hard in 24 hrs. Synthetic resin vehicles dry somewhat more rapidly—S. G.

Can Boiler Explosions Due to Low Water be Prevented ? [Fusible Plugs]. Frank Russell (*Railway Age*, 1936, 100, (12), 499-501; *C. Abs.*, 1936, 30, 3917).—On the Southern Pacific Lines the locomotives are protected against overheated crown sheets and explosions due to low water by the multiple application of boiler drop-plugs, consisting of brass plugs held in place by rings of fusible metal, the heads of the plugs on the fire side being covered with fusible metal to ensure free movement of the plug in case of low water.—S. G.

Necessary Conditions for the Use of Copper in Locomotive Fireboxes. —— Chan (*Rev. gén. Chemins de Fer.*, 1936, 55, (5), 331–338).—The high working temperature of the firebox in modern locomotive practice $(300^{\circ}-350^{\circ}C.)$ leads to excessive wear on firebox stays and to recrystallization and ageing of the plates. The improvement in elastic limit induced by the coldworking of "pure" copper (maximum total impurities 0.4%), and the effect of temperatures up to 420° C. on the hardness of such cold-worked material are shown graphically. C. discusses the possibility of increasing the temperature of recrystallization above the working limit by additions of suitable metals (silver, cobalt, &c.) or of preliminary heat-treatment of the metal in order to prevent recrystallization.—P. M. C. R.

----- (Water Works Eng., 1934, 86, Report of the Copper Pipe Committee. 437, 496-497; J. Amer. Water Works Assoc., 1935, 27, 1092) .-- Results are given since 1928 for 12 water-works in the Netherlands with dune, river, and ground waters. Tinned pipes must have a non-porous layer of tin and not less than 30 grm. tin per m.² covered. Copper, dissolved by 2% ammonium persulphate in 30 minutes, must not be more than 0.5 mg. per 100 cm.² of tinned surface and the lead content of the tin must not exceed 0.5%. It is generally considered that the small amounts of copper dissolved from copper pipes have had no bad effect on health, but the maximum is fixed at 3 mg. per litre after 16 hrs. contact; this amount causes no unpleasant taste in water, beverages, or food. In only one case did copper exceed this amount; no danger arises from copper containing 0.25-0.45% arsenic. The amount of copper dissolved is affected by the carbon dioxide content, and copper is found to be slightly less soluble in warm than in cold water. The use of untinned copper is not permissible if the $p_{\rm H}$ is 6.9 or lower, or if dissolved oxygen exceeds 3 mg./litre, but tinned copper may be used .- S. G.

Copper Tubing [for the Refrigerating Industry]. O. Z. Klopsch (Refrigerating Eng., 1936, 31, (3), 162-165; C. Abs., 1936, 30, 3759).—Copper tubes for the refrigeration industry should be free from scale and dirt, be made from deoxidized copper, be bright-annealed after the last drawing operation, be thoroughly recrystallized and have an average grain-size not exceeding 0.04 mm. in diameter at a magnification of \times 85, contain 99.90% copper and a maximum of 0.10% phosphorus, and should have a tensile strength of 30,000 lb./in.². Other physical properties are also given.—S. G.

The Use of Copper Tubing for Gas Service Replacement Work. H. S. Harris (Gas Age-Record, 1936, 77, (17), 427-430).—The use of copper tubing for gas service pipe replacement is described. The tubing is, in some cases, drawn through conduits.—J. S. G. T.

Copper Channel Bus-Bars. G. W. Preston (*Elect. Rev.*, 1936, 118, (3036), 160).—Bus-bars made of copper channel sections, provided with flexible expansion joints and silver-plated contact surfaces, are used in the Boulder

Dam hydro-electric scheme and are cheaper than laminated bars. The housing and inter-phase barriers are constructed of copper sheet.—J. C. C.

[Copper-]Copper Oxide Rectifiers. R. J. Bussell (*Elect. Eng. and Merchandiser* (*Melbourne*), 1935, 12, (8), 267-274).—Read before the Postal Electrical Society of Victoria. An account of the construction, characteristics, and uses of copper-copper oxide rectifiers.—J. C. C.

Effect of Copper on Yeast. B. Lampe (Brennerei-Zeit., 1935, 52, 6-7).—A discussion, based on the results of previous investigators.—S. G.

The Primitive Use of Gold. T. A. Rickard (*Trans. Inst. Min. Met. Eng.*, 1935, 44, 49–76; discussion, 77–87).—See Met. Abs., 1935, 2, 735.—S. G.

Nickel Alloys in Japanese Industry. Yasushi Taji (*Engineer*, 1936, 161, (4190), 467–468, 493–494).—A review of applications for transport and general engineering work.—R. Gr.

Alloys for Electrical Heating. Harold Silman (Met. Ind. (Lond.), 1936, 48, (22), 603-606).—A review of the properties required by alloys to be used for heating elements in electric furnaces, radiators, &c. Apart from the mechanical, thermal, and electrical properties of the alloys themselves, the nature of the oxide films affect the life of the element when exposed to high temperatures. The advantages and disadvantages of a number of alloys are discussed with special reference to the effect of impurities, and the improved resistance to scaling and attack by certain gases, which may be conferred by small additions of added metals. 80:20 nickel-chromium alloys are the most widely used, while the cheaper one containing nickel 60, chromium 16, and iron 24% is finding many applications.—J. E. N.

Power Plant Auxiliaries [Monel Metal]. G. E. Scholes (Eng. Rev., 1936, 49, (9), 708-710).—The importance of Monel metal as material for boiler plant accessories is illustrated by an account of its use for ball floats, baffles for steam purifiers, soot-blower valves and seats, and jointing rings.—P. M. C. R.

Nickel- or Monel-Plated Aluminium. — (New Products Digest, 1936, May 16; and (abstract) Light Metals Rev., 1936, 2, (22), 400).—See Met. Abs., this vol., p. 180.—L. A. O.

New Industrial Uses for Silver. Lawrence Addicks (*Min. Met. Soc. Amer. Bull.* No. 236, 1936, 5–20).—Recent developments in the use of silver in industry are described with especial reference to its use in sterilizing water, beer, vinegar, fruit juices, &c., in the manufacture of chemical plant, in the preparation of bearing metals, and in modifying the annealing characteristics of copper. Aluminium alloys with up to 10% silver have a fine, bright surface, are readily machinable, and find considerable uses in the manufacture of scientific instruments. Cadmium containing 0.75–1.75% silver and a little copper is finding increasing use as a bearing metal for motor-cars. Tin is considerably hardened by addition of up to 3.5% silver, and the alloy makes satisfactory strong, corrosion-resistant pipes. A low silver-tin alloy gives a much better tinplate for dairy use than does pure tin. The use of silver commutators on motors entirely prevents brush drop.—A. R. P.

*On the Applicability of the Oligodynamic Action of Silver in the Food Industry. V. D. Slavin (Voprosui Pitaniya, 1935, 4, (4), 147–152; C. Abs., 1936, 30, 3531).—[In Russian.] No oligodynamic action of silver (bactericidal action of very small doses) was observed in the case of water, and silver dosages which were bactericidal in water were found to be stimulators of bacterial growth in organic substances of foods. The use of silver for sterilization of food products and wash waters is justified neither by theoretical nor experimental results.—S. G.

Bearing Metals for Steam Power Plants. H. N. Bassett (*Eng. Rev.*, 1936, 49, (9), 718–719; (11), 881).—This discussion of the characteristics of bearing metals includes a consideration of necessary lubrication conditions, and of the "conformability," thermal conductivity, resistance to deformation, and

composition of such alloys in relation to steam operating conditions. Reference is made to recent work on the influence of cadmium and of lead on tin-base bearing alloys.—P. M. C. R.

The Dry Tin Accumulator. Ch. Fery (Compt. rend. Assoc. franç. Avanc. Sci., 1934, 56-58).—Cf. Met. Abs., 1934, 1, 328. The advantages of a dry accumulator, using plates of tin and lead, are briefly outlined. No constructional details are given.—J. C. C.

Switchgear with Special Metal Coatings for Oil Relays. Karl Meier (*Elektrotech. Z.*, 1936, 57, (18), 493–495).—The use of tungsten-copper contacts is described.—B. Bl.

The Use of Hard Alloys [in the Refractories Industry]. D. L. Shmukler and —— Turezkiy (*Ogneupori* (*Refractories*), 1936, (2), 30-33).—In the manufacture of refractories in the U.S.S.R. the parts of apparatus subjected to great wear are coated with hard alloys.—N. A.

The Use of Hard Metal Alloys in the Potassium Industry. V. Bakul and A. Kolesnikov (*Kalii* (U.S.S.R.), 1936, (2), 18–23; C. Abs., 1936, 30, 3385).— [In Russian.] A description of the use and care of (1) Stalinit, which is a powdered alloy composed of chromium 9.5, manganese 11.5, carbon 12.5, and iron 55.5% and which is used for electric welding on the iron surfaces of drills and borers; and of (2) Pobedit, a mixture of tungsten and cobalt powders pressed together and sintered.—S. G.

Review of the Fields in which Zinc Die-Castings are Used.—I-II. Herbert Chase (Met. Ind. (Lond.), 1936, 48, (21), 582-584; (23), 635-637).—(I.—) Zinc-base die-castings are used in the motor-car industry for mechanical parts, and structural and decorative fittings. Their use is extending to other industries and they are now incorporated in automatic sales machines, einécameras and projectors, many types of electrical instruments and meters, and such office equipment as typewriters, duplicating machines and cash registers. In all these applications the accuracy of dimensions and the smoothness of surface reduce the finishing costs. (II.—) Further applications of die-castings are described, ranging from motor-car radiator grilles to mechanical toys. Lead-base die-castings are now generally restricted to parts where high corrosion-resistance is required, but for milder forms of corrosion the zinc-base alloys are quite satisfactory.—J. E. N.

Recommended Materials for Railway Engineering. —— (Bur. Information on Nickel, No. AA9, 1936, 6 pp.).—The recommended materials included the following non-ferrous alloys: 5 nickel-copper alloys, 3 nickel-copper-zinc alloys, 3 nickel-bronzes, 1 nickel-chromium alloy, and 1 nickel-chromium-iron alloy, and their use for such parts as firebox plates, stay bolts, safety valves and seats, feed-pump liners, electric heater elements, and rolling stock and decorative fittings both in the form of eastings and extruded sections.—J. W. D.

[†]Economy of Domestic Materials in German Locomotive Construction with Special Reference to the Question of Bearings. R. P. Wagner and H. Muethen (Glasers Annalen, 1936, 118, (4), 31–38; (6), 59–69; (10), 103–104).—Possible German materials for use in locomotive construction in place of imported metals are discussed, with special reference to the use of aluminium alloys.—B. Bl.

Service Pipe Friction Losses. James E. Gibson (Water Works Eng., 1935, 88, (9), 467; J. Amer. Water Works Assoc., 1936, 28, 283).—Friction losses in ft. of head per 100 ft. length are given for various types of house service connections. Diagrams are given for lead, copper, and galvanized pipe at flow rates of from 5 to 50 gall./minute and for loss of head up to 180 ft. per 100 ft. of pipe, the meter in each case being set at the pavement curb. Service line and meter account for the majority of head loss. The superiority in this respect of lead to copper and to galvanized iron is manifest. The standard "K" copper service tubing is, however, an ideal material for the purpose because of its sustained delivery, non-corrodibility, low cost, durability, ease of installation, and salvage value.—S. G.

The Formation of Metallic Blacks on Thin Foils by Evaporation. R. V. Jones and B. V. Rollin (*J. Sci. Instruments*, 1936, 12, (4), 130–131).—A note. Heating of the receiver sometimes prevents the formation of black metallic deposits by evaporation. This may sometimes be prevented by the use of atmospheres of hydrogen or helium since these have relatively high thermal conductivities.—W. H.-R.

Metallic Insulation. J. T. Nichols (*Ice and Cold Storage*, 1935, 38, 177– 178; *C. Abs.*, 1936, 30, 3541).—Metal surfaces which give relatively poor reflection in the visible region were found to be good reflectors of the longer wave-lengths; thus, black plate and galvanized plate are good reflectors for the longer wave-lengths. Relative reflectivities are given for a number of metals and plated materials.—S. G.

Bi-Metals. G. Keinath (Arch. tech. Messen, 1936, 5, (58), τ 55– τ 56).—The thermal expansions of a number of metals and alloys between 0° and 600° C. are reproduced graphically, as are the degrees of expansion over the same range of 6 types of bimetal strip. The construction and principal uses of plain and pre-stressed strips are considered, and the degree of accuracy obtainable is discussed. An illustrated account is given of the testing of bimetal strip.

-P. M. C. R.

Metal Spraying in the Welding Shop. H. B. Rice (Welding Eng., 1936, 21, (1), 34-42).—The wire-gun process is discussed. Zinc, aluminium, and stainless steel are given as among the best spray metals. Sand-orgrit-blasting is necessary to provide a key for the bonding of the deposit to the surface which is to be sprayed. Where heavy deposits are required, machine tooling or knurling, prior to blasting, is advisable. Some applications described are : zinc-spraying of scams in welded galvanized material; closing of porous welds; building-up worn machine parts; spraying of bearing metals: protecting aluminium crank-cases by spraying with lead; producing phosphor-bronze wear-resisting surfaces on steel parts.—H. W. G. H.

XXII.—MISCELLANEOUS

(Continued from p. 227.)

Physical Metallurgy. I.—Recent Developments. II.—Diagnosis of Mechanical Failures. Gordon Sproule (*Canad. Inst. Min. Met. Bull.*, No. 289, 1936, 257-264, 264-277).—(I.—) Precipitation-hardening of non-ferrous metals is briefly discussed. (II.—) The use of the microscope in detecting faulty structures in steels is described.—A. R. P.

Fifty Years' Aluminium. K. Arndt (*Elektrotech. Z.*, 1936, 57, (8), 199–200).—Historical.—B. Bl.

The Geographical Evolution of the Aluminium Industry. Robert Pitaval (J. Four élect., 1936, 45, (2), 49-51).—J. E. N.

The Primitive Smelting of Copper and Bronze. T. A. Rickard (*Trans. Inst. Min. Met. Eng.*, 1935, 44, 227–252; discussion, 252–254).—Sce Met. Abs., 1935, 2, 127.—S. G.

Improvements in the Brass Industry. D. K. Crampton (Monthly Rev. Amer. Electroplaters' Soc., 1936, 23, (4), 23–30).—A review of recent progress, with special reference to annealing furnaces.—A. R. P.

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(Continued from pp. 227-233.)

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 [1936.] New York: The Bureau, 33 Rector St. (\$2.00.)

[The statistics issued by the American Bureau will be found most valuable because of the obvious care that is taken in their compilation. They are clearly printed on large pages on good paper. The present volume, covering the year 1935, deals in the greatest detail with copper (34 pp.), lead (22 pp.), zinc (25 pp.), and gold and silver (13 pp.); the remaining pages deal with platinum, antimony, nickel, tin, aluminium, cadmium, cobalt, brass, and bronze, and the metal consumption per person in the principal countries from 1919 to 1935, average prices of the principal metals (New York and/or St. Louis and/or London) from 1886 to 1935, and yearly average prices from 1882 to 1935 for copper, lead, zine, and silver. For the principal metals, the particulars given include world's production and consumption, refined metal production, mine production, producers, smelting and refining plants, smelter output, stocks, deliveries, ore reserves, imports and exports, metal available for consumption, use in U.S.A., and prices.]

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[Reprinted from Analyst, 1936, 61, 242-245; see Met. Abs., this vol., p. 212.]

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- Viscosity and Plasticity. First Report on Viscosity and Plasticity. By J. M. Burgers, et. al. Pp. 256 + viii. Amsterdam : Committee for the Study of Viscosity, Academy of Sciences of Amsterdam. (Paper, 10 guilders; cloth, 11 guilders.)

XXIV.—BOOK REVIEWS

(Continued from pp. 234-236.)

Gmelins Handbuch der anorganischen Chemie. Achte völlig neubearbeitete Auflage. Herausgegeben von der Deutschen Chemischen Gesellschaft. Mitarbeiter: R. Glauner, M. A. W. Barnick, H. Lehl. System-Nummer 35: Aluminium. Teil A, Lieferung 4. Sup. Roy. Svo. Pp. 535-682, illustrated. 1936. Berlin: Verlag Chemie G.m.b.H. (R.M. 24; ausl. pr., R.M. 18.)

This section of the "Handbuch" deals with the alloys of aluminium with a number of other elements, namely those comprising certain sub-groups of the Periodic System.

The whole of the available information on alloys containing Group VIb elements (sulphurpolonium), and Group IIIa elements (of which boron is the only one mentioned) is contained in half a page. 91 pages are then devoted to a description of the aluminium-silicon alloys. Their preparation, treatment, chemical and physical properties are described with a wealth of detail, and the influence of impurities is discussed at length. The alloys with elements of Group Vb (phosphorus-bismuth) are next described, followed by those of Group Ia (the alkali metals). The remainder of the book deals with the metals of Group IIa (beryllium, magnesium, and the alkaline earths). 33 pages are devoted to alloys containing magnesium, and here again the treatment is extremely thorough.

It is necessary to point out that the only ternary alloys described are those whose constituents fall into the sub-groups mentioned above. Alloys containing magnesium and silicon, for example, are dealt with, but not those containing magnesium and copper, silicon and copper, &c. It is to be presumed that alloys of aluminium with the elements of the remaining subgroups will be described in a further volume.

The information given appears to be complete and up to date, and the book can be warmly recommended.—H. W. L. PHILLIPS.

Aluminium-Legierungen. Patentsammlung. Von A. Grützner unter Mitarbeit von G. Apel. Nebst einem Markenverzeichnis bekannter Aluminiumlegierungen von A. v. Zeerleder. 2. Teil. Zugleich Anhang zu Aluminium Teil A in Gmelins Handbuch der anorganischen Chemie. Achte völlig neu bearbeitete Auflage. Herausgegeben von der Deutschen Chemischen Gesellschaft. Sup. Roy. Svo. Pp. 343-868. 1936. Berlin: Verlag Chemie G.m.b.H. (R.M. 54; ausl. pr., R.M. 40.50.)

This volume completes the classified list of patents covering aluminium alloy compositions issued as an appendix to the volumes on aluminium in Gmellns "Handbuch," of which the first part was reviewed in *Met. Abs.*, this vol., p. 140. In addition to the patents, it contains a list of commercial aluminium alloys, under their trade names, giving their compositions and the names of their producers. As a work of reference the book should be invaluable.

Traité Pratique de Galvanisation à Chaud. By Jean Chambran. (Bibliothèque de l'Usine.) Med. 8vo. Pp. 137, with 47 illustrations. 1936. Paris : L'Usine, 15 Rue Bleue, IXe. (Broché, 24 francs.)

The present work replaces that of C. Kluytman which was published in Paris in 1927. As its title implies, it deals primarily with the hot-dipping process of galvanizing, but a short illustrated note on sprayed zinc coatings is added as an appendix.

The book is divided into four parts. In the first part the general principles of hotgalvanizing, comprising the theoretical aspects of the picking and galvanizing operations, a study of the steel base and of the spelter used, are dealt with in a very elementary and superficial manner; some of the author's statements in this section will certainly meet with criticism. The second part deals with the mechanical hot-galvanizing of sheets: the lay-out of a modern galvanizing plant, practical hints on the choice of apparatus, machinery, and raw materials, and detailed information regarding the many difficulties encountered in working such a plant, with suggested methods for overcoming them. The third part describes in a similar manner the practical aspects of the hand-dipping process, while machines for shearing, corrugating, bending, and roller-levelling are dealt with in the final part. Essentially a book for the man in the shop.—E. R. HOWELL.

Chromium Plating. A Text-Book for the Practical Electroplater, the Production Engineer, and the Student. By E. S. Richards. Foreword by J. B. Maclean. Second Edition, Revised. Cr. 8vo. Pp. vii + 131, with 70 illustrations. 1936. London: Charles Griffin and Co., Ltd. (4s. net.)

The chief modifications in this second edition are the insertion of 4 pages on metal rectifiers for supplying current in the plating shop and of 2 extra pages on barrel plating : otherwise, apart from a few minor additions, the book has not been altered. It is a book intended for the practical plater and is written presumably by a practical plater. Half of the space is devoted to plant (including sources and distribution of current) and to the preparation of work for plating (polishing and cleaning). The remainder of the book deals with copper, nickel, and chromium plating, the latter occupying about one-third of the total number of pages.

The book is chiefly valuable for its useful practical information on plant arrangement, polishing, and methods of jigging and suspending articles for chromium plating. The sections on copper, nickel, and chromium plating are disappointingly lacking in critical information : there is nothing about the control of these processes, and one is not told how to produce goodquality coatings of permanent value. Of the many points of detail which are open to criticism, two may be mentioned : some detrimental evidence of the quality of French chromium plating is cited, but there are so many important omissions of fact that the reader cannot judge its validity : it is to be regretted that an unqualified statement that "glue is sometimes added to (nickel plating) solutions to give white deposits " should have been repeated in this edition in view of the disastrous effect of this substance in concentrations exceeding "bout 0-1 grm. per litre. On pp. 06 and 67, sodium bisulphate, instead of bisulphite, is again given as an ingredient of a copper cyanide plating solution.—A. W. HOTHENSALE.

Le Groupe des Industries de l'Acetylène et de la Soudure Autogène-Ses Organismes Centraux. Par Lise Bloch-Sée. Med. 8vo. Pp. 176. 1935. Paris : Institut de Soudure Autogène, 32 Boulevard de la Chapelle.

This is a fascinating book. Its fascination depends in part on the remarkable ramifications of the subject, and, perhaps in greater part, on the way in which those ramifications are presented in clear perspective. A historical survey of the acetylene and welding industries in France is followed by an explanation of the growth of a central organization to guide their economic and technical progress. A detailed description is given of the origin, development, and functions of the following well-known bodies : the Chambre Syndleale de l'Acétylène, de la Soudure Autogène et des Industries qui s'y rattachent; the Office Central de l'Acétylène et de la Soudure Autogène; the Institut de Soudure Autogène; the École Supérieure de Soudure Autogène; the Société des Iugénieurs Soudeurs; and the Permanent International Commission of Acetylene, Acetylene Welding, and Allied Industries. The "powers that be " in the welding industries of this country cannot fail to find much of value in this study—to use its last words—" de la collaboration méthodique."—H. W. G. HIGNETT.

Electric Arc Welding Practice. A Handbook for Welding Engineers and Welders. By H. I. Lewenz. Demy 8vo. Pp. 126, with 103 illustrations. 1936. London: Crosby, Lockwood and Son, Ltd. (8s. 6d. net.)

This book is an elementary introduction to the subject of arc welding, the main principles of which are explained with as much clarity as the size of the book permits. In considering this size, account must be taken of excessively wide margins, which make the price less attractive than appears at first sight. The non-ferrous welder will find little of interest except a clearly written account (Chapter VI) of the stresses and deformation set up by welding. The author is so very cautious in passing rapidly, evading, or even ignoring controversial points, that it is almost a shock to find the definite statement that "For reasons which have been explained, d.c. is preferable to a.c." Although this opinion may be perfectly correct, the reasons are certainly not explained. The printing and illustrations are excellent. A remarkably useless appendix is given .- H. W. G. HIGNETT.

Handbook of Chemistry and Physics. A Ready-Reference Book of Chemical and Physical Data. Twentieth Edition. Edited by Charles D. Hodgman. Fcap. 8vo. Pp. xiv + 1951. 1935. Cleveland, O.: Chemical Rubber Publishing Co. (\$6.00.)

The twentieth edition of this very useful book of reference differs from its immediate predecessor in many respects, the most important of which deal with organic chemistry. The section on X-ray spectra has been thoroughly revised and brought up to date and minor revisions have been made in most sections of the volume.

This book is undoubtedly one of the most useful works of its kind published in any language; it becomes more valuable with each succeeding edition. The data are accurate and well chosen. The book is well printed and bound and its form renders the finding of information extremely easy. It is a book to be recommended to chemists, physicists, and engineers, and all others whose work touches the fringes of chemistry and physics.

Soviet Science. By J. G. Crowther. Demy 8vo. Pp. x + 342, with 16 plates. 1936. London: Kegan Paul, Trench, Trubner & Co., Ltd. (12s. 6d. net.)

The title of this book is a misnomer : there is no Soviet science in the sense that there is Russian music. "Science in U.S.S.R." should be the title of the book. "Soviet" science, as revealed in this book, is the same as science everywhere else. The subject-matter of the book is almost entirely a recital of the various subjects of research in physics, chemistry, applied science, and biology undertaken in the scientific institutes established by the Soviets at Leningrad, Kharkov, Dniepropetrovsk, Moscow, and Sverdlovsk. This information has been supplied in most cases, probably in all, by the Directors of the respective Institutes, and reading it has left me with the impression that the main value of the work is propagandist in character. The first chapter is entitled "Dialectical Materialism," and opens "Little insight into the most original characteristics of the present developments in the Soviet Union can be acquired without some knowledge of the dialectical materialist philosophy." And what is dialectical materialism? "Its main ideas were propounded by Karl Marx"; the author then proceeds to extol Marx as a genius of high order, and to describe Lenin's book " Materialism and Empirio-Criticism " as perhaps the most remarkable essays on science ever written by a statesman of the highest order of genius. And listen to this (pp. 156, 157); "Authorities such as Rosenhain and Hume-Rothery have explained the necessity for a closer collaboration between metallurgy and physics. But their exhortations have not had the desirable effect, partly owing to the patent-monopolies in Western countries which create barriers between empirical industrial research and science. . . . The proper connection between industry and science can be established in a planned economy, so in the U.S.S.R. . . ." Well, my opinion, for what it is worth, is that scientific research in U.S.S.R., as revealed in this book, is overplanned, so much so indeed that the planning would appear to be the more important and essential part of the work. And with all this planning, there appear to be certain essentials, ministering to the comforts of everyday life, clamant for attention, but apparently receiving little or none, even from the scientists. Thus, e.g. (p. 38) the rooms set apart for scientists visiting Leningrad "are not entirely free from vermin. It (sic) gets in the cracks of the wall plaster near the stoves." The water-supply of Kharkov is inadequate and probably responsible for a considerable amount of minor summer aliments, and trains are quite commonly late in reaching their destinations. Here, ready to hand, are subjects for "planning" investigations, but Soviet science apparently passes them by, and bends itself to the task of tracking down the neutrino, investigating the facts of electrocapiliarity, &c. Here, in this book, all this

scientific activity is set out in very considerable detail. Unless the book is propaganda, I can see no reason for its publication; if it is propaganda (and of this there is plenty of internal evidence) then the price is very high.-J. S. G. THOMAS.

The Directory of Shipowners, Shipbuilders, and Marine Engineers, 1936. 34th Edition. Compiled under the direction of the Editor of Shipbuilding and Shipping Record. Demy 8vo. Pp. 806 + 75. 1936. London: The Directory Publishing Co., Ltd., 33 Tothill Street, S.W.1. (20s. net.)

This is a most useful publication to all who are interested in marine engineering. It furnishes particulars of all the leading steamship companies, ship-builders, ship-repairers, and marine engineering works throughout the world. It also gives the names of the directors and principal officials of the companies, and, in the case of shipping concerns, details of the fleets. A supplementary section includes a list of societies, institutions, trade and labour federations, and a directory of consulting marine engineers and naval architects. At the end of the volume are exhaustive indexes covering some 25,000 entries.