METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

Volume 3 1936 Part 13

I.—PROPERTIES OF METALS

(Continued from pp. 487–503.)

***Mechanical Properties of Aluminium and Its Alloys After Prolonged Heating.** A. von Zeerleder and R. Irmann (*J. Inst. Metals*, 1936, 59, 111–124; discussion, 125–127).—The strength of pure aluminium and various aluminium alloys was investigated after heating for long periods at 75°–300° C. The strength properties of the same materials were determined also in the state of complete stabilization. The heating periods employed extended over approximately 2 years. After treatments of different duration at elevated temperatures, some specimens were cooled and tested at room temperature; others were tested at the treatment temperature. For complete softening at 250° C., for instance, to obtain the properties observed in completely stabilized samples, heating periods of at least 6 months are required in the case of pure aluminium and Anticorodal, and of more than 2 years for Avional and " Y " alloy. A still longer heating time is necessary in the case of the alloy " R.R. 59." To determine the decrease in strength of any material after heating for long periods at elevated temperatures it is necessary, therefore, to carry out tests of long duration. The values of the yield-point observed in the normal short time test after heating periods of 1 year form a basis for calculations for engineers. The permissible loads can be found only by observation of the creep limit, and this property is being studied by the authors.—A. v. Z.

***The Conductivity of Super-Purity Aluminium: The Influence of Small Metallic Additions.** Gaston G. Gauthier (*J. Inst. Metals*, 1936, 59, 129–146; discussion, 147–150).—This paper deals with the effect on the conductivity of super-purity aluminium (exceeding 99·99%) of additions of those elements which may occur as impurities in commercial aluminium. It is shown that aluminium follows the universal law that the conductivity and the temperature coeff. of conductivity both increase with the purity: Matthiessen's Law has been confirmed. The data presented in this paper on the effect of small additions on the conductivity of aluminium are of value in that they have been determined under favourable experimental conditions, owing to the extreme purity of the basis metal and the large amount which has been available. This high purity has made it possible to determine, with a stated accuracy, the effect of each one of the added elements in the almost complete absence of other impurities. Further, the figures given for iron and silicon, for these elements with titanium and vanadium, and for magnesium and silicon, make it possible to calculate the conductivity of aluminium of accurately known purity. Norbury's Law does not appear to hold in the case of aluminium.—G. G. G.

The Influence of Thermal Expansion on the Electrical Resistance of Conductors, and its Influence on Measurements of Temperature–Resistivity Coefficients [of Aluminium]. O. Scarpa (*Alluminio*, 1934, 3, (2), 63).—The error introduced into determinations of the temperature–resistivity coeff. of aluminium by the thermal expansion of the material is shown to be considerable, and S. emphasizes the desirability of stating whether or not the necessary correction has been applied if the above coeffs. are to be given.
—P. M. C. R.

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* Denotes a paper describing the results of original research.
† Denotes a first-class critical review.

***On the Average Value to be Given to the Temperature Coefficient of the Electrical Resistance of Aluminium Conductors.** O. Scarpa (*Alluminio*, 1935, 4, (3), 145–148).—Various attempts were made by the International Electrotechnical Commission to fix the value of this coeff. Accurate measurements were made by S., and the value suggested for aluminium conductors in the as drawn state is + 0·00405. The resistance of an aluminium conductor can be obtained therefore by the equation: $r_t = 2{\cdot}840[1 + 0{\cdot}00405(t - 20)]\frac{l_{20}}{S_{20}}$, where 2·840 is the resistivity at 20° C. of drawn aluminium; l_{20} and S_{20} being, respectively, the length in cm., and average cross-sectional area in cm.^{2} at 20° C. For aluminium conductors treated for 4 hrs. at 250° C. the suggested value is + 0·00410, and the resistivity can be obtained, therefore, from the equation: $\rho_t = 2{\cdot}777[1 + 0{\cdot}0041(t - 20)]$. The resistivity of annealed aluminium at 20° C. is 2·777. From experiments carried out in the same laboratory on Italian aluminium, it was found that the average specific weight of aluminium conductors in the annealed state is greater than that for the non-treated metal. The average specific weight at 20° C. of non-treated drawn aluminium is 2·705, and for the same material treated 4 hrs. at 250° C. is 2·709.—J. K.

***Electrical and Optical Investigation of the Transformation from Non-Metallic to Metallic Antimony.** R. Suhrmann and W. Berndt (*Physikal. Z.*, 1936, 37, (5), 146–149).—Experiments are described in which the changes of electrical resistance and optical absorption of thin films of antimony were used to show the transformation from amorphous to metallic antimony. The films, which were prepared by condensation at liquid air temperature in a vacuum, have high resistances and temperature coeff. of resistance compared with the metal; after heating to a temperature which depends on the thickness and is between 270° and 320° A., they become normal in respect of both resistance and optical absorption. The films were from 15 to 109 mμ thick.—B. C.

***The Vapour Pressure of Barium.** J. A. M. van Liempt (*Rec. trav. chim.*, 1936, 55, (6), 468–470).—[In German.] Formulæ are given for the vapour pressure and velocity of vaporization of barium *in vacuo*. Values obtained by Hartmann and Schneider for the latent heat of vaporization, boiling point, and Trouton's const. are considered to be too high.—E. J. G.

***The Influence of Oxygen, Carbon Dioxide, Nitrogen, and Mercury on the Photoelectric Effect of Barium and Potassium.** A. V. Afanasieva and Yu. I. Lun'kova (*Zhurnal Tehnicheskoy Fiziki* (*J. Tech. Physics*), 1935, 5, 1000–1006).—[In Russian.]—S. G.

†Properties and Alloys of Beryllium. Louis L. Stott (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, 122, 57–73).—See *Met. Abs.*, this vol., p. 440.—S. G.

***The Magnetic Properties of Bismuth.** David Shoenberg (*Abstracts of Dissertations Univ. Cambridge*, 1935–1936, 120–121).—The magnetic susceptibility of bismuth was measured by the Faraday method. Above 50° K. the magnetization-field curve is linear; below this temperature it is more complicated, as already noted by de Haas and van Alphen. Details of both the normal and the de Haas–van Alphen effect, and also the influence of small additions of lead and tellurium have been investigated. The transverse magnetostriction of single crystals was measured, and the results, with Kapitza's earlier longitudinal data, give a complete scheme of magnetostriction moduli. The effect of foreign atoms and that of temperature cannot be explained by change of lattice dimensions. It is concluded that the theories of Jones and Peierls provide too simple a picture of the electronic structure of bismuth.—A. G. D.

***The Hall Effect in a Circular Bismuth Plate.** L. Howard Petersen (*Proc. Indiana Acad. Sci.*, 1935, 45, 214–215).—Volterra (*Nuovo cimento*, 1915, 9, 23) developed a Principle of Reciprocity for the Hall effect in a circular plate. Alimenti (*Nuovo cimento*, 1915, 9, 109, and 1916, 11, 217) extended the principle. Let the current enter and leave a circular plate at the mid-points of perpendicular radii; Alimenti found four points on the plate where the potential difference between the points in all combinations of 2's is the same when the field is excited. P. failed to confirm A.'s results in the case of a circular bismuth plate. A special case occurs when the current-carrying electrodes are situated on the circumference of the plate. This is V.'s so-called "theorem of four vertices." This theorem is confirmed by P.—J. S. G. T.

The Normal Cathode Potential Drop at the Melting Point in Bismuth. H. Kurzke (*Ann. Physik*, 1936, **25**, 688–696).—The dependence of cathode drop on temperature was investigated by a measurement of the variation of cathode potential and temperature simultaneously during cooling. It is shown that the cathode drop increases by about 2 v. on solidification for bismuth, while for tin and lead it decreases. The change in electron emission work is related to the figures obtained for the cathode drop.—B. C.

***The Vapour Pressure of Cæsium.** J. A. M. van Liempt (*Rec. trav. chim.*, 1936, **55**, (3), 157–160).—[In German.] At 300°–1000° abs. the vapour pressure of cæsium is given by the expression :—$\log p$ (mm.) $= -(3701/T) + 6{\cdot}62$, and the rate of sublimation at 270°–300° abs. by the expression: $\log p = -(3813/T) + 5{\cdot}74 + \frac{1}{2}\log T$.—A. R. P.

***Atomic Weight of Calcium in Old Potassium-Rich Minerals.** W. W. Smith and T. Tait (*Proc. Roy. Soc. Edinburgh*, 1933–1934, **54**, (1), 88–101).—Values of 40·089 and 40·092 were found for calcium extracted from two different sources.—S. G.

***The Diffusion of Water Vapour through Copper.** J. H. de Boer and J. D. Fast (*Rec. trav. chim.*, 1935, **54**, (12), 970–974).—[In German.] At 800° C. the rate of diffusion of water vapour through 1 cm. of copper is $1{\cdot}9 \times 10^{-12}$ mol./cm.^{2}/second/atm. compared with a value of 23×10^{-12} mol./cm.^{2}/second/atm.$^{\frac{1}{2}}$ for hydrogen. Nitrogen does not diffuse through copper under these conditions. Water vapour does not diffuse through chromium–iron alloys, whereas nitrogen diffuses at the rate of $> 6{\cdot}9 \times 10^{-12}$ mol./cm.^{2}/second/atm.$^{\frac{1}{2}}$.—A. R. P.

***The Reaction of Atomie Hydrogen and Metallic Copper.** Francis A. McMahon and Peter L. Robinson (*J. Chem. Soc.*, **1934**, (June), 854–855).—Atomic hydrogen passed at the rate of 0·5 litre/hr. over copper which has been oxidized and reduced, or roughened, gives a black Cu^{I} hydride soluble in 70% hydrochloric acid in absence of air.—S. G.

***Effect of Time on Tensile Properties of Hard-Drawn Copper Wire.** Albert J. Phillips and A. A. Smith, Jr. (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (II), 263–273; discussion, 274–275).—The object of this paper is to show the effect of time on the flow of hard-drawn copper wire under sustained loads. An accurate determination was also made of the modulus of elasticity for both soft and hard-drawn copper wires. Test wires were fastened by swivel clamps at the top, threaded through brass tubing and dead weights suspended at the bottom by means of suitable clamps. Determination of strain was made with a portable microscope, measuring the distance between a knife edge at the bottom of the brass tubing and another knife edge on a small sleeve threaded over the wire. The gauge-length was 60 in. and the accuracy was ± 0·000004 in. per in. From the data obtained it is concluded that: (1) hard-drawn copper wire will creep at room temperature for many days even under loads of only 50% of the tensile strength; (2) the creep characteristics of different copper wires are similar for a given percentage of their respective tensile strengths; (3) creep characteristics are similar for intermittently and continuously loaded wires for tensile loads not exceeding 78% of the tensile strength; (4) the modulus of elasticity of certain hard-drawn copper wires is 18,000,000 lb./in.^{2} ± 400,000 lb./in.^{2}; (5) the modulus of elasticity of certain annealed copper wires is 13,400,000 lb./in.^{2} ± 500,000 lb./in.^{2}.—S. G.

***Principal Elastic Constants of Single Crystals of Copper, Gold, and Lead.** E. Goens (*Physikal. Z.*, 1936, 37, (9), 321–326).—An account is given of measurements of the principal elastic constants of copper, gold, and lead, using a previously described dynamical method. The values of the constants are given in detail.—B. C.

***Resistometrical Method for Determination of the Electrothermic Homogeneous Effect and Gas Ion Effect [Copper; Platinum].** C. Benedicks, C. W. Borgmann, and P. Sederholm (*Arkiv Mat. Astron. Fysik*, 1935, [A], 25, (9), 1–28).—[In English.] A resistometric method is introduced for the determination of the electrothermic homogeneous effect in metal wires. The method has been used on wires exposed to a gas atmosphere of definite low pressure. It is based on the use of a Wheatstone bridge, the indications of which are dependent on the direction of the current. Copper gave very regular results, of correct sign, at about 26° C.; a variation of pressure between 10^{-5} and 10^{-1} was found to exert a rather weak influence on the constant of the effect. This proves the method to be reliable. In platinum certain irregularities were observed which depend on the pressure of the gas surrounding the test wire. It is necessary to distinguish between (*a*) the electrothermic homogeneous effect of gas-free platinum, being negative ("metal effect"), and (*b*) an electrothermic homogeneous effect depending on gas ions, causing a positive effect ("gas effect"). In copper the electrothermic homogeneous effect was likewise found to some extent to be dependent on the gas pressure. —S. G.

***Paramagnetism of Metallic Gadolinium Above Its Curie Point.** Felix Trombe (*Compt. rend.*, 1935, 201, 652–653).—The specific susceptibility, χ, of gadolinium was determined from 16° to 360° C. The paramagnetic and ferromagnetic Curie points are at 29·5° and 16° C., respectively.—S. G.

***On the Electrical Resistance of Gold at Low Temperatures in Transverse Magnetic Fields.—I., II.** E. Justi and H. Scheffers (*Physikal. Z.*, 1936, 37, (10), 383–384; (13), 475–481). (I.—) In spite of the cubic structure of gold, the orientation of the crystal axis to the applied magnetic field has a considerable influence on the resistance. Curves are given showing this angular dependence of the ratio of the resistance with and without a magnetic field (21·7 kilogauss) at 20·38° and 14·0° abs. (II.—) The previously described anisotropy of gold crystals at low temperatures with respect to electrical resistivity in transverse magnetic fields is further investigated. It is shown that the ratio by which the resistance changes owing to a magnetic field depends on the angle between the crystal axes and the direction of the field.—B. C.

***The Magnetic Properties of Lanthanum, Cerium, and Neodymium.** F. Trombe (*Compt. rend.*, 1934, 198, 1591–1593).—The metals contained not more than 0·05% silicon and 0·02% iron; they were tested at 16° C. in different fields. At 3000 gauss the values found for the magnetic susceptibility $\chi \times 10^6$ were: lanthanum 1·21, cerium 17·94, neodymium 39·48. Curves of variation of $1/\chi$ with temperature show that there is a slight decrease of the susceptibility of lanthanum and cerium with stronger fields, but that of neodymium is practically constant. There are two states of cerium between 100° and 200° K. For lanthanum and cerium there are slight discontinuities at 110° and 109° K., respectively.—S. G.

***Some Creep Tests on Lead and Lead Alloys.** Albert J. Phillips (*Proc. Amer. Soc. Test. Mat.*, 1936, 36, (II), 170–182; discussion, 183–193).—Creep test data on lead and lead alloys from tests of 3 years' duration are presented to show that it is unsafe to extrapolate creep rates calculated from short-time tests. Many alloying elements which increase the tensile strength of lead decrease the resistance to creep under low loads. Copper added to lead improves the creep resistance very markedly. Antimony decreases the creep resistance except in the age-hardened condition where the elongation under fairly high tensile loads is practically nil. Such a metal will fracture, however, without flow under sustained loads, making it difficult, if not impossible, to calculate a safe working stress. Tin likewise decreases the creep resistance of lead, but in the heat-treated condition the alloy shows excellent creep resistance without serious loss in ductility. Tellurium added to lead decreases its creep resistance under low loads in both the hard-rolled and the annealed conditions.—S. G.

The Effect of Prolonged Tension on Lead and Its Alloys. H. Shimba (*Denki Gakkwai Zasshi* (*J. Inst. Elect. Eng. Japan*), 1936, 56, (5), 593–594).—[In Japanese.]—S. G.

***Relation between Field Strength and Magnetic Induction for Superconducting Lead.** J. N. Rjabinin and L. W. Schubnikow (*Physikal. Z. Sowjetunion*, 1934, 6, (6), 557–568; *Sci. Abs.*, 1935, [A], 38, 439).—[In German.] Two different methods of measuring the magnetic induction of superconductors for different fields and temperatures are described in detail. At the temperature of 4·24° K. the dependence of the magnetic induction of superconductors on the field was investigated, and an abrupt increase in the induction from $B = 0$ to $B = H$ was found in general at the transition from the superconducting state. In the reverse process there is also an abrupt change of induction for the same fields. The process is not reversible, but is accompanied by marked hysteresis.—S. G.

***Methods for Obtaining Magnesium Single Crystals from a Melt.** M. D. Mochalov (*Zhurnal Tehnicheskoy Fiziki* (*J. Tech. Physics*), 1936, 6, (4), 605–607).—[In Russian.] A full description is given of the method of production of magnesium single crystals (5 × 7 × 150 mm.) in an iron mould placed horizontally in the furnace.—N. A.

***Constants of Elasticity, Electrical Resistance, and Thermal Expansion of Magnesium Crystals.** E. Goens and E. Schmid (*Physikal. Z.*, 1936, 37, (11), 385–391).—By measurements on single-crystal rods of magnesium of different crystallographic orientations, the authors determined the principal constants of elasticity and the principal values of the specific resistance at room temperature, the relative electrical resistance values $\left(\frac{R\,t^\circ\text{ C.}}{R\,0^\circ\text{ C.}}\right)$ in the region + 100° to − 269° C., and the principal values of the thermal expansion in the range + 200° to − 253° C. The experimental results are discussed in comparison with the corresponding values for zinc and cadmium.—P. W. R.

***Investigations on the Nitriding of Magnesium and Aluminium.** P. Laffitte, E. Elchardus, and P. Grandadam (*Rev. Indust. minérale*, **1936**, (375), 861–867).—The temperature of incipient nitriding of magnesium by nitrogen is shown to depend on previous exposure to air in addition to the usual conditions of pressure, rate of heating, &c. The nitriding curve obtained when ammonia was used showed a break at 275° C., corresponding with an anomaly in the temperature–resistivity curve of magnesium, and it is suggested that an allotropic transformation of the metal may occur. A similar break in the case of aluminium is attributed to impurities. Nitriding–speed curves at different temperatures are given for both metals. The nitriding temperature range for aluminium in ammonia is restricted by the dissociation of the product, which begins at 265° C.—P. M. C. R.

Theory of Constant Paramagnetism. Its Application to Manganese. Louis Néel (*Compt. rend.*, 1936, 203, (4), 304–306).—Cf. *Met. Abs.*, this vol., p. 201. Extended generalizations derived from N.'s previous demonstrations of susceptibility independent, at low temperatures, of temperature. Excellent agreement is obtained in the case of manganese between theoretical and experimental results.—E. J. G.

***Optical Examination of Thin Films. I.—Optical Constants of Mercury.** Leif Tronstad and C. G. P. Feachem (*Proc. Roy. Soc.*, 1934, [A], **145**, 115–

126).—The values of the optical constants of mercury were measured for λλ 4350, 5460, and 5780 A.; they are discussed in relation to previously published values for wave-lengths in the visible region of the spectrum.
—S. G.

***The Electrical Conductivity of Thin Metal Films, Particularly of Molybdenum Films.** J. H. de Boer and H. H. Kraak (*Rec. trav. chim.*, 1936, **55**, (9/10), 941–953; and *Laboratoria N.V. Philips' Gloeilamp. Eindhoven, Separaat* **1142**, 1936).—[In German.] An investigation of the conductivity of sputtered molybdenum films as dependent on film thickness, and with the glass basis surface at different temperatures, both during sputtering and during measurement of conductivity. At all temperatures below the maximum to which the film has been subjected, variations with temperature are practically reversible; above the maximum, however, the conductivity increases irreversibly. The theory evolved resembles that of Wilson for semi-conductors.—E. J. G.

***The Evaporation of Nickel in a Vacuum.** George Bryce (*J. Chem. Soc.*, **1936**, (Oct.), 1517–1518).—From experiments on the rate of evaporation of nickel atoms from a filament heated at 1318°–1602° abs. in a high vacuum (10^{-5} mm. of mercury) the energy of vaporization of nickel atoms is deduced to be 85 kg.-cal. If c is the condensation coeff. of nickel atoms on a nickel surface at $T°$ abs. and p is the vapour pressure of nickel in mm. of mercury, then it can be shown that $\log_{10}(cp) = 9{\cdot}148 - 2{\cdot}00 \times 10^4/T$.—A. R. P.

***The Rate of Adsorption of Ethylene by Silica and Nickel.** E. W. R. Steacie and H. V. Stovel (*J. Chem. Physics*, 1934, **2**, (9), 581–584).—The adsorption of ethylene by reduced nickel was studied from − 80° to 150° C. Definite slow effects and temperature hysteresis were observed. Since diffusion into the crystal lattice (" solubility ") is extremely unlikely in this case, more definite conclusions can be reached than have been possible in previous investigations.—S. G.

***The Modulus of Torsion of Magnetized Nickel at High Temperatures.** W. Möbius (*Physikal. Z.*, 1934, **35**, 806–811; *Sci. Abs.*, 1934, [A], **37**, 1245).—A continuation of work described in an earlier paper (*Met. Abs.* (*J. Inst. Metals*), 1932, **50**, 419). Greater field strengths were employed and more accurate temperature measurements made, particularly in the region of the Curie point.—S. G.

***The Magnetic Behaviour of Nickel at Temperatures up to the Curie Point.** W. Schnabl (*Ann. Physik*, 1936, **27**, (2), 169–185).—The dependence of magnetic losses on frequency is shown to be marked between 0·50 and 500 Hz, while between 50 and 500 Hz amplitudes depend strongly on frequency. Differences observed cannot be attributed to eddy current losses. At higher temperatures the frequency effects decrease markedly, and partially vanish.
—E. J. G.

†*Resistance, Spontaneous Magnetization, and Curie Point of Nickel. W. Gerlach, H. Bittel, and S. Velayos (*Sitzber. math.-naturw. Abt. bayer. Akad. Wiss. München*, **1936**, 81–136; *C. Abs.*, 1936, **30**, 7401).—The results of many investigations on the magnetic and electrical properties of various specimens of nickel are reviewed, and anomalies in the resistance are correlated with changes in magnetic properties. The paper is divided into 6 sections. (I.—) The resistance–temperature curves of samples of nickel of varying purity are considered, and it is shown that by the application of Matthiessen's addition rule these can all be reduced to the r-T curve for purest nickel ($r_t = R_t/R_0$). (II.—) Describes in detail new experiments of the highest precision by B. and V. on the resistance of nickel of various purities in the range − 200° to + 600° C. (cf. *Met. Abs.*, this vol., p. 194). These results confirm the validity of the deductions of Section I. (III.—) The general validity of the quantitative interdependence of the resistance anomaly and the square of the spontaneous magnetization is shown, as well as that the proportionality const. is independent of the purity. (IV.—) A discussion is given of an interpretation of the resistance anomaly proposed by Borelius (*Ann. Physik*, 1931, 8, 261), whose "reduced resistance" is contradicted by the experimental data. (V.—) Consideration of the resistance anomaly demonstrates that an inner spontaneous magnetization can be detected far above the temperature hitherto taken as the Curie point. (VI.—) Experimental data collected in this section demonstrate that nickel gradually loses its spontaneous magnetization, and with it also the possibility of ferromagnetic magnetization, first far above the previously assumed Curie point.—S. G.

***Temperature Variation of the Structural Demagnetizing Factor in Nickel and Cobalt.** Théodore Kahan (*Compt. rend.*, 1934, **199**, 349–351).—S. G.

***Ferromagnetic Curie Points for Electrodeposited Nickel Films.** S. Procopiu and T. Farcas (*Compt. rend.*, 1934, **198**, 1983–1985).—See *Met. Abs.*, this vol., p. 194.—S. G.

***The Behaviour of Hydrogen Dissolved in Palladium.** K. F. Herzfeld and Maria Goppert-Mayer (*Z. physikal. Chem.*, 1934, [B], 26, (3), 203–208).—S. G.

The Interpretation of the Dissociation Pressures of the Palladium–Hydrogen System. Max H. Hey (*J. Chem. Soc.*, **1935**, (Sept.), 1254–1258).—Cf. Hey, *Met. Abs.*, this vol., p. 493. An equation developed from simple kinetic theory is shown to give a reasonably satisfactory account of the dissociation pressures of the palladium–hydrogen system, on the assumption that there is only one phase present throughout. The limiting composition of the system is PdH, which possibly has a sodium chloride type structure. The equation is probably a first approximation to the truth.—S. G.

***The Dependence of the Modulus of Elasticity, Elastic Limit, and Ultimate Strength of Palladium on the Hydrogen Content.** F. Krüger and H. Jungnitz (*Z. tech. Physik*, 1936, **17**, (9), 302–306).—The modulus of elasticity, elastic limit, and ultimate strength of a palladium wire are shown first to undergo a small initial increase and then to decrease almost in proportion to the gas content, up to the limit of saturation. The increase coincides with absorption in the atomic form, the subsequent decrease with the entry of molecular hydrogen.—E. J. G.

Expansion Pressures of Metallic Hydrogen and Deuterium. A. R. Ubbelohde (*Nature*, 1936, **138**, (3498), 845).—Differences in the expansion of the space-lattice of palladium when alloyed with metallic hydrogen and deuterium are adduced as evidence that the hydrogen in certain metallic hydrides exists in the metallic state.—P. M. C. R.

***Electronic Specific Heat in Palladium.** G. L. Pickard (*Nature*, 1936, **138**, (3481), 123).—The specific heat of palladium was measured between 2·5° and 22° K., and the results are considered in terms of the electronic theory of Mott. An expression is given for the specific heat in the range named.—B. C.

†Metals of the Platinum Group. Ores, Recovery and Refining, Fabrication and Uses, and Properties. R. H. Atkinson and A. R. Raper (*J. Inst. Metals*, 1936, **59**, 179–206; discussion, 207–210).—An attempt is made to present up-to-date metallurgical information about the 6 metals of the platinum group. After a brief description of the discovery of the metals and an account of the ores, particular attention is devoted to the recovery and refining of the metals produced from the Canadian nickel industry. This is followed by a full description of the methods of fabrication of the metals and their alloys. It is shown that the two ductile metals of the group, platinum and palladium, are readily worked, while rhodium and iridium are worked with much greater difficulty. The two metals osmium and ruthenium, belonging to the hexagonal system, have not up to the present been thoroughly investigated. Finally, an account is given of the properties of the metals and their uses.—R. H. A.

***The Adsorption of Oxygen on Platinum, Iron Oxide, and Chromium Oxide.** Bernhard Neumann and Erich Goebel (*Z. Elektrochem.*, 1934, **40**, 754–764).—

The adsorption of oxygen on platinum was measured over the range 20° to 400° C. The isobar for oxygen on platinum increased with increasing temperature between 20° and 300° C. and decreased at higher temperatures. A comparison is made of the measured values with the equations of Freundlich and of Langmuir; the agreement for both equations is good for platinum and iron oxide; for chromium oxide the Langmuir equation gives the better agreement.—S. G.

***The Kinetics of the Adsorption of Hydrogen and Deuterium by Platinum.** Edward B. Maxted and Charles H. Moon (*J. Chem. Soc.*, **1936**, (Oct.), 1542–1546).—The early stages of adsorption of hydrogen and deuterium by platinum closely follow an equation of the type $\log a/(a - x) = kt^n$, in which a is the saturation capacity. For hydrogen $k = 0{\cdot}0955$ and $n = 0{\cdot}326$ and nk (which is a true measure of the rate of adsorption) is 0·0311 at 18° C. The ratio of the values for nk for hydrogen and deuterium is 1·4–1·5.—A. R. P.

***The Catalytic Properties and Structure of Metal Films. II.—The Electrical Condition of Platinum Films.** G. I. Finch and A. W. Ikin (*Proc. Roy. Soc.*, **1934**, [A], **145**, 551–563).—The surface potentials and rates of charging-up of sputtered platinum films in contact with electrolytic gas at room temperature were determined, and the film structures examined by electron diffraction. Electrically active films were also catalytically active, whilst electrically neutral films were inert as catalysts. The rates at which active films promoted the union of oxygen and hydrogen were directly proportional to their rates of charging-up. With the more active films, the crystals were arrayed at random, whereas with inactive films a considerable proportion of crystals possessed a common direction of orientation. The diffuse background in electron diffraction patterns obtained from active films increased in intensity with increasing activity. Heating rapidly destroyed the latent activity of a film, and when sufficiently prolonged also broke down the crystal structure. From these facts in conjunction with those set forth in Part I (*Met. Abs.* (*J. Inst. Metals*), **1933**, **53**, 611) it is concluded that, under the conditions of the experiments: (1) catalytic action was determined by a prior interaction between the surface and one or both constituents of the combining mixture, whereby the catalyst became electrically charged; (2) activity was not determined by either crystal size or orientation; (3) catalytic activity may have been centred around atoms of platinum not forming part of any ordered array or structure.—S. G.

***Variations of the Resistance of a [Platinum] Metallic Conductor of Small Volume.** J. Bernamont (*Compt. rend.*, **1934**, **198**, 2144–2146).—Measurements were made of the variations of resistance of a platinum wire of 1 μ diameter towards currents of frequencies up to 8 kc.—S. G.

***Conductivity of Thin Metallic Films [Gold; Platinum] in an Electrostatic Field.** E. Perucca (*Atti R. Accad. Sci. Torino*, **1934**, **69**, (1), Disp. 2, 166–170; *Sci. Abs.*, **1934**, [A], **37**, 717).—Metallic films of gold and of platinum deposited on quartz, having a resistance comprised between $\sim 10^{12}$ and $\sim 10^{10}$ ohms, have shown a conductivity strongly variable in a reversible manner with the electrostatic charge. The effect consists always in an increase of the conductivity by the action of the external field, whatever may be the sign of the charge. Increases of conductivity up to 40% have been observed.—S. G.

***Paramagnetic Susceptibility of Colloidal Powder of Platinum.** Noboro Takatori (*Sci. Rep. Tôhoku Imp. Univ.*, **1936**, [i], **25**, (3), 489–503).—[In English.] See abstract from journal published in Japanese, *Met. Abs.*, this vol., p. 239.—S. G.

***The Optical Constants of Potassium.** Herbert E. Ives and H. B. Briggs (*J. Opt. Soc. Amer.*, **1936**, **26**, (6), 238–246).—The method of Voigt was used for determination of the optical constants for the ultra-violet region. Potassium was condensed on a quartz plate and covered with glass, the metal being subsequently melted to give complete contact. Data are given showing variation in reflecting power of the metal over the range 2500–6000 A. and calculated transmission for thicknesses of metal of 1·25 to $7 \cdot 5 \times 10^{-5}$ cm. The transmission falls rapidly above a wave-length of 3000 A.—R. G.

***Atomic Work-Function of Tungsten for Potassium.** R. C. Evans (*Proc. Roy. Soc.*, 1934, [A], **145**, 135–144).—S. G.

Magnetochemistry of Rhenium. Nicolas Perakis and Léandre Capatos (*J. Phys. Radium*, 1935, **6**, (11), 462–468).—Cf. *Met. Abs.*, this vol., p. 239.
—S. G.

***Transparency of Sodium and Potassium Films in the Schumann Region.** W. H. Watson and D. G. Hurst (*Nature*, 1936, **138**, (3481), 124).—The transparency of thin films of sodium and potassium in the far ultra-violet was determined. It is pointed out that the results conflict with the theory of the optical properties of metals.—B. C.

Calculated and Experimental Photoelectric Emission from Thin Films of Potassium. Herbert E. Ives and H. B. Briggs (*J. Opt. Soc. Amer.*, 1936, **26**, (6), 247–250).—Experimental data supported the theory of Ives respecting photoelectric emission from thin films. In view of this, it is concluded that the occurrence of spectral maxima of emission with bulk alkali metals must be regarded as actually thin film phenomena.—R. G.

***The Catalytic and Electrical Properties of Metallic Surfaces. I.—A Silver Surface Catalyzing the Combustion of Carbonic Oxide.** B. W. Bradford (*J. Chem. Soc.*, **1934**, (Sept.), 1276-1283).—S. G.

***Changes of Resistance of Metallic Films Due to Charging [Silver, Gold, Copper, Bismuth].** Alexander Deubner (*Ann. Physik*, 1934, **20**, 449–462).

***A New Interference Phenomenon in the Passage of Fast Electrons Through Crystals [Silver].** F. Kirchner and H. Lassen (*Ann. Physik*, 1935, **24**, 113–123).—A new type of crystal lattice interference has been found in the study of thin silver layers. The interference points form a cross. This phenomenon is ascribed to the irradiation of many small silver crystals, which are spread on the surface, oriented exactly parallel.—S. G.

***Dispersion of the Phase Change for Reflection of Light from Thin Metallic Layers [Silver, Gold, Platinum].** J. Bauer (*Ann. Physik*, 1934, **20**, (5), 481–501).—Thin layers of silver, gold, and platinum were produced partly by cathodic sputtering and partly by vaporization in high *vacuo*, and the measurements in the visible region were made by modifying Fabry and Buisson's method. There is a close connection between the phase change and the absorption coeff. The two modifications of silver found by Fabry and Buisson were shown to be identical with those of Ritschl. With non-homogeneous layers the phase change is not the same at different points. A theoretical study shows that the dependence of the phase change on wave-length is due to reflection within the metallic layers at the boundary surface. Thus, while formerly the interference phenomena with the Fabry–Perot grating were considered as a two-surface problem (Airy formula) they are conceived here as a four-surface problem. It provides for the different metals the relation of phase change and wave-length found experimentally.—S. G.

***The Energy Distribution of Photoelectrons from Sodium.** A. G. Hill and L. A. DuBridge (*Phys. Rev.*, 1936, [ii], **49**, (11), 877).—Abstract of a paper read before the American Physical Society.—S. G.

***The Creep of Tin and Tin Alloys.—I.** D. Hanson and E. J. Sandford (*J. Inst. Metals*, 1936, **59**, 159–176; discussion, 176–178).—Describes results of creep tests of long duration on tin and some of its alloys in the rolled condition. Silver up to 3·5% greatly improves the creep-resistance of tin. Bismuth–tin alloys are more resistant to flow than pure tin at stresses above about 300 lb./in.^{2}, but at lower stresses they are inferior to pure tin. Antimony improves the creep properties of tin: the alloy containing 8·5% antimony withstands a stress 3 times that of pure tin for an equal duration. Cadmium-tin alloys are greatly improved by heat-treatment and offer considerable resistance to creep. The mechanism of failure of these alloys is discussed. Results are given of tests on lead–tin solders and on the cadmium–tin eutectic alloy: these flow under stresses as low as 130–150 lb./in.^{2}. It is shown that in many cases there is no relationship between resistance to creep and ultimate tensile strength.—D. H.

***A Relation between Heat of Transition and Transition Point of Enantiotropic Modifications [Tin].** J. A. M. van Liempt (*Rec. trav. chim.*, 1935, 54, 934–936; *Brit. Chem. Abs.*, **1936**, [A], 276).—[In German.] An equation is derived connecting heat of transmission with temperature, and the atomic frequencies and densities of the modifications at the transition temperature. Direct confirmation is lacking, owing to absence of data, but by substituting the ratio of the atomic frequencies by the ratio of the absolute temperature at which the forms have equal specific heats, the calculated transition temperatures for tin and sulphur are of the same order as the experimental values. —S. G.

***The Adsorption of Hydrogen on Tungsten.** W. Frankenburger and A. Hodler (*Naturwiss.*, 1935, 23, (35), 609).—The phenomena of "activated adsorption" are studied for hydrogen on tungsten; they are shown to be non-existent if both materials are extremely pure, and it is suggested that they depend on "fractional self-purification" of the metallic surface in the presence of small amounts of oxygen and organic compounds. Adsorption isobars for pure tungsten are reproduced, as are the curves previously obtained by Taylor.—P. M. C. R.

***Adsorption of Nitrogen on Tungsten.** J. K. Roberts (*Nature*, 1936, **137**, (3468), 659–660).—It is shown that the adsorption of small quantities of nitrogen on tungsten takes place rapidly, provided that the quantity of nitrogen is less than sufficient to cover the surface of the wire.—B. C.

Tungsten–Thorium Problem. II.—The Anomalous Activation. E. Chalfin (*Physikal. Z. Sowjetunion*, 1934, 5, (6), 838–847).—[In German.] The anomalies of the activation of thoriated tungsten are caused by fluctuations of the distribution of thorium atoms on the surface of the tungsten. The electron emission from a thoriated tungsten surface depends not only on the number but also on the distribution of the thorium atoms on the surface. Calculation of the surface covered is possible only when the activation curve is normal; in the abnormal region larger values than the true value of the surface covering are obtained.—S. G.

***Picture of the [Electron] Emission Process from Thoriated Tungsten and Thoriated Molybdenum.** E. Brüche and H. Mahl (*Z. tech. Physik*, 1935, 16, (12), 623–627; 1936, 17, (3), 81–84; (8), 262–266).—In the first two papers of this series the electron microscope has been applied to obtain pictures of details shown by the surface of thoriated tungsten during the processes of electron emission. Phenomena associated with the processes of heating, reduction, activation, and de-activation are observed and discussed in considerable detail. The thorium metal is not uniformly dispersed throughout the superficial crystal lattice of the supporting tungsten metal but occurs at a number of discrete points of the surface, and can migrate over the surface. In the third paper it is shown that the process and mechanism of electron emission are the same from thoriated molybdenum as from thoriated tungsten. —J. S. G. T.

***The Properties of Metallic Uranium.** H. A. Mayor (*Abstracts Dissertations Dr. Phil. Univ. Oxford*, 1936, 8, 118–119).—The atomic heat of uranium, measured between 30° and 60° abs., is in agreement with theory. At higher temperatures, however, the measured values increase above the theoretical value, and appear to continue to increase, reaching the value of 6·7 cal. at 60° C.—C. E. R.

***Growth of Crystals of Zinc Containing Cadmium by the Czochralski-Gomperz Method.** Harold K. Schilling (*Physics*, 1935, **6**, (3), 111–116).—In previous experiments it was found impossible to duplicate results of Hoyem and Tyndall (*Phys. Rev.*, 1929, **33**, 81), who found a "range" for the successful growth of single crystals of zinc. Most specimens were "optically mosaic." It is now shown that, by adding cadmium to zinc of highest purity, single crystals can be grown, and that a "range" is connected with their growth. The range is similar to, but not identical with, that of Hoyem and Tyndall. Moreover, the shape of the range is dependent on the cadmium content and on the speed of growth of the crystals. Optical mosaics as well as the changes of Hoyem and Tyndall are found outside the range. In general, optical mosaics are less frequent the higher the cadmium content. Certain surface markings appear on the crystals even for only 0·20% cadmium; these are believed to be identical with markings previously described by Rosbaud and Schmid and by Straumanis, and probably indicate concentration of cadmium along basal planes.—S. G.

***Creep and Twinning in Zinc Single Crystals.** Richard F. Miller (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **122**, 176–190; discussion, 190–191).—See *Met. Abs.*, this vol., p. 343.—S. G.

***" Jump "-Like Deformation of Zinc Crystals.** E. S. Jakovleva and M. V. Jakutovich (*Zhurnal Tehnicheskoy Fiziki* (*J. Tech. Physics*), 1935, **5**, (10), 1744–1759).—[In Russian.] A survey is given of literature on "jump"-like deformation. A micro-study was carried out on zinc crystals of the distribution of deformation, corresponding to a series of consecutive jumps. Curves of individual and of a series of consecutive jumps during extension of zinc crystals were obtained photographically. The force diagrams of separate jumps were obtained graphically. Recovery curves of a stretched zinc crystal are given. On the basis of the experimental material, a theory of the process of "jump"-like deformation is evolved.—N. A.

***On the Energy States of Valency Electrons in Some Metals. I.—The Crystal Energy Levels of Valency Electrons in Zinc (1).** Mituru Satô (*Sci. Rep. Tôhoku Imp. Univ.*, 1936, [i], **Honda Anniv. Vol.**, 136–145).—[In English.] See abstract from journal printed in Japanese, *Met. Abs.*, this vol., p. 396.—S. G.

***The α–β Transition in Zirconium in the Presence of Hydrogen.** J. H. de Boer and J. D. Fast (*Rec. trav. chim.*, 1936, **55**, (5), 350–356).—[In English.] Hydrogen dissolves in both forms of zirconium and with increasing temperature the solubility decreases, but at the transformation point there is a sudden increase in solubility, the metal absorbing the gas during the transformation and then gradually losing it again as the temperature is increased further. The change in solubility is exactly reversible (see also following abstracts).—A. R. P.

***The α–β Transition with Mechanically Treated and with Untreated Zirconium.** J. H. de Boer, P. Clausing, and J. D. Fast (*Rec. trav. chim.*, 1936, **55**, (6), 450–458).—[In English.] Cf. abstracts above and below. The α–β transformation in pure zirconium occurs at 865° ± 10° C. Other values recorded by previous workers are shown to be due to absorption of gases from the air during mechanical working and annealing. The total radiation of light by β-zirconium is proportional to $T^{4\cdot7}$.—A. R. P.

***The Influence of Oxygen and Nitrogen on the α–β Transition of Zirconium.** J. H. de Boer and J. D. Fast (*Rec. trav. chim.*, 1936, **55**, (6), 459–467).—[In English.] Cf. preceding abstracts. Zirconium can dissolve up to 10 atomic-% of oxygen or nitrogen with corresponding widening of the α–β transformation range, the fully oxygen-saturated metal showing a range of from < 910° to > 1550° C. during which the β-phase with a low oxygen content is in equilibrium with the α-phase of high oxygen content. Zirconium containing oxygen or nitrogen shows considerable hysteresis effects in the temperature-electrical resistance curve, which are absent in the case of the pure metal.—A. R. P.

On the Change of the Resistance of Alkali Metals in a Magnetic Field. M. Koretz (*Physikal. Z. Sowjetunion*, 1934, 5, (6), 877–886).—[In English.] See *Met. Abs.*, 1934, 1, 93.—S. G.

The Ills of Metals. Epidemic and Contagious. Auguste Hollard (*Bull. Soc. d'Encour.*, 1936, **135**, (10 and 11), 593–608).—Season-cracking, season-cracking in tin, "tin pest," the attack of lead by Heller's solution, fatigue in lead, and fissures in steel rails are briefly described as examples of "diseases of metals." [*Note by Abstractor:* The intercrystalline attack of Heller's solution on lead is not now considered to produce an allotropic change.] —J. C. C.

Recent Research in Elasticity. J. N. Goodier (*J. Applied Mechanics*, 1936, **3**, A26–27).—A short review.—S. G.

Fractures in Metals and Brittle Materials. —— (*Nature*, 1936, **138**, (3481), 132–133).—Report of Discussion at the Royal Society. An account is given of a discussion on the problem of fracture. The discussion was opened by *H. J. Gough*, who pointed out the importance of work on single crystals, and that recent work showed that a type of recrystallization occurs under fatigue failure conditions. *G. I. Taylor* discussed the mathematical theory of internal flaws, and *L. N. G. Filon* dealt with the different types of fracture that occur in solids. *E. N. da C. Andrade* gave an account of evidence pointing to the importance of surface cracks in initiating failure. *W. H. Hatfield* discussed the effect of inclusions and grain-size on the mechanical properties of a metal. *B. P. Haigh* discussed the possibility of slip depending on the production of amorphous metal, and —— *Main* suggested that insufficient attention had been paid to speed and temperature of testing. *Sir Robert Hadfield* also discussed some aspects of the question of the speed of testing.—B. C.

***Random Fracture of a Brittle Solid.** C. C. Lienau (*J. Franklin Inst.*, 1936, **221**, (4), 485–494; (5), 673–686; (6), 769–787).—Brittleness is considered as an intensive property of a solid which depends, among other things, on temperature. The common conception of brittleness is made more precise by measuring the resistance to shattering by $u/3k$, where u is the ultimate static tension and k the bulk elastic modulus. A statistically homogeneous brittle solid is considered to fail along surfaces where the average positive tension becomes u. The average work of the boundary forces prior to fracture is that necessary to produce a homogeneous tension u in the solid. When fracture occurs, a stationary state is attained in a time short compared with the pre-fracture period. A mathematical theory of random fracture is developed, based on these conceptions, and employing certain distribution functions derived from Poisson's law of small numbers. Surface friction and plastic deformations are supposed negligible. Experimental results obtained in the fracture of 1200 brittle spaghetti rods agree with theoretical anticipations fairly satisfactorily. The theory is in accord with the experimental results of Martin (*Trans. Inst. Chem. Eng.*, 1926, **4**, 42), Gaudin, and Terada.—J. S. G. T.

***Strength of Metals in the Light of Modern Physics.** H. J. Gough and W. A. Wood (*J. Roy. Aeronaut. Soc.*, 1936, **40**, (308), 586–616; discussion, 616–621; also *Met. Ind.* (*Lond.*), 1936, **48**, (19), 532–536; and (summary) *Engineering*, 1936, **141**, (3672), 590).—Failures under static and fatigue stressing are studied with the aid of precise methods of X-ray diffraction. The effects of static tensile and torsional stressing, and also of 3 types of cyclic stressing, on specially prepared test-pieces of mild steel are described. Failure under static and fatigue stressing is associated with changes in the crystalline structure which are identical. These are (1) dislocation of the originally perfect grains into large components the orientations of which vary from that of the internal grain by amounts up to 2°; (2) the formation of "crystallites" about 10^{-4} to 10^{-5} cm. in size whose orientation differs widely from that of the original grains; and (3) the presence of severe internal strains in the "crystallites." X-ray diffraction methods distinguish clearly between the effects of application of safe and unsafe stresses. The present position of knowledge on the inner structure of metals, effects of cold-rolling and drawing, strength and atomic structure, and imperfections of crystals is surveyed.—H. S.

Report of [A.S.T.M.] Research Committee on Fatigue of Metals. H. F. Moore (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 123–124).—Reports on co-operative work with Committee E-4 on Metallography, and on noteworthy developments of the year in fatigue testing.—S. G.

The Practical Importance of the Damping Capacity of Metals, Especially Steels. O. Föppl. Appendix: **A Note on the Terminology of Damping and Fatigue.** F. Bacon (*J. Iron Steel Inst.*, 1936, **134**, 393–423; discussion, 424–455).—See *Met. Abs.*, this vol., p. 499.—S. G.

***The Meaning and the Measurement of Hardness.** E. G. Mahin (*Proc. Indiana Acad. Sci.*, 1935, **45**, 217–219).—A metal, subjected to plastic deformation, becomes harder and stronger, as measured by its resistance to further deformation under stress. Is hardness, then, to be considered as a measure of resistance to *any* permanent deformation, however small, or as a measure of the ability of the metal finally to *stop* deformation? If the latter, then the "hardness" of metals, as measured by any existing method, is the hardness of strain-hardened material; if the former, then there is no standard method of determining hardness. By *absolute* hardness is meant the maximum unit stress which a metal will support, applied through a loaded penetrator, without suffering any permanent deformation. Harris (*J. Inst. Metals*, 1922, **28**, 327) has attempted to determine such absolute hardness by observation of the sequence of values of the penetration of a Brinell ball into a metal which was annealed subsequently to each application of the load. Two objections are raised to this procedure. M. attempts to remove the complications of this method by producing a "Brinell" impression by mechanical removal of metal rather than by inducing plastic flow. For this purpose, after performing a conventional Brinell test, a series of depressions is made by a special drill until a depth of drilling is found such that the Brinell ball, under selected load, just fails to widen the impression. Absolute hardness, so determined, is much lower than the conventional hardness. It is hoped that the work-hardening capacity of metals, &c., may be expressed in terms of the two hardness numbers.—J. S. G. T.

***The Surface Temperature of Sliding Metals, and the Area and Nature of Contact of the Moving Surfaces.** Kenneth Edgar William Ridler (*Abstracts of Dissertations Univ. Cambridge*, **1935–1936**, 110–111).—By using the contact surface of two different metals as a thermojunction, the temperature of the sliding metals at the point of contact can be measured. This may exceed 1000° C. The increase in temperature is directly proportional to load, speed, and coeff. of friction, and inversely proportional to the square root of the thermal conductivity. With most metals the temperature increases to the melting point. Over 600° C. was reached with lubricated surfaces. From the measured temperature, an approximate "radius of contact" is calculated. This is shown to be independent of the load, geometrical area, and surface finish. Measurements of electrical resistance support the view that the real area of contact is independent of speed, load, and geometrical area.—A. G. D.

The Wear of Metals under Sliding Friction. —— (*Metallurgist* (Suppt. to *Engineer*), 1936, **10**, 164–165).—A brief review of some recent papers by H. Meyer, B. Kehl, and E. Siebel (see *Met. Abs.*, this vol., p. 249), M. von Schwarz, and R. Koch (see *Met. Abs.*, this vol., p. 122).—R. G.

Report of Joint Research Committee [of the A.S.T.M. and A.S.M.E.] on Effect of Temperature on the Properties of Metals. H. J. French and N. L. Mochel (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 127–150).—Reports the work of the Committee during the past year. Appendices give details of the progress made in the various researches (on steels).—S. G.

The Interaction of Metals with Gases at Low Pressures [Nickel; Tungsten]. George Bryce (*Abstracts of Dissertations Univ. Cambridge*, **1935–1936**, 104–105). —(*a*) The rate of disappearance of carbon monoxide surrounding a heated nickel filament is shown to be governed by the rate of evaporation of nickel atoms from the filament, which rate is unaffected by the presence of the gas. The gas probably combines with the nickel atoms as they are deposited on the glass walls. By cooling these walls in liquid air, a product approximating in composition to $Ni(CO)_2$ is obtained. This can take up more carbon monoxide at higher temperatures, and is, therefore, probably a sub-carbonyl of nickel. It is stable at − 190° C. and completely decomposed at 100° C. (*b*) By removing the atomic hydrogen by means of potassium or molybdenum oxide, the rate of dissociation of hydrogen by a hot tungsten filament is shown to be many times greater than was supposed. The apparent heat of activation is 50·5 k. cal.—A. G. D.

***Kinetics of the Oxidation of Metallic Spherules and Powders.** Gabriel Valensi (*Compt. rend.*, 1936, **202**, (4), 309–312).—From theoretical considerations it is shown that for nickel spherules of initial radius r_0 cm. the fraction, m, oxidized at $T°$ abs. in t hrs. in oxygen at 760 mm. pressure is:—

$$F(m) = 2{\cdot}471 - (1 - m)^{\frac{2}{3}} - 1{\cdot}471(1 + 0{\cdot}68m)^{\frac{2}{3}} = (38{\cdot}14/r_0) \,.\, t \,.\, e^{-\frac{22420}{T}} \quad . \quad . \quad . \quad . \quad (1)$$

For fine powders $F(m)$ varies linearly with t up to a certain time, which decreases with increase of T; the degree of oxidation is a parabolic function of t. The slope of the lines, $F(m) = Ct$, is proportional to $e^{-\frac{22420}{T}}$. Experimental results show that the factor $(38{\cdot}14/r_0)$ in equation 1 does not apply owing to the lack of sphericity of the particles, but a parameter $\rho_0 = (38{\cdot}14/C) \,.\, e^{-\frac{22420}{T}}$ corresponds with the radius of an equivalent sphere independently of the conditions. By a single practical experiment this parameter can be determined and substituted for r_0 in equation (1) to make it generally applicable.—A. R. P.

***On the Kinetics of the Oxidation Process in Molten Metals (Zinc, Lead, Silver, Copper).** A. Krupkowski and S. Balicki (*Internat. Giessereikongress, Düsseldorf*, 1936, *Tech.-wiss. Vorträge*, 1936, (19), 12 pp.).—[In German.] Oxidation was carried out at constant temperature in air and oxygen under conditions which are described in detail. Zinc and lead, with which a protective layer is formed, inhibiting oxygen diffusion, were found to obey the parabolic law, the coeff. for which were determined (zinc, 600°–700° C.; lead, 470°–626° C.). Molten silver and copper, in which the oxides are soluble, oxidized at constant rate for constant temperature, this rate depending (in air) on the resistance to diffusion between the liquid and gaseous phases and the resistance of the column of nitrogen in the crucible.—H. W. G. H.

Interference Colours of Thin Films of Oxides, Sulphides, or Iodides on Metals. U. R. Evans (*Kolloid-Z.*, 1934, **69**, 129–137).—A review of published work in the light of optical theory.—S. G.

***The Rate of Evaporation of Metals in a Gas Atmosphere.** J. A. M. van Liempt (*Rec. trav. chim.*, 1936, **55**, (1), 1–6).—[In German.] The following expression is derived for calculating the rate of evaporation of a metal in a gas atmosphere:—

$$\frac{V}{V_v} = 1 - \frac{2}{\pi} \text{arc sin} \frac{1}{1 + \dfrac{3{\cdot}4}{r \,.\, d_g \,.\, d_m \,.\, p \,.\, 10^{19}}}$$

where V and V_v are the rates of evaporation in the gas and *in vacuo* respectively, r is the radius of the wire, d_g and d_m are the diameters (in cm.) of the gas and metal atoms respectively, p is the gas pressure in mm. of mercury at 20° C. Experiments on a number of metals gave results in agreement with this expression.—A. R. P.

***The Vapour Pressure of Metals and Their Rate of Evaporation in Vacuo.** J. A. M. van Liempt (*Rec. trav. chim.*, 1935, **54**, (11), 847–852).—[In German.] The rate of evaporation (m) of cubic metals in grm./cm.²/second is given by the expression: $\log m = -(E/4{\cdot}57T) + \log(\sqrt{AT_s}/V) + 5{\cdot}12$, where E is the heat of sublimation in grm.-cal./grm.-atom, A the atomic weight, T_s the melting point (in ° abs.), and V the atomic volume. The sublimation curve is given by the expression: $\log p$ (atmospheres) $= -(E/4{\cdot}57T) + 3{\cdot}47 + \log(\sqrt{TT_s}/V)$, and the heat of sublimation at T_k° by $E = 4{\cdot}57T_k[3{\cdot}47 + \log(\sqrt{T_kT_s}/V)]$. The values for $\log m$ for tungsten, molybdenum, platinum, nickel, iron, copper, and silver are tabulated.—A. R. P.

***Stability of Emulsions in the Presence of Metals.** A. G. Nasini, C. Rossi, and A. Balian (*Atti V. Congr. naz. chim. pura applicata, Roma*, 1935, **1936**, (II), 809–818).—Some metals, on immersion in a 50% emulsion of bitumen in water at p_H 9·2, take on a thin coating of the bitumen; such metals are aluminium, iron, zinc, lead, and nickel, while tin, silver, and copper have no effect. After measuring the coagulating power of the metal ions in question, the corrosion of the metal surfaces in alkaline solutions, and the potentials of the immersed metals, the authors attribute the deposition to the presence in the medium of cations of the immersed metal.—S. G.

***Alteration of the Free Surface Energy of Solids. I.—Vertical Rod Method for the Measurement of Contact Angles and Preliminary Study of Effect of Heat-Treatment on Magnitude of Contact Angles.** F. E. Bartell, J. L. Culbertson, and Mike A. Miller (*J. Physical Chem.*, 1936, **40**, 881–888).—A method developed for measuring contact and interfacial contact angles of liquids against solid rods has been applied to following the changes in free surface energy which occur on the surface of solids. Platinum and gold were among the materials studied. The results showed that the pretreatment of the metal, and time of exposure to the atmosphere, can greatly alter the magnitude of the contact angles (see also following abstracts).—C. E. R.

***Alteration of the Free Surface Energy of Solids. II.—Effect of Heat-Treatment of Metals in Air.** F. E. Bartell and Mike A. Miller (*J. Physical Chem.*, 1936, **40**, 889–894).—See also abstracts above and below. Rods of platinum and gold were pretreated to have standard surfaces for reference; such a standard surface could not be produced on steel in air. Heat-treatment of standard rods in air resulted in a progressive reduction of the water–air contact angle as the temperature of treatment was increased from 100° to 600° C. Measurement of the contact angle at water–organic liquid interfaces showed that the metals became less organophilic the higher the temperature of treatment, and could even be caused to become hydrophilic in nature. The changes are attributed to oxidation and recrystallization.—C. E. R.

***Alteration of the Free Surface Energy of Solids. III.—Effect of Heat-Treatment of Metals in a Vacuum and in Several Gases.** F. E. Bartell and Mike A. Miller (*J. Physical Chem.*, 1936, **40**, 895–904).—See also preceding abstracts. By polishing in nitrogen and then heating to 100° C. in vacuum, surfaces with standard adhesion properties were produced on rods of platinum, gold, copper, 18 : 8 stainless steel, silver, aluminium, tungsten, and brass. Subsequent heating *in vacuo* at temperatures up to 250° C. decreased the water–air contact angle, showing that crystallization phenomena are at least partially responsible for these changes. Heating to 200° C., in different gases, caused the metals to become less hydrophilic than after similar vacuum treatment, the resulting adhesion tensions being in the order vacuum > hydrogen > air > nitrogen. All the metals, except platinum and tungsten, when heat-treated in nitrogen readily reacted chemically with acetylene tetrabromide; gold, copper, and brass, similarly heat-treated, reacted with α-bromonaphthalene. Aluminium and tungsten heat-treated in hydrogen reacted with acetylene tetrabromide.—C. E. R.

Use of the Skin Effect in Investigating Thin Metal Layers. U. Goldfeld and N. I. Kobozev (*Acta Physicochimica U.R.S.S.*, 1936, **5**, (2), 243–270 (in German); and *Zhurnal Fizicheskoy Khimii* (*J. Phys. Chem.*), 1936, **8**, (2), 208–225 (in Russian)).—Electrolytic films of iron on platinum and silver were studied by the method of high-frequency resistance measurement based on the skin effect. The change in high-frequency resistance depends on the change in the magnetic permeability (μ) of the films. The variation of μ with the thickness of the layer, the current density during electrolysis, and time of ageing after deposition are discussed in the light of Becker's theory of film structure (*Z. Physik*, 1930, **62**, 253) and W. Elenbaas and W. F. Peype's data (*Met. Abs.* (*J. Inst. Metals*), 1932, **50**, 599). The method may be used for studying the kinetics of layer crystallization; thus in the formation of iron–platinum alloy on annealing the upper limit of the diffusion rate was found to be 10^{-6} cm./second. Deposition of a zinc film on iron by electrolysis is accompanied by diffusion of zinc into the iron.—N. A.

***A New Kind of Ring Phenomenon in Sputtered Metallic Films.** Utsab Kumar Bose (*Nature*, 1936, **138**, (3494), 684–685).—The formation of coloured rings round a drop of oleic acid on a glass plate on to which silver or copper is sputtered is described. The phenomenon is explained by regarding the sputtered metal as a " liquid expanded " or " gaseous " film.—B. C.

***New Investigations on Thin Metal Films.** Romolo Deaglio (*Atti Accad. Sci. Torino, Classe sci. fis. mat. nat.*, 1935, **71**, 131–135).—Cf. *Met. Abs.*, this vol., p. 290.—S. G.

***Condensation of Thin Metallic Films: Some Reflecting Observations.** T. V. Starkey (*Phil. Mag.*, 1934, [vii], **18**, 241–256).—S. G.

Optical Properties of Thin Films. M. Blackman (*Phil. Mag.*, 1934, [vii], **18**, 262–272).—The theory of transmission and reflection of light by a plate is given in brief outline, and from it various conditions of the ratio of the thickness to the wave-length are considered and compared with experimental results.—S. G.

Specific Heats of Metals and Alloys at High Temperatures. F. M. Jaeger (*Nature*, 1936, **138**, (3483), 211–212).—Report of a lecture. An account is given of investigations of the specific heats of metals up to 1600° C., the principal method used being that of the metal block calorimeter. The importance of previous heat-treatment to remove internal stresses is pointed out. The investigations have yielded much information about allotropic changes and about " retardation " phenomena connected with them. The influence of gases on phase changes is mentioned. The theoretical implications of the results are discussed.—B. C.

***Kinetics of Selective Wetting and Surface Reactions on Metals in the Presence of Electrolytes.—I.** D. I. Mirlis and P. A. Rebinder (*Dokladi Akademii Nauk S.S.S.R.*, 1936, **3**, (3), 123–128 (Russian); and *Compt. rend. Acad. Sci. U.R.S.S.*, 1936, [N.S.], **3**, (3), 123–128 (English)).—Strips of zinc, iron, and aluminium, previously cleaned with a fine file and by washing in warm benzene, were immersed horizontally in a benzene bath, and a 3 mm. drop of pure water or a solution of an electrolyte was placed on the metal and a 7–10 fold enlargement of the drop projected on to a screen and photographed at specified intervals, the contact angles of wetting being measured on the photographs. The results show that the primary contact angle of the water drop is 115°–130°, corresponding to the intrinsic hydrophobe nature of the metal surface free from a layer of disperse particles, but when electrolytes are present in the aqueous phase, accumulation of the products of corrosion produces a change in the molecular nature of the surface which becomes sharply hydrophilic, and the contact angles of the drop are reduced to 60°–14°. On iron, aluminium, and other metals, which form a more resistant surface oxide film than zinc does, the drop spreads considerably more slowly. The changes in the contact angles, under conditions of selective wetting of metals, may serve as a sensitive and quantitative criterion of the modification of the nature of their surfaces during corrosion.—N. A.

Fifth Report of the Committee on Atomic Weights of the International Union of Chemistry. G. P. Baxter, O. Hönigschmid, P. LeBeau, and R. J. Meyer (*J. Chem. Soc.*, 1935, (June), 788–795).—See *Met. Abs.*, 1935, 2, 416. —S. G.

On the Theory of Solid and Liquid Metals. R. C. Majumdar (*Proc. Nat. Inst. Sci. India,* 1935, 1, (2), 77–86).—S. G.

***Electron Theory of Metals.** S. Shubin and S. Wonsowsky (*Proc. Roy. Soc.*, 1934, [A], 145, 159–180).—The most serious difficulty in the current electron theory of metals is that the models used do not allow of the simultaneous treatment of electrical and magnetic properties, *e.g.* conductivity and ferromagnetism. For example, in Heisenberg's model, which can be applied with some success to ferromagnetism, the approximation on which the theory is constructed considers only non-polar states of the constituent atoms, and therefore no one of the states of the model can carry any current. The necessary generalization is attempted in this paper by including in the zero approximation of Heisenberg's model, also polar states in which some of the atoms have 2 electrons and others none. The inclusion of these states allows for travelling electrons and therefore for states carrying current, and also modifies in an important way the conditions for a ferromagnetic. These conditions prove to be much more restrictive than appears in Heisenberg's theory, and ferromagnetics should be rarer than that theory leads one to expect—in conformity with the facts. The conditions for a ferromagnetic which replace the simple $J > 0$ of Heisenberg's theory are formally set out here and appear to explain why the alkalies cannot be ferromagnetics even if they have a positive J.—S. G.

Studies in the Electron Theory of Solid Metal. N. K. Saha (*Trans. Nat. Inst. Sci. India,* 1936, 1, (8), 125–185).—Consists of 3 chapters. (1) Deals with the historical development of the electron theory of the electrical conductivity of solid metals, together with an extension of the Pauli–Sommerfeld degenerate electron–gas theory to the calculation of the latent heats of fusion of certain metals; (2) develops in a new form the quantum mechanical theory of electrical conductivity in metals, including some numerical results, and (3) the pressure coeff. of resistance of metals is accounted for by a theory which gives numerical results generally in agreement with measurements.—E. J. G.

The Electron Theory Applied to Metals of General Crystalline Form. M. Kohler (*Ann. Physik,* 1936, 27, (3), 201–216).—Effects associated with the electron theory of metals are investigated to determine their dependence on crystallographic orientation.—E. J. G.

***Inelastic Scattering of Electrons from Solids [Copper, Silver, Gold, and Calcium and Barium and Their Oxides].** Erik Rudberg (*Phys. Rev.*, 1936, [ii], 50, (2), 138–150).—S. G.

Theory of Inelastic Scattering of Electrons from Solids. E. Rudberg and J. C. Slater (*Phys. Rev.*, 1936, [ii], 50, (2), 150–158).—S. G.

***Direction of Polarization and Selectivity in the External Photoelectric Effect of Metals.** F. Hlučka (*Z. Physik,* 1934, 92, 5–6; *Sci. Abs.*, 1935, [A], 38, 121).—Determinations were made of the selective photoelectric maxima for the metals silver, gold, platinum, nickel, copper, and zinc for both directions of polarization of the light. The photoelectric current as function of the angle of incidence for both directions of the polarization was measured and calculated approximately. The new proposition valid for all the metals investigated can be stated, that to each optical characteristic vibration two photoelectric maxima lying near each other correspond, of which one belongs to the parallel or to the normal component of the light vector. Thus the selective maxima in the external photoelectric effect of all the metals examined are conditioned not only by the normal component relative to the cathode surface (as was hitherto assumed from observations on the alkalis) but also by the parallel component, so that the two maxima corresponding to a component appear somewhat shifted with regard to each other. The absence of this effect for the parallel component of the light vector in the alkalies is traced back to the dependence of the optical data on the direction of polarization existing in that case.—S. G.

***Emission of Electrons from Cold Metal Surfaces.** Carl C. Chambers (*J. Franklin Inst.*, 1934, 218, (4), 463–484).—The results of Del Rosario on cold emission are shown to result from the fact that, through the attainment of specially good vacuum conditions and freedom from contamination, the cold electron current from the wire was suppressed up to field strengths greater than those at which measurable current was obtained in the work of previous observers. It was in fact suppressed beyond the point at which discharge started from points on the welding of the support. The results of Del Rosario are thus probably characteristic of conditions other than those pertaining to the wire, a conclusion which accounts for his current voltage curves. The formula of Fowler and Nordheim is found to apply in the measurable regions in form directly, and in magnitude only, if irregularities of the surface are such as to raise the field at the surface to a sufficiently high value. Breakdowns after intense heat-treatment are studied and found to be caused by immeasurably small currents of electrons knocking ions from the anode. The erratic original curves obtained by previous investigators are found to be caused by successive breakdowns similar to those found after intense heating.—S. G.

†The Methods of Measuring the Volta Effect. H. Gericke (*Physikal. Z.*, 1936, 37, (9), 327–338).—A critical account of the various methods of measuring the Volta effect between metals.—B. C.

***An Atomic Theory of the Magneto Caloric Effect.** Kotarô Honda and Tokutaro Hirone (*Nature*, 1936, 137, (3464), 492).—The changes of temperature due to magnetization for iron, nickel, and cobalt are calculated from the Honda–Okubo theory of ferromagnetism, and it is shown that the theoretical results are in fair agreement with the experimental results of Okamura.—B. C.

***An Approach to an Explanation of the Surface Work-Functions of Pure Metals.** Joseph F. Chittum (*J. Physical Chem.*, 1934, 38, (1), 79–84).—S. G.

***Calculation of External Work-Function from Compressibility.** H. Bomke (*Z. Physik*, 1934, 90, (7/8), 542–550).—A simple relation exists between external work-function and the compressibility of metals. There is a fundamental significance in the classification of metals into 2 groups suggested by Bother and B. (*ibid.*, 1934, 87, 11–12).—S. G.

Molar Peltier Heats of Pure Metal Two-Phase Systems. J. Monheim (*Z. Elektrochemie*, 1934, 40, (7), 375–378).—The Peltier heat for many purposes is better considered as a molar heat than as cal./coulomb. The relation of the molar Peltier heat to the Peltier coeff. and other thermodynamic factors is explained. M. gives diagrams of the Peltier heat presented as a mol. quantity for numerous metals against copper, and the behaviour of the temperature variation of the quantity in bismuth, iron, and palladium–silver, palladium–gold, and palladium–platinum alloys against copper.—S. G.

***Theory of Steady Currents in Metallic Conductors.** F. Odone (*Nuovo cimento*, 1934, [N.S.], **11**, 361–371).—O. has re-examined Duhem's theory of thermoelectric effects which is based on thermodynamics together with certain special hypotheses. An error in Duhem's analysis is corrected.—S. G.

A Note on the Application of Thermodynamics to Superconductivity. A. J. Rutgers (*Physica*, 1936, 3, (9), 999–1005).—[In German.] Mathematical.—C. E. R.

***On the Change of Current Distribution and Magnetic Induction at the Onset of Superconductivity.** W. Meissner and Fr. Heidenreich (*Physikal. Z.*, 1936, **37**, (13), 449–470).—Experimental results on the distribution of the magnetic field round superconducting specimens of tin in various conditions show that the superconducted current is confined to a layer near the surface, and the permeability is zero. The existence of a persistent magnetic field in the bore of a superconducting tube is described, and its characteristics discussed.—B. C.

Phenomenological Theory of Superconductivity. E. Schrödinger (*Nature*, 1936, **137**, (3472), 824).—A simplification of the theory of superconductivity of F. and H. London is advanced, a third type of current, the supercurrent, being assumed, which either is added to, or replaces, the ordinary conduction current.—B. C.

Electrodynamics of Macroscopic Fields in Superconductors. F. London (*Nature*, 1936, **137**, (3476), 991–992).—The superconductivity theory is extended to the "intermediate" state in the presence of an electric field. The theory given is stated to be a provisional attempt, but to have been successfully applied to the problem of a superconducting wire in which the magnetic field due to the current itself causes the phase change.—B. C.

***Destruction of Superconductivity by Electric Current and Magnetic Field.** L. Shubnikov (*Nature*, 1936, **138**, (3491), 545–546).—From a graph of induced current and field intensity, it is shown that superconductivity only occurs when the magnetic field is zero throughout the volume of the superconductor and not in excess of a critical value on its surface.—B. C.

Time Effects in Superconductors. K. Mendelssohn and R. B. Pontius (*Nature*, 1936, **138**, (3497), 29–30).—The variations of magnetic induction with field for a sphere and for a cylinder of superconducting tin are shown; the behaviour agrees with the assumption that the time effects observed are due to a slow expansion or contraction of superconducting regions.—B. C.

Present Status of Ferromagnetic Theory. R. M. Bozorth (*Elect. Eng.*, 1935, **54**, (11), 1251–1261).—S. G.

Abnormalities in the Elastic Modulus of Ferro-Magnetic Materials. M. Kersten (*Z. Metallkunde*, 1935, **27**, (5), 97–101).—The connection between the magnetic and mechanical properties of ferromagnetic materials is discussed, with special reference to magnetostriction, the relation of which to load-extension phenomena is examined. The abnormal thermal properties of Elinvar are associated with its magnetostrictive characteristics.—P. M. C. R.

Ferromagnetic Materials. J. L. Snoek (*Ingenieur*, 1936, **51**, E87–89).—The subjects previously considered (preceding abstract) are discussed in greater detail with reference to various ferromagnetic materials.—S. G.

***Magnetic Anisotropy and Cold-Working.** A. Schigadlo and S. Sidelnikov (*Physikal. Z. Sowjetunion*, 1934, **5**, (5), 714–721).—[In German.] The crystalline texture of a cold-rolled ferromagnetic specimen is determined by Akulov's method. Taking into account the anisotropy thus determined, close agreement is found between the theoretical hysteresis curve and that found by experiment.—S. G.

Diamagnetism and Particle Size. H. Lessheim (*Current Sci.*, 1936, **5**, (3), 119–127; *Sci. Abs.*, 1936, [A], **39**, 1326).—The investigation of the diamagnetism of small particles obtained by colloidalization or cold-working has shown that apparently the susceptibility depends on the size of the particles.

L. gives a critical survey of the whole subject; the conclusions which may at present be reached are: The theoretical considerations put forward by S. R. Rao do not support this view that the surface area of the particle is the immediate deciding factor. The effect of increased surface is far too small to account for the decreased diamagnetism. The available evidence is in complete agreement with Bhatnagar's view that the increased surface may only be effective in facilitating hydration, oxidation and other processes. From this point of view the decrease of diamagnetism is solely an impurity effect.—S. G.

Crystal Structure and Magnetism. J. L. Snoek (*Ingenieur*, 1936, **51**, E81–84).—A review is given of theories of ferromagnetism. Magnetic hysteresis only assumes high values when the displacement of the boundaries of the magnetic elementary regions is retarded or prevented. This state may be achieved by the artificial production of a pronounced non-homogeneous voltage distribution in the material. In modern magnetic steels an attempt is made to arrive at this result by quenching to supercool a supersaturated solid solution, after which partial precipitation is induced by heating to medium temperatures. In the case of soft materials, on the other hand, the endeavour is made to obtain a maximum homogeneity; to do this a pure material is chosen which exhibits a low magnetostriction or in which the latter's disturbing effect has been eliminated (Permalloy treatment; cooling in a magnetic field). At the same time the crystal anisotropy must also be made as low as possible.—S. G.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 503–525.)

†**Light-Weight Structural Alloys.** Zay Jeffries, C. F. Nagel, and R. T. Wood (*Proc. Amer. Soc. Civil Eng.*, 1936, **62**, (8), 1211–1237; and (summary) *Light Metals Rev.*, 1937, **3**, (12), 279–281).—Contribution to a symposium on the structural application of steel and light-weight alloys. The general characteristics of the structural aluminium and magnesium alloys are described, attention being given to corrosion-resistance, ease of welding, and the effects of cold-working and heat-treatment. The composition of the principal alloys, with typical values of their mechanical properties after different treatments, are given in tabular form.—J. C. C.

Alloys of Aluminium and Magnesium. E. H. Dix, Jr., and J. J. Bowman (*Amer. Soc. Test. Mat.: Symposium on High-Strength Constructional Materials*, **1936**, 109–124; discussion, 125–126; and (summary) *Light Metals Rev.*, 1936, **2**, (22), 388–390).—The mechanical properties of numerous wrought, heat-treatable, and casting aluminium alloys are tabulated, and examples are given of their use in aircraft, railway coach, and bridge construction, and in general engineering work. The properties of various Dowmetal magnesium-base alloys are also tabulated and their uses briefly indicated.—A. R. P.

The Properties of the Light Metals Aluminium and Magnesium. W. Wunder (*Tech. Zentr. prakt. Metallbearbeitung*, 1935, **45**, (13/14), 356–363).—A summary is given of the sources, physical properties, and uses of magnesium, and of the composition, mechanical factors, uses, and chemical properties of the most important of its alloys. The casting of aluminium and magnesium and of their alloys, their rolling, working, and general heat-treatment are discussed. —W. A. C. N.

***Density Changes in Solid Aluminium Alloys.** L. W. Kempf and H. L. Hopkins (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **122**, 266–281; discussion, 281–283; and *Aluminium and Non-Ferrous Rev.*, 1936, **1**, (9), 405–411).—See *Met. Abs.*, this vol., p. 73.—S. G.

***The Conductivity of Super-Purity Aluminium: The Influence of Small Metallic Additions.** (Gauthier.) See p. 629.

***Mechanical Properties of Aluminium and Its Alloys After Prolonged Heating.** (v. Zeerleder and Irmann.) See p. 629.

***Age-Hardening of Aluminium Alloys. I.—Aluminium-Copper Alloy.** William L. Fink and Dana W. Smith (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, 122, 284–293; discussion, 293–300).—See *Met. Abs.*, this vol., p. 296.
—S. G.

Aluminium Casting Alloys for Heat-Treatment. P. Barrand (*Rev. Mét.*, 1934, 31, (12), 551).—A summary of a paper presented before the Congress of the Association Technique de Fonderie. See *Met. Abs.*, 1935, 2, 96.—P. R.

***Mechanically Treated High-Performance Aluminium Alloys.** I. G. Shulgin (*Vestnik Ingenerov i Tehnikov* (*Messenger Eng. Tech.*), **1936**, (9), 542–545).—[In Russian.] Two improved Duralumin alloys were investigated; they contained (*a*) copper 4·3–4·5, manganese 0·64–0·69, magnesium 0·7–0·92, silicon 0·77–1·0, and iron 0·62–0·75%, and (*b*) copper 4·3–5·2, manganese 0·7–1·2, magnesium 0·5–0·7, silicon 0·6–0·8, iron 0·61, and titanium 0·15–0·25%. The optimum mechanical properties were obtained by ageing at 160°–170° C. for 15 hrs., the values being: tensile strength 49·6–50·6 kg./mm.^{2}, yield-point 38–43 kg./mm.^{2}, elongation 8–10%, limit of proportionality 34–40 kg./mm.^{2}, modulus of elasticity 6960–7527 kg./mm.^{2}. The alloy free from titanium is superior to that containing titanium.—N. A.

***Behaviour of Metals and Method of Testing at Low Temperatures.** S. E. Beljaev (*Tehnika Vosdushnogo Flota* (*Tech. of Air Fleet*), **1936**, (10), 97–106).—[In Russian.] The impact strength of Duralumin increases with decrease in temperature, being 3·15, 3·65, and 3·83 kg./cm.^{2}, respectively, at + 20°, − 40°, and − 70° C.—N. A.

***On the Equilibrium Diagram of the Aluminium–Magnesium System.** Masuo Kawakami (*Sci. Rep. Tôhoku Imp. Univ.*, 1936, [i], **Honda Anniv. Vol.**, 727–747).—[In English.] Previously published in Japanese, *Kinzoku no Kenkyu*, 1933, **10**, 532; see *Met. Abs.*, 1934, 1, 169 (in the second line from the end of which "ε-phase, found . . ." should read "γ-phase, found . . .").—S. G.

***Diffusion of Magnesium and Silicon into Aluminium.** Hertha R. Freche (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, 122, 324–336).—See *Met. Abs.*, this vol., p. 296.—S. G.

***Equilibrium Relations in Aluminium–Magnesium Silicide Alloys Containing Excess Magnesium.** F. Keller and C. M. Craighead (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **122**, 315–323).—See *Met. Abs.*, this vol., p. 296.—S. G.

***Investigation of the Magnalium-Type Aluminium Alloys.** N. D. Bobovnikov (*Tehnika Vosdushnogo Flota* (*Tech. of Air Fleet*), **1936**, (10), 29–41).—[In Russian.] The main causes of the brittleness of Magnalium (aluminium with magnesium 8, manganese 0·6%) in rolling are: the presence of Mg_2Si inclusions, incomplete homogenization before rolling, and homogenization outside the temperature range of maximum plasticity (430°–440° C.). A preliminary forging or pressing is necessary before rolling. Complete homogenization takes place in 12–24 hrs. at 500° C. The tensile strength of the hard-rolled alloy (50% reduction) is 48 kg./mm.^{2} with 8–10% elongation. Sheets 0·8–1·0 mm. thick in the work-hardened and tempered states, were found in practice to be resistant to sea- and fresh-water, but after annealing or ageing at 200° C. corrosion is intense. The desired mechanical properties should be produced not by low-temperature heating but by suitable cold-rolling of fully annealed metal.—N. A.

Thermal Treatment of AC–11 Alloy Pistons in Connection with Warping Phenomena. V. A. Livanov (*Tehnika Vosdushnogo Flota* (*Tech. of Air Fleet*), **1936**, (10), 85–96).—[In Russian.] Internal stress in a tempered piston of AC–11 alloy may be as much as 25 kg./mm.^{2}. The best heat-treatment of pistons, to obtain the optimum mechanical properties and minimum internal stress, consists in annealing in a nitre bath for 3–4 hrs. at 525°–530° C., quenching in water, ageing immediately in an electric furnace for 20–30 hrs. at 175° C., and air-cooling. Stresses are thereby reduced to a third and the alloy given the following mechanical properties: tensile strength 33–36 kg./mm.^{2}, proportionality limit 23–28 kg./mm.^{2}, elongation 7–10%, Brinell hardness 100–110, and impact strength (notched bar) 1·10–1·40 kg./cm.^{2}.—N. A.

***The Binary Aluminium–Manganese Alloys Rich in Aluminium.** M. Bosshard (*Alluminio*, 1932, 1, 361–367; *C. Abs.*, 1933, 27, 3693).—Cf. *Met. Abs.* (*J. Inst. Metals*), 1933, 53, 10. By means of conductivity measurements, certain points on the equilibrium diagram, especially the solid solubility of manganese in aluminium, have been corrected. Alloys containing 1·2–1·5% manganese have the highest resistance to corrosion by sodium chloride plus hydrogen peroxide. Addition of manganese does not adversely affect the wire-drawing properties and up to 1·4% manganese the tensile strength is improved; beyond this limit the effect is slight. Alloys annealed below 250°–300° C., the limit of recrystallization, show considerable variation in properties. The electrical conductivity diminishes with increased manganese up to 1·4%, beyond which the curve flattens.—S. G.

***The Effect of Manganese on the Mechanical Properties of Aluminium.** Tsutomu Matsuda and Isawo Suzuki (*Sumitomo Kinzoku Kōgyō Kenkyu Hōkoku* (*Res. Rep. Sumitomo Metal Industries, Ltd.*), 1936, 2, (6), 544–557).—[In Japanese.] Gives the results (tables and curves) of an investigation of the mechanical properties of aluminium alloys containing not more than 1·6% manganese.—S. G.

Light Aluminium Alloys Containing Nickel. —— (*Nickel Bull.*, 1936, 9, (7), 144–152).—The compositions are given of "Y"; R.R. 50, 53, 53c, 56, and 59; Ceralumin C; Lo-Ex; Birmasil Special; and P2 alloys, and their mechanical and physical properties and the effect of heat-treatment are tabulated. Applications of the alloys are briefly dealt with.—S. G.

Recent Technical Details and Practical Experiences of Silumin. E. Scheuer (*Schweiz. Arch. angew. Wiss. Tech.*, 1936, 2, (6), 151–155).—An account of the constitution and properties of Silumin-γ. Curves show the variation of properties with the speed of quenching and with the magnesium content.
—W. A. C. N.

***Equilibrium Relations in Aluminium–Zinc Alloys of High-Purity.—II.** William L. Fink and L. A. Willey (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, 122, 244–260; discussion, 260–265).—See *Met. Abs.*, this vol., p. 297.—S. G.

The Strength of Light Alloys. —— (*Apparatebau*, 1936, 48, (7), 70–71).—Data are tabulated for the properties of (*a*) aluminium and 6 light alloys in various states of heat-treatment; (*b*) Bondur sheet, strip, pressed sections, rod, tubing, and wire; (*c*) B.S.–Seewasser as in (*b*).—P. M. C. R.

†**Development of Light Metal Bearings.** H. Steudel (*Luftfahrtforschung*, 1936, 13, (2), 61–66; and (summary) *Light Metals Research*, 1936, 4, (23), 427–428).—Graphs are given showing the hardness, coeff. of expansion, and the tensile and compression strengths of various bearing metals (white metals, bronzes, and light metals) at temperatures up to 300°–400° C., and characteristic structures are illustrated. Silicon–aluminium alloy bearing metals have much higher compression and tensile strengths and retain their hardness to much higher temperatures than white metal alloys of the lead- and tin-base series; they also withstand higher loads, but are sensitive to irregularities in the surface caused by foreign matter getting into the bearing, overloading, or tearing out of particles of the hard constituent, and are more difficult to work to a smooth bearing surface.—A. R. P.

Present Position of Light and Ultra-Light Alloys. The Alloys of Beryllium. Marcel Ballay (*Bull. Soc. d'Encour.*, 1936, 135, (8 and 9), 526–544).—A useful compilation, summarizing the characteristics of the principal aluminium, magnesium, and beryllium alloys.—J. C. C.

Vacuum-Melted, Cold-Rollable Beryllium Alloys. Paul Wiessner (*Kalt-Walz-Welt*, 1936, (8), 60–61).—The properties of alloys of nickel and copper containing small amounts of beryllium are briefly discussed. Beryllium has also been used for imparting age-hardening properties to Contracid and to 5% silver–copper, 5% manganese–copper, 5–10% cobalt–copper and 80 : 20 nickel–chromium alloys.—A. R. P.

***The Periodic-Torsional Rigidity of Beryllium–Nickel and Beryllium–Contracid.** W. Meissner (*Z. tech. Physik*, 1935, **16**, (12), 591–593).—Apparatus is described for submitting a test-piece to periodic torsional stresses, and which does not require the test-piece to be thinned down or provided with a thick end. Results obtained with the device give the following values of the periodic-torsional rigidities of the respective alloys submitted to 2 million torsional oscillations: beryllium–nickel (unpolished), 22·5–26·10 kg./mm.^{2}; turned and polished 35·2–47·2 kg./mm.^{2}; beryllium-Contracid (unpolished), 13·0–16·0 kg./mm.^{2}; chromium–molybdenum–vanadium steel, 24·8–29·6 kg./mm.^{2}. All the test-pieces were untempered. Turning and polishing, by removing superficial irregularities, are seen to increase the rigidity about 100%.—J. T.

Report of [A.S.T.M.] Committee A–10 on Iron–Chromium, Iron–Chromium–Nickel, and Related Alloys. Jerome Strauss and H. D. Newell (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 119–122).—Progress report.—S. G.

Alloys of Copper. C. H. Davis (*Amer. Soc. Test. Mat.: Symposium on High-Strength Constructional Materials*, **1936**, 79–89; discussion, 90–94).—The composition, mechanical, electrical, and thermal properties, and the densities and coeff. of expansion of numerous high strength and heat-treatable copper alloys are tabulated, and a brief account is given of their uses in architecture, chemical equipment, tank construction, shipbuilding, railway and aeroplane work. The preparation and properties of copper alloy wires are also discussed.—A. R. P.

†A Review of Copper Alloys (—II). M. G. Corson (*Iron Age*, 1936, **138**, (17), 29–31, 68).—Cf. *Met. Abs.*, this vol., p. 507. Discusses high electrical or thermal conductivity copper alloys, in which tin, silver, chromium, nickel, and silicon, either alone or in various combinations, are alloyed with copper. The properties and applications of Constantan and Manganin are more fully described. —J. H. W.

***Order of Affinity of Metals for Copper, Iron, Cobalt, and Nickel.** A. S. Russell (*Nature*, 1936, **138**, (3482), 161).—It is shown that aluminium, tin, zinc, cadmium, mercury, and lead which all form compounds with copper, can be arranged in order of their affinity for copper, this order being as given. Similarly, the orders of affinities with iron, nickel, and cobalt have been found. They are slightly different from the order with copper.—B. C.

***Effect of Heat-Treatment on Properties of Manganin.** Seth Holmqvist (*Iva*, **1936**, (2), 43–54).—Resistance measurements made on Manganin wires heated for 20 hrs. at 140° C. show a reduction of resistance of the order of 0·5%, and also of the temperature coeff. An increase of the contact potential (*Note*: Seebeck potential is the actual term used) for Manganin–copper junctions is quite marked for various times of ageing, and results are tabulated for various temperatures and for both hard and soft wires which give markedly different results.—E. v. S.

***Coefficient of Equivalence of Iron With Respect to Aluminium in Aluminium Bronze [Constitution of Copper–Aluminium and Copper–Iron–Aluminium Alloys].** J. L. Bray, M. E. Carruthers, and R. H. Heyer (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **122**, 337–346; discussion, 346–348).—See *Met. Abs.*, this vol., p. 298.—S. G.

***Contribution to Our Knowledge of the Copper–Silicon System.** Karl Sautner (*Forschungsarbeiten über Metallkunde u. Röntgenmetallographie*, 1933, (9), 1–31).—The system was investigated up to 13% silicon by X-ray analysis and micrographic examination. The α-phase contains 4·2% silicon at 400° C., 5·2% at 700° C., and 4·8% at 830° C. The β-phase is stable in a narrow range with about 6% silicon between 700° and 830° C. and has a close-packed hexagonal lattice with $a = 2·40$ A., $c/a = 1·633$, 16 atoms per unit cell corresponding to Cu_7Si. The γ-phase exists in a narrow range of composition round 8·12% silicon up to 815° C. and has a β-manganese structure with $a = 6·21$ A. and 20 atoms in the unit cell; it appears to be Cu_5Si. Alloys with 7–8% silicon contain at 760°–830° C. the ζ-phase which has a close-packed hexagonal lattice with $a = 2·58$ A. and $c/a = 1·633$. The δ-phase is formed by a peritectic reaction at 810° C. and is decomposed into $\gamma + \eta$ at 710° C. The η-phase is cubic face-centred, with $a = 9·69$ A., 76 atoms in the unit cell corresponding to Cu_3Si, and the ε-phase is body-centred tetragonal with $a = 9·21$ A., $c/a = 1·143$, also 76 atoms in the unit cell; ε is formulated as $Cu_{29}Si_9$ and is stable only below 610° C.—A. R. P.

Equilibrium at Relatively Low Temperatures in Copper–Tin Alloys. —— (*Metallurgist* (Suppt. to *Engineer*), 1936, **10**, 167–171).—A review of recent work including a detailed summary of a paper by Haase and Pawlek in *Z. Metallkunde*, 1936, **28**, 73; see *Met. Abs.*, this vol., p. 198.—R. G.

Nickel in Bronze. —— (*Nickel Bull.*, 1936, **9**, (1), 1–4).—A review, with data, of the effect of additions of nickel to tin bronzes. The most convenient method of adding nickel to bronzes is in the form of 50 : 50 nickel–copper shot, which has a lower melting point than pure nickel and is readily soluble in copper.—S. G.

***Internal Stresses and Season Cracking in Brasses.** L. Matteoli (*Metallurgia italiana*, 1934, **26**, 229–242).—The origin and progress of season-cracking in cold-drawn brass are reviewed, with reference to internal stresses and the action of external corrosive agents. Methods for the quantitative measurement of internal stresses in brass bars and tubing are reviewed, and suitable annealing conditions are deduced from a correlation of recrystallization temperatures and of the variation of mechanical properties with the annealing time, for brasses of different compositions. The action of mercurous nitrate in relieving internal stresses, and in promoting the development of cracks, is discussed. An illustrative account is given of experimental heat-treatments, correlated with mechanical tests, on brass gun bodies. A *bibliography* is appended.—P. M. C. R.

Highly-Alloyed Nicla Brass. A. S. Ball (*Tehnika Vosdushnogo Flota* (*Tech. of Air Fleet*), **1936**, (10), 78–85).—[In Russian.] Castings of Nicla brass, containing nickel 12–15, lead 1·75–2·25, aluminium 1·25–1·5, zinc 39–41%, made at 1120°–1140° C. with careful stirring to avoid segregation of the lead have a tensile strength of 41–48 kg./mm.^{2}, an elongation of 3–5·5%, Brinell hardness 162–172, and an impact strength of 0·5–2·5 kg./cm.^{2}. Quenching from 750° C. and reheating for 30 minutes at 450° C. increases the hardness to 200. The brass has an $\alpha + \beta$ structure with lead inclusions; it may be forged at 850°–830° C.—N. A.

Notes on the Admos Alloys, with Special Reference to Admiro, and on Their Importance in the Construction of Apparatus. J. F. Kesper (*Apparatebau*, 1935, **47**, (2), 13–14).—High fatigue strength and resistance to attack by superheated steam and acid fumes are claimed for the Admos copper-base alloys; the mechanical properties of 2 copper–zinc–nickel alloys containing aluminium and manganese (Admiro I and V) are tabulated for cast and pressed material.—P. M. C. R.

***On the Anodic Behaviour of Gold–Copper Alloys in 5*N* Hydrochloric Acid and 1*N* Sulphuric Acid.** W. J. Müller, H. Freissler, and E. Plettinger (*Anz.*

Akad. Wiss. Wien, Math.-naturw. Klasse, 1936, 73, 86–87).—For a full account of this work see *Met. Abs.*, this vol., p. 352.—S. G.

Noble Metals and Their Alloys. O. Feussner (*Deut. Goldschmiede-Zeit.*, 1934, 37, 317–320; *Chem.-Zentr.*, 1934, **105**, (II), 2892).—F. reviews the hardening of gold–platinum and gold–palladium alloys by magnesium, alkaline earth metals, iron, cobalt, nickel, tin, and zinc. By alloying with silver difficulties in melting palladium, caused by gas absorption, may be avoided. —S. G.

Alloys to Replace 14-Carat Gold. L. Sterner-Rainer (*Deut. Goldschmiede-Zeit.*, 1934, 37, 387–388; *Chem.-Zentr.*, 1934, **105**, (II), 2892).—Discusses palladium–gold alloys. An alloy of palladium, silver, and copper, with the addition of cadmium, zinc, or tin to lower the freezing point, can be hardened at 300°–500° C. and its properties are comparable with those of gold alloys. —S. G.

Coloured Gold Alloys with Palladium. L. Sterner-Rainer (*Deut. Goldschmiede-Zeit.*, 1934, 37, 512–514; *Chem.-Zentr.*, 1935, **106**, (I), 783).—Alloys are described with gold plus palladium >25, palladium $\not>9\%$, and the zinc content $<13\%$ of the gold. The tin content is $<5\%$ of the gold, $<10\%$ of the silver, and $<14\%$ of the copper content. Analyses are not given.—S. G.

White Gold. P. Nicolet (*Chim. et Ind.*, 1935, 34, 535–536).—Compositions of white gold alloys and methods of analysis are reviewed.—S. G.

Papers on Iron Alloys. N. N. Kurnakow (*Uspehi Khimii* (*Progress of Chemistry*), 1936, 5, (7/8), 1108–1119).—[In Russian.] A review.—N. A.

***The Nature of the Solid Solution of Antimony in Lead.** N. W. Ageew and I. W. Krotov (*J. Inst. Metals*, 1936, **59**, 301–308; discussion, 309–310; also (in Russian) *Trudi Leningrad. Indust. Inst.*, **1936**, (4), 26–31).—X-ray analysis and density determinations show that the solid solution of antimony in lead is of the simple monatomic type. The thermodynamic analysis is not in contradiction to this conclusion if errors of the order of 2° C. are assumed to exist in the equilibrium diagram.—N. A.

***The Solid Solutions of Indium and Lead.** Nicholas Ageew and Vera Ageewa (*J. Inst. Metals*, 1936, **59**, 311–316).—The constitutional diagram of the alloys of indium and lead has been modified as a result of new data obtained by means of X-ray examination and thermal analysis. The diagram shows that the alloys have limited solid solubility and a peritectic transformation. The physical properties of the alloys are in agreement with this diagram.—N. A.

On Ternary Lead Alloy With Great Strength Against Vibration Fatigue. K. Ono and K. Ikeda (*Denki Gakkwai Zasshi* (*J. Inst. Elect. Eng. Japan*), 1936, **56**, (5), 595–596).—[In Japanese.]—S. G.

Recent Progress in the Field of Magnesium and Ultra-Light Alloys. Paul Bastien (*Mém. Soc. Ing. civ. France*, 1936, **89**, (5), 659–687; and (abstract) *Usine*, 1936, **45**, (46), 31).—A comprehensive review of the preparation, properties, working, heat-treatment and resistance to corrosion of commercial magnesium alloys with copious references to recent literature.—A. R. P.

Magnesium Alloys and Their Structural Application. A. W. Winston (*Proc. Amer. Soc. Civil Eng.*, 1936, **62**, (8), 1329–1340).—Contribution to a symposium on the structural application of steel and light-weight alloys. The mechanical properties of the principal magnesium alloys are compared with those of other structural materials, and notes given on their machining, forming, riveting, welding, and surface protection.—J. C. C.

Magnesium and the Ultra-Light Alloys. Paul Bastien (*Tech. moderne*, 1936, **28**, (3), 65–71).—Constitutional diagrams of the magnesium–aluminium, magnesium–copper, lead–antimony and antimony–cadmium alloys are reproduced, in each case in combination with the " castability " curve of the series. Other graphs summarize the influence of remelting on the castability, chemical composition, and impact properties of a magnesium alloy containing

6% aluminium. The influence of the nature and purity of the foundry sand employed is also summarized graphically. The phenomena of shrinkage are briefly analyzed, and total shrinkage curves are given for sand-cast and chill-cast magnesium–aluminium and magnesium–copper alloys. The influence of composition on hot-working properties is discussed, and a concluding section deals with the resistance of the ultra-light alloys to the various types of corrosive attack and with methods of protection.—P. M. C. R.

The Magnesium-Base Ultra-Light Alloys. M. Bardot (*Tech. moderne*, 1936, **28**, (19), 687–688).—A summary is given of the physical properties of magnesium and its industrial alloys, with directions for handling, working, welding, heat-treatment, and protection, and a note on the design of castings.—P. R.

On Magnesium Casting Alloys. H. Busch (*Light Metals Research*, 1936, **4**, (24), 470–475; and *Aluminium and Non-Ferrous Rev.*, 1936, **1**, (10), 471–473). —Translated in full from *Giesserei*, 1936, **23**, (12), 290; see *Met. Abs.*, this vol., p. 455.—J. C. C.

Magnesium Alloy Developed for Die-Cast Products. J. B. Nealey (*Steel*, 1936, **98**, (3), 29–30).—The principal physical properties of pure magnesium and of 7 grades of Dowmetal are tabulated, and the mechanical properties of 5 types of Dowmetal, in different conditions of heat-treatment, are summarized. Dimensional tolerances for die-castings in Dowmetal are indicated, and forging practice is considered in a brief note.—P. M. C. R.

***Age-Hardening of Magnesium–Aluminium Alloys.** A. M. Talbot and John T. Norton (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **122**, 301–313; discussion, 313–314).—See *Met. Abs.*, this vol., p. 248.—S. G.

***On Some Properties of the Alloy Hy 7 (Mg 7).** Isamu Igarashi (*Sumitomo Kinzoku Kōgyō Kenkyu Hōkoku* (*Res. Rep. Sumitomo Metal Industries, Ltd.*), 1936, **2**, (6), 534–543).—[In Japanese.] A collection of experimental data on the properties of this alloy, for the information of users.—S. G.

***Contribution to the Study of Ternary Alloys. [System Magnesium–Calcium–Zinc.]** René Paris (*Publ. sci. tech. Ministère de l'Air* (*Paris*), 1934, (45), 86 pp.; *C. Abs.*, 1937, **31**, 2566).—In the theoretical part of this work, P. explains the triangle of concentrations and its relation to the complete thermal diagram of ternary alloys. Non-miscibility in the solid state is discussed in the cases of (*a*) the absence of binary or ternary compounds, (*b*) the presence of binary compounds only, and (*c*) the existence of ternary compounds. Miscibility in the solid state is then considered. The experimental part of the work represents a comprehensive study of the *ternary system magnesium–calcium–zinc* (cf. *Met. Abs.*, 1934, **1**, 123). Cooling and heating curves were carefully taken of all alloys in a specially designed crucible capable of holding the alloys in a fused state up to 900° C. in an inert atmosphere. Polishing specimens for micro-examination required working dry or in non-aqueous solvents, as water decomposes these alloys. Alloys were etched with 1 and 5% nitric acid in alcohol. Previously published work on the binary systems magnesium–calcium, calcium–zinc, and magnesium–zinc is reviewed. The complete ternary temperature diagram is first described. Eight compounds are found in the system: Mg_5Ca_3, Ca_5Zn_2, Ca_2Zn_3, $CaZn_4$, $CaZn_{10}$, $MgZn_2$, $MgZn_5$, and $Mg_5Zn_5Ca_2$. There are six binary and six ternary eutectics, three binary and four ternary peritectics. There are eleven warped surfaces of primary crystallization, thirty-six right conoids of secondary crystallization, four horizontal peritectic planes and six horizontal eutectic planes. Sixteen vertical sections through the four-dimensional diagram were examined by thermal analysis, the detailed data being given for each section. 215 different cooling curves were made. The alloys containing more than 30% calcium are readily oxidized in moist air and react more or less violently with water, depending on the calcium content. Sawed particles from these alloys in air readily burn with a yellow flame. The alloys containing more than 40% zinc are hard and brittle and difficult to saw; they crumble easily under pressure in the fingers. The alloys rich in magnesium are the most interesting, practically, for they can be worked, do not oxidize as readily as magnesium, and are very light. Two of the best of these alloys are magnesium with: (1) 1% each of zinc and calcium, and (2) 2% each of zinc and calcium. The densities are: (1) 1·748 and (2) 1·766, with that of magnesium as 1·738; hardness (1) 59 and (2) 48 average; Charpy impact (1) 0·64 and (2) 0·073 kg./in.^{2}.—S. G.

***The Free Energy of Formation of Lead Amalgams.** Creig S. Hoyt and Gebhard Stegeman (*J. Physical Chem.*, 1934, 38, (6), 753–759).—Cf. *Met. Abs.*, 1935, 2, 374. Concentration cells having pure lead as one pole and lead amalgams of varying concentration as the other were constructed and their potentials measured. Reproducible potentials are secured with amalgams up to 66 atomic-% lead. The amalgam is saturated at 0·0142 mole fraction at 25·00° C., and all amalgams between that concentration and 0·66 give the same potential. The free energy of formation of amalgams up to a mole fraction of approx. 0·50 were calculated as well as the activities of lead and mercury in the amalgams. The heat of solution of lead in unsaturated amalgams was calculated from the temperature coeff. of the e.m.f.—S. G.

***A Thermodynamic Study of Liquid Potassium Amalgams.** Marion H. Armbruster and James L. Crenshaw (*J. Amer. Chem. Soc.*, 1934, 56, (12), 2525–2534).—The e.m.f. of the concentration cell potassium (amalgam concentration c_1)–KCl (aqueous solution)–potassium (amalgam concentration c_2) was measured at 15°, 25°, and 35° C. over a wide range of liquid amalgam concentrations using dropping electrodes. It is concluded that amalgams of concentrations between 0·01 and 0·40 grm. of potassium per 100 grm. of mercury give e.m.f.'s which are reproducible within a few hundredths of 1 mv., but that reliable results cannot be obtained with amalgam concentrations below this range. The effects of type of dropping electrode, rate of flow, &c., are investigated. The free energy of transfer of potassium from one amalgam to another was calculated from the results and found to agree with that derived from measurements of the activity of potassium in mercury. The standard electrode potential of potassium was measured and found to be 2·9243 v. at 25° C. The solubility of potassium in mercury over the range 0° to 35° C. was determined.—S. G.

***The Activity of Sodium in Concentrated Liquid Amalgams.** E. S. Gilfillan, Jr., and H. E. Bent (*J. Amer. Chem. Soc.*, 1934, 56, (7), 1505–1509).—The activity of sodium in concentrated liquid sodium amalgams is approximately the same as that of the solid metal. Sodium amalgams cannot be well represented by the equation $\log a_2/N_2 = \frac{1}{2}\beta N_1^2$, which has been used successfully in treating so many solutions. The vapour pressure of mercury from concentrated liquid sodium amalgam is probably much less than 10^{-10} mm.
—S. G.

***Effects of Variation in the Manipulation on Dimensional Changes and Flow of Amalgams.** Marcus L. Ward and Erman O. Scott (*J. Dental Research*, 1935, 15, (3/4), 168–169).—Abstract of a paper read before the International Association for Dental Research. Volume change in setting of amalgams is influenced by variations in the mercury content and by overwork in mixing the alloy and mercury. If the mixture is kept for 5 minutes before packing in the cavity the amount of mercury retained in the packing is increased. With a high packing pressure the mercury content is low and the flow low. Using a standard alloy variations from 1·12 to 10·17% in flow were obtained with pressures varying between jarring in the mould and 80 lb. on a 2 mm. plunger.
—A. R. P.

***Surface Tension of Amalgams.** V. K. Semenchenko, B. P. Bering, and N. L. Pokrovskiy (*Kolloidnii Zhurnal* (*Colloid J.*), 1935, 1, 205–215; *C. Abs.*, 1936, 30, 7975).—[In Russian.] Cf. *Met. Abs.*, this vol., p. 523. Amalgams were obtained of silver, cadmium, and zinc by direct solution of metal in mercury, of barium by electrolysis of $BaCl_2$, and of sodium and potassium by distillation of vapours into mercury. In all cases except that of zinc amalgam the surface tension at first decreases with increasing concentration of metal and then is almost constant. The effect of amalgamated metal decreases in the order potassium, sodium, barium, silver, cadmium, and is negative for zinc. Values for concentrations and corresponding surface tension were: pure mercury 410 dynes/cm.; potassium 0·0024 atom-%, 392; 0·0080 atom-%, 326; 0·0183 atom-%, 296; 0·264 atom-%, 284; sodium 0·0045, 386; 0·135, 337; barium 0·0042, 407; 0·22, 358; cadmium 0·0110, 409; 1·22, 406; silver 0·0129, 409; 0·0295, 406; zinc, 0·0245, 411; 1·315, 420.—S. G.

***Properties of Metallic Solutions. III.—Surface Tension of Amalgams.** V. K. Semenchenko, B. P. Bering, and N. L. Pokrovskiy (with E. E. Scharovoy) (*Acta Physicochimica U.R.S.S.*, 1936, 5, (2), 181–192 (in English); and *Zhurnal Fizicheskoy Khimii* (*J. Phys. Chem.*), 1936, 8, (3), 364–371 (in Russian)).—Cf. *Met. Abs.*, this vol., p. 523. The surface tension at 18°–20° C. and various concentrations was studied in the case of various amalgams containing cæsium, rubidium, lead, tin, silver, copper, potassium, sodium, lithium, zinc, bismuth, cobalt, barium, strontium, magnesium, or cadmium. The values obtained for active metals at low concentrations satisfy Shishkovsky's equation. Divergence of the experimental curves from those of Shishkovsky occurs above a critical concentration which is a linear function of the activity limit. The experimental curves for surface tension concentration are much better expressed by: $\sigma_0 - \sigma = a \log (ebc + 1) - dc$, obtained by integration of Gibbs' equation.—N. A.

Alloys of Nickel. G. F. Geiger (*Amer. Soc. Test. Mat.: Symposium on High-Strength Constructional Materials,* **1936**, 95–108).—Tables and graphs are given showing the physical and mechanical properties after various heat and mechanical treatments of nickel, Monel metal, and Inconel. Methods of working and uses are also described.—A. R. P.

Inconel. —— (*Nickel Bull.*, 1936, **9**, (4), 78–80).—Some notes on the properties of Inconel (approx. nickel 80, chromium 14, iron 6%) and its uses, and details of methods of joining.—S. G.

†**Magnetic Alloys of Iron, Nickel, and Cobalt.** G. W. Elmen (*Elect. Eng.*, 1935, **54**, (12), 1292–1299; discussion, 1936, **55**, (8), 887–889; also *Bell System Tech. J.*, 1936, **15**, (1), 113–150; and (summary) *Metal Progress*, 1937, **31**, (3), 284, 326–328).—A report of the extensive investigation by the Bell Telephone System of the alloys of iron, nickel, and cobalt with and without additions of certain non-magnetic metals. E. discusses the preparation and composition of the alloys, which are classified into groups in which the magnetic properties are similar. The properties of the groups and certain specific alloys are discussed and their particular application mentioned.
—S. V. W.

Nickel-Copper Alloys. —— (*Japan Nickel Information Bureau, Tech. Information*, **B–11**, 70 pp).—[In English and Japanese.] This booklet is divided into two parts dealing, respectively, with the alloys containing less than 50% nickel and more than 50% nickel. In each case, the constitution, melting and casting, mechanical and heat-treatment, mechanical and physical properties, resistance to corrosion, and uses are discussed.—H. W. G. H.

Engineering Properties of "K Monel" Metal. C. A. Crawford, G. F. Geiger, and W. A. Mudge (*Metals and Alloys*, 1935, 6, (5), 101–105).—An abstract, *in extenso*, of a commercial technical bulletin. The physical, mechanical, thermal, magnetic, working, and machining properties of K-Monel metal are described with tabulated or graphical summaries in many cases. The alloy, which is similar to Monel metal in composition, but which also contains aluminium about 3·5%, is resistant to corrosion by alkali, sea-water, or sulphides.—P. M. C. R.

A Free-Machining Monel. —— (*Inco*, 1936, 14, (2), 20–21); and *Iron Age*, 1936, 138, (7), 7).—A brief note, with table. The form of Monel metal introduced for easy cutting ("R Monel") is lower in strength and resistance to corrosion than ordinary Monel and is not suitable for hot-working or severe cold-working. The tensile properties given show that the elongation (cold-drawn 35–15 and hot-rolled 45–30% on 2 in.) is not lower in "R" alloy. The Brinell hardness is 145–210 cold-drawn (against 160–220 for Monel), and 130–165 hot-rolled (against 130–170).—R. G.

Nickel–Copper–Iron Alloys and Their Magnetic Properties. —— (*Metallurgist* (Suppt. to *Engineer*), 1936, 10, 104–107).—A brief review and discussion of several papers on the subject published during 1935, respectively, by (*a*) O. Dahl, J. Pfaffenberger and K. Schwartz (*Met. Abs.*, 1935, 2, 504; (*b*) W. Köster and W. Dannöhl (*Met. Abs.*, 1936, 3, 4); (*c*) O. von Auwers and H. Neumann (*Met. Abs.*, 1935, 2, 580); and (*d*) H. Neumann (*Met. Abs.*, 1935, 2, 505).—R. G.

High-Permeability "Furukawa Magnetic Alloy." —— (*Nippon Elect. Communic. Eng.*, 1936, (4), 315–321).—[In English.] The "Furukawa" magnetic alloy has been developed in Japan for the continuous loading of submarine cables, the cores of audiofrequency transformers and other telephone apparatus. The patent claim is for an alloy containing iron 15–78, nickel 20–83, cobalt 0·6–27, chromium 0·3–13·5, silicon 0·1–4·5, and manganese 0·5–2%. Alloys within this range can readily be worked cold or hot. Maximum permeability is developed by heating at 900°–1200° C. (a short time only being required) and cooling in air. The magnetic properties of Furukawa alloy are dealt with in some detail.—E. V. W.

***Magnetic Characteristics of Nickel–Iron Alloys with Alternating Magnetizing Forces.** E. Hughes (*J. Inst. Elect. Eng.*, 1936, 79, (476), 213–223).—The magnetic properties of Mumetal and Permalloy "C" laminæ are determined with sinusoidal alternating magnetizing forces. It is shown that for magnetizing forces of the order exhibiting greatest d.c. permeability, a.c. permeability at 50 cycles may be only $\frac{1}{10}$ of this value, although for relatively large forces, permeabilities are almost identical in both cases. An unexplained dissymmetry is observed in the *B-H* loops obtained with alternating magnetization.—E. J. G.

Magneto-Resistance of Iron–Nickel Alloys, and a Relation Between Magneto-Resistance and Initial Permeability. K. Mihara (*Denki Gakkwai Zasshi* (*J. Inst. Elect. Eng. Japan*), 1936, 56, (5), 599–600).—[In Japanese.]—S. G.

***Bimetal Strips.** W. Weibull (*Iva*, 1936, (3), 87–89.—Outlines the calculations for the bending and power of bimetallic strips, with particular reference to German (Heraeus) nickel–iron alloy strips. The possibility of getting a variable temperature-curvature coeff. is mentioned, as with Invar-tungsten strips which bend one way when heated below 300° C., straighten at that temperature and reverse their bending above it.—E. v. S.

The Study of Platinum and Other Noble Metal Alloys. V. A. Nemilov (*Uspehi Khimii* (*Progress of Chemistry*), 1936, 5, (7/8), 1120–1129).—[In Russian.] A review.—N. A.

***The Iron–Platinum Alloys. Curie Points and Magnetic Moments.** A. Fallot (*Compt. rend.*, 1934, 199, 128–129; and *Bull. Soc. Franç. Phys.* (suppl. to *J. Phys. Radium*), 1934, (360), 146–147).—Curves of Curie points and atomic moments are given for alloys containing 0–25 atomic-% platinum. With more than 3·7 atomic-% platinum the transformation from the α to γ form with increasing temperature takes place at a higher temperature than the reverse change with decreasing temperature. The atomic moment of platinum–iron alloys increases linearly with increase of platinum up to 12·5 atomic-% platinum, and then returns to its initial value in the same way at

23 atomic-% platinum. This is the first time that a non-ferromagnetic element has been known to produce such an effect. A superstructure of the Fe_7Pt type is predicted.—S. G.

*__On the Equilibrium Diagram of the Silver-Rich Silver–Aluminium Alloys.__ Ichiji Obinata and Masami Hagiya (*Sci. Rep. Tôhoku Imp. Univ.*, 1936, [i], **Honda Anniv. Vol.**, 715–726; and *Mem. Ryojun Coll. Eng.*, 1937, **10**, (1), 1–10).—[In English.] See abstract from a journal printed in Japanese, *Met. Abs.*, this vol., p. 5.—S. G.

*__X-Ray Investigation of the Transformations in Aluminium–Silver Alloys.__ W. Hofmann and K. E. Volk (*Metallwirtschaft*, 1936, **15**, (30), 699–701).—An aluminium–silver alloy containing 25 atomic-% of aluminium (Ag_3Al) was prepared, and examined by X-ray crystal analysis in a high-temperature camera. At 700° and 605° C. the structure was body-centred cubic, with $a = 3{\cdot}24$ A. at 700° C. At 370° and 20° C. the alloy possessed the β manganese structure. These results confirm those of previous investigators. At 570° and 465° C., the structure was that of the hexagonal close-packed γ phase with $a = 2{\cdot}90$ A., $c = 4{\cdot}71$ A., $c/a = 1{\cdot}62$ at 570° C. According to the diagram of Ageew and Shoyket (*J. Inst. Metals*, 1933, **52**, 119) the alloy at these temperatures should be in the $(\alpha + \gamma)$ region, so that the γ phase boundary of these investigators is not confirmed, although it is possible that the α phase was present in quantities too small to produce visible diffraction lines. The general type of diagram of Ageew and Shoyket is confirmed.—W. H.-R.

*__Tantalum–Iron Alloys and Tantalum Steels.__ R. Genders and R. Harrison (*J. Iron Steel Inst.*, 1936, **134**, 173–209; discussion, 210–212).—See *Met. Abs.*, this vol., p. 393.—S. G.

*__The Creep of Tin and Tin Alloys.—I.__ (Hanson and Sandford.) See p. 637.

*__A Further Study of the Constitution of the Cadmium–Tin Alloys.__ D. Hanson and W. T. Pell-Walpole (*J. Inst. Metals*, 1936, **59**, 281–300).—A further study (cf. *J. Inst. Metals*, 1935, **56**, 165) was made of the constitution of the tin-rich cadmium–tin alloys by means of detailed thermal and microscopical analyses, and by electrical resistivity measurements. A peritectic reaction occurs at 223° C. with a formation of a new phase, β, which undergoes eutectoid decomposition at 127° C. on cooling, producing the well-known transition at this temperature. The limits of the α and β phases have been accurately determined, and the equilibrium temperature of the eutectoid transition is shown to be 133° C. The earlier diagrams by the authors and by Matuyama can be explained partly as representing metastable conditions which are very easily produced in these alloys, both on heating and on cooling; thus the peritectic reaction is only observed on cooling curves taken at very slow rates of cooling. The solidus and solid solubility lines of tin in cadmium were determined accurately, and the results are in agreement with those of Stockdale.—D. H.

*__The Effect of the Addition of Lead on the Endurance Limit of a Certain Tin-Base Bearing Alloy.__ John N. Kenyon (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (II), 194–197; discussion, 198–200).—See *Met. Abs.*, this vol., p. 249.—S. G.

*__Physical Properties of Soft Solders and the Strength of Soldered Joints.__ B. W. Gonser and C. M. Heath (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **122**, 349–371; discussion, 371–373).—See *Met. Abs.*, this vol., p. 454.—S. G.

*__Alloys of the System Iron–Carbon–Titanium.__ I. S. Gaeff (*Sobshenia Tsentralnogo Instituta Metallov Leningrad* (*Comm. Central Inst. Metals, Leningrad*), 1935, **(18)**, 68–93; *C. Abs.*, 1936, **30**, 8128).—[In Russian.] The alloys contained carbon 0·08–2·70 and titanium 0·1–4·47%. Titanium is a very active carbide-forming element. The carbides are stable, take no part in the transformation process under heat-treatment and prevent the enlargement of crystals of the solid solution in steels having no $\alpha \rightleftarrows \gamma$ changes.

TiC in hyper-eutectoid steel prevents the formation of cementite needles during overheating. Titanium is very active in closing the γ field.—S. G.

***Investigation of Hard Alloys Without Tungsten. Sormite Type.** I. S. Brokhin and F. I. Domorkin (*Sobshenia Zentralnogo Instituta Metallov Leningrad* (*Comm. Central Inst. Metals, Leningrad*), 1935, (18), 95–113; *C. Abs.*, 1936, **30**, 8126).—[In Russian.] The influence of silicon, nickel, and chromium on Sormite was studied, and a method for welding on the hard alloys was developed. Silicon above 4·5% increases the hardness and resistance to wear, but results in irregular values for temporary resistance to rupture and resistance to bending. There is a decrease in corrosion with a high silicon content. The nickel content can be reduced to 3% without affecting the mechanical properties or changing the microstructure. Carbon increases the hardness and resistance to wear. Addition of 30% or more chromium greatly increases the corrosion-resistance. The best composition for Sormite is chromium 25–29, nickel 3–6, carbon 2·7–3·3, silicon 3·5–4·5, manganese up to 1·5, phosphorus and sulphur each not more than 0·07%. Two hard alloy layers (1·2–3 mm.) should be welded on, and the zone of overheating should be subjected to hardening, normalizing, and quenching in oil. Such heat-treatment will not affect the structure and properties of the primary cast alloy. —S. G.

Alloys Prepared by Ceramic Methods. N. M. Zarubin and M. Suitin (*Redkie Metally* (*Rare Metals*), 1935, 4, (4), 21–25).—[In Russian.]—S. G.

***Phase Changes During Ageing of Zinc Alloy Die-Castings. II.—Changes in the Solid Solution of Aluminium in Zinc and Their Relation to Dimensional Changes.** M. F. Fuller and R. L. Wilcox (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **122**, 231–243).—See *Met. Abs.*, this vol., p. 38.—S. G.

***An Investigation of the Zinc-Rich Portion of the System Iron–Zinc.** E. C. Truesdale, R. L. Wilcox, and J. L. Rodda (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **122**, 192–228; discussion, 228–230).—See *Met. Abs.*, 1935, **2**, 582.—S. G.

No. 3 Zinc-Base Die-Cast Alloy. —— (*Metalgram* (*Apex Smelting Co.*), 1936, Nos. **6–10**, 20 pp.).—Charts (Nos. 6–9) giving the tensile strength, stability, elongation, and impact strength of No. 3 zinc-base die-casting alloy (zinc with aluminium 4·1 and magnesium 0·04%) produced under different conditions of temperature and pressure and subsequently kept in water vapour at 95° C.; No. 10 is a summary of the physical properties graphically illustrated in Nos. 6–9.—S. G.

No. 5 Zinc-Base Die-Cast Alloy. —— (*Metalgram* (*Apex Smelting Co.*), 1936, Nos. **11–15**, 20 pp.).—Charts (Nos. 11–14) giving the tensile strength, elongation, impact strength, and stability of No. 5 zinc-base die-casting alloy (zinc with aluminium 4·10, copper 1·0, and magnesium 0·03%); No. 15 summarizes the physical properties graphically illustrated in Nos. 11–14. —S. G.

"Zamak," a Zinc Die-Casting Alloy. —— (*Apparatebau*, 1936, **48**, (16), 178–179).—The composition and mechanical properties of die-cast "Zamak 2" and "Zamak 5" are tabulated, and compared with those of Zamak 3. The properties of chill-cast Zamak 5 and Zamak 3 (copper-free type) are summarized, and applications of the various types are indicated. Some notes on protection processes are appended.—P. M. C. R.

***The Forming Properties of Some Non-Ferrous Sheet Metals.** G. R. Gohn (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (II), 207–220; discussion, 221; also *Bell Telephone System Tech. Publ.*, *Metallurgy*, *Monograph*, **B-987**, 1936, 14 pp.; and (summaries) *Machinist* (*Eur. Edn.*), 1936, **80**, (46), 929–930; (48), 965–966; *Sheet Metal Ind.*, 1936, **10**, (113), 693; and *Aluminium and Non-Ferrous Rev.*, 1936, **2**, (2), 89–91).—See *Met. Abs.*, this vol., p. 302.—S. G.

Bearing Metals. G. J. Brittingham (*Australasian Engineer*, **1936**, May 7, 12–13, 25–26; and *Commonwealth Eng.*, 1937, **24**, (6), 211–214).—Read before the Metallurgical and Engineering Society, Port Kembla. A brief account is given of the properties and uses of bearing bronzes, and of tin-, lead-, and cadmium-base bearing alloys. The addition of 1–1·5% of cadmium to tin-base bearing metals stiffens the matrix and considerably improves the fatigue-resisting properties. Cadmium-base alloys contain small amounts of copper, silver, and magnesium as hardening elements; they are harder, stronger, less readily deformed, and more heat conductive than tin-base alloys, but are more expensive.—A. R. P.

New Hypotheses Concerning the Chemical Elements and the Reaction between Bearing Metals and Lubricants. Heinrich Herbst (*Chem.-Zeit.*, 1935, **59**, (76), 777–778).—A general description of the physical and chemical properties of solids and liquids. An hypothesis is developed regarding the effect of two metals constituting a bearing upon an external field of radiated matter, and further regarding the effect of both radiation and metal on oil drops applied to the metallic surfaces. Lubricating effects are explained in terms of the disturbing influence of oil films on the radiation.—E. J. G.

New Tendencies in the Study of the Mechanical Properties of Metals and Alloys. Léon Guillet, Jr. (*Mém. Soc. Ing. civ. France*, 1936, **89**, (5), 647–658; and (summaries) *Génie civil*, 1936, **109**, (20), 433; and *Light Metals Research*, 1936, **5**, (9), 210–211).—Recent work on endurance testing, modulus of elasticity, measurement of the hardness of very hard alloys, mechanical testing of metals at high temperatures, and the influence of structure on the mechanical properties of metals is reviewed.—A. R. P.

Phenomena of Instability in Metals. J. Galibourg (*Sciences. Rev. Assoc. Franç. Avanc. Sci.*, 1936, **64**, (6), 251–260).—G. discusses the occurrence and significance of creep, and gives an historical account of ageing phenomena, and ageing after quenching and its effects on the mechanical properties of metals, with particular reference to Duralumin and beryllium–copper alloys. Ageing following work-hardening in steel is discussed, and the necessity for avoiding harmful consequences as a result of this phenomenon is stressed.
—E. J. G.

Age-Hardening Alloys and Their Applications. R. H. Harrington (*Gen. Elect. Rev.*, 1936, **39**, (3), 124–127).—The mechanism of simple precipitation-hardening, simple lattice-strain hardening, and precipitation-hardening involving allotropic reactions is considered, and is illustrated by reference to actual alloy systems. Other causes of age-hardening are summarized, and methods of study are described. Recently-developed age-hardening alloys include alloys " 548 " and " 42 " (iron- or nickel-base alloys containing a high proportion of cobalt and considerable percentages of molybdenum, chromium, carbon, and vanadium), 2·25% beryllium–copper, a copper–beryllium–cobalt alloy, and Alnico (nickel–aluminium–iron–cobalt). These materials, and their applications, are briefly described.—P. M. C. R.

The Complex Interdependence of the Properties of Alloys and the Industrial Conditions of Their Manufacture, Testing, and Use. R. de Fleury and H. Portier (*J. Inst. Metals*, 1936, **59**, 211–219; discussion, 219–224).—Indirect factors influencing the properties of light alloys in service are classified and some methods of recognizing and controlling them are described.—R. de F.

***Heterogeneity of a Solid Solution and its Mechanical and Chemical Properties.** Pierre Chevenard (*Compt. rend.*, 1934, **199**, 861–863).—See *Met. Abs.*, 1934, **1**, 584.—S. G.

***Heterogeneity of Solid Solutions in Cast Alloys.** Pierre Chevenard and Xavier Waché (*Rev. ind. minérale*, 1936, (377), 925–939).—Cf. *Met. Abs.*, this vol., p. 523.—S. G.

***The Electrical Properties of Dilute Solid Solutions.** N. F. Mott (*Proc. Cambridge Phil. Soc.*, 1936, **32**, (2), 281–290).—The electrical resistance of a metal is greatly increased by addition of a second metal. The quantical explanation of this phenomenon was first given by Nordheim. M. discusses the suggestion that the field within the foreign atom is different from that within the other atoms so that the lattice field is no longer periodic. The effect due to lattice distortion round the foreign atom is probably small. Following the method due to Wigner and Seitz (*Met. Abs.* (*J. Inst. Metals*), 1933, **53**, 352) an expression is derived for the resistance of a dilute solid solution in the case when the solvent metal is either copper, silver, or gold or one of the alkali metals. Fairly satisfactory agreement between experimental and theoretical values of the increase of resistance is obtained in the case of the mutual dilute solid solutions (1%) of copper, silver, and gold. Excellent qualitative agreement is also found between experimental and theoretical results in the case of alloys of metals in different columns of the periodic table, *e.g.* zinc, gallium, tin, and arsenic dissolved in a noble metal.—J. S. G. T.

***New Magnetic Phenomenon: Increasing Paramagnetism Superposed on Diamagnetism in Alloys With False Curie Point.** R. Forrer and A. Serres (*Compt. rend.*, 1934, **198**, 1903–1905; *C. Abs.*, 1934, **28**, 5022).—According to F.'s theory of contacts, these are ruptured at the false Curie point of alloys, but such contacts should tend to persist above that point, their gradual disappearance with increase of temperature being indicated by increasing paramagnetism or decreasing diamagnetism. This is shown to be the case with β and γ brass (CuZn and Cu_5Zn_8), AgZn and Ag_5Zn_8, for the last of which θ is 25°.—S. G.

***Magnetic Susceptibility of Some Alloys of "Gamma Brass" Structure.** Cyril Stanley Smith (*Physics*, 1935, **6**, (1), 47–52).—The change of diamagnetic susceptibility with composition of a number of phases of γ-brass structure (copper–zinc, copper–cadmium, silver–zinc, silver–cadmium) was determined. In each case when the phase makes its first appearance with low electron ratio it is not strongly diamagnetic, but the increase in diamagnetism is approximately linearly dependent on the number of free electrons, and the strongest diamagnetism occurs at the limit of the γ-phase with the highest electron ratio possible for the structure.—S. G.

†Diffusion in Solid Metals. Robert F. Mehl (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **122**, 11–56).—Institute of Metals Division Lecture, 1936. See *Met. Abs.*, this vol., p. 457.—S. G.

***Methods for the Examination of Thermal Effects Due to Order–Disorder Transformations.** C. Sykes and F. W. Jones (*J. Inst. Metals*, 1936, **59**, 257–280).—Describes an experimental method particularly suitable for the determination of thermal changes in order–disorder transformations occurring in the temperature range 100°–500° C. The apparatus possesses the advantage that it is simple to construct and easy to operate. The authors are of the opinion that it could be applied to the study of other types of solid transformation. Various manifestations of the transformation in Cu_3Au are used as illustrations of the type of experimental result which can be obtained.—C. S.

Heat Capacity of Solid Solutions. L. E. Gurevich (*Zhurnal eksperimentalnoi i teoreticheskoy Fiziki* (*J. Exper. Theoret. Physics*), 1936, **6**, (6), 537–543).—[In Russian.] Impurities in the crystal lattice distort the character of atomic oscillation and therefore alter its heat capacity. At low temperatures this changes the Debye characteristic temperature, calculation of which is given. —N. A.

Reactions in the Solid State. V.—Reactions in Solid Metals. G. Masing (*Angew. Chem.*, 1936, **49**, (51), 907–915).—The nature of reactions in the solid state is correlated with temperature conditions, which may permit or suppress local changes in concentration. Transformations in solid solutions, magnetization phenomena, separation hardening and its reversal, and transformations in pure metals are considered on this basis.—P. M. C. R.

On the Relation Between the Curves of Reciprocal Properties in Binary Systems. V. J. Anosov (*Izvestia Sektora Fiziko-Khimicheskogo Analiza* (*Ann. Sect. Anal. Phys. Chem.*), 1936, **8**, 69–75).—[In Russian.]—N. A.

Mensuration of a Chemical Equilibrium Diagram. N. I. Stepanow (*Uspehi Khimii* (*Progress of Chemistry*), 1936, **5**, (7/8), 972–986).—[In Russian.] The quantitative algebraic relation between the diagram elements is established, as well as between the quantities which characterize the chemical process within the system, and the geometrical properties of the diagram. A series of the author's papers is examined, investigating the rate of formation of chemical compounds in the magnesium–cadmium system.—N. A.

***Singular Points in the Reaction Isotherm Diagram.** N. I. Stepanow (*Izvestia Akademii Nauk S.S.S.R.* (*Bull. Acad. Sci. U.R.S.S.*), **1936**, [Chim.], (2), 219–253).—[In Russian.] The paper represents the algebraic and geometric theoretical relations between the composition of a system in equilibrium and the amount of formed chemical compound at various degrees of dissociation. —N. A.

The Topology of the Diagram of Chemical Equilibrium. N. S. Kurnakow (*Trav. Congr. Jubilaire Mendeleev, Acad. Sci. U.R.S.S.*, 1936, **1**, 535–555 (in Russian), 557–577 (in French)).—See *Met. Abs.*, this vol., p. 302.—S. G.

III.—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

(Continued from pp. 525–533.)

Report of [A.S.T.M.] Committee E-4 on Metallography. C. H. Davis and O. E. Harder (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 542–544).—Submits revisions of standard rules governing the preparation of micrographs of metals and alloys, and of the standard grain-size chart for classification of steels. Recommends the adoption as standard of the tentative recommended practice for metallographic testing of ferrous and non-ferrous metals, to replace the present standards.—S. G.

The Microscope in Engineering and Industry. A. E. Bingham (*J. Record Trans. Junior Inst. Eng.*, 1936, **47**, (2), 33–58).—S. G.

Correlation Between Metallography and Mechanical Testing. Herbert F. Moore (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **120**, 13–35; also *Univ. Illinois Bull.*, 1936, **34**, (31); and (summaries) *Iron Age*, 1936, **137**, (9), 26–29, 106; *Light Metals Research*, 1936, **4**, (24), 441–442; *Met. Ind.* (*Lond.*), 1936, **48**, (12), 355).—Henry Marion Howe Memorial Lecture. The use of metallographical examination in detecting the cause of fatigue cracking and in associating mechanical properties with particular structures is discussed, with special reference to cast iron, pure iron, and steel.—A. R. P.

***†Optical Polarization in Metallographic Investigations.** Hans Daschner (*Forschungsarbeiten über Metallkunde u. Röntgenmetallographie*, 1936, (19), 32 pp.).—The theory of the reflection of plane-polarized and of feebly elliptically polarized monochromatic and white light by anisotropic absorbing crystals is developed. Details are given of the percentage reflection of light of wave-lengths corresponding to the *C*, *D*, *E* and *F* lines for various azimuths of the plane of polarization by the α' and β' phases of copper–aluminium alloys, by $CuAl_2$, and by magnesium, antimony, and cadmium. The observations are made by means of a special type of polarization microscope using either a dry or an oil-immersion objective.—J. S. G. T.

On Macroscopic and Macrographic Tests of Metals. P. Regnauld (*Mem. Artillerie Française*, 1935, **14**, (3), 599–631).—R. gives compositions of reagents for copper alloys and aluminium alloys, and describes the methods of application.—S. G.

***Microscopic Study of Ancient Bronze and Copper.** C. G. Fink and E. P. Polushkin (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **122**, 90–117; discussion, 118–120).—See *Met. Abs.*, this vol., p. 251.—S. G.

***On the Mechanism of Deformation in a Drawn Tube.** V. Montoro (*Metallurgia italiana*, 1934, **26**, 331–334).—The microstructure of a drawn tube of aluminium–brass shows marked variations in the orientation of the crystals across the thickness of the tube: these are related to the action of the mandrel. The existence of considerable internal stresses is demonstrated by the presence of slip-bands.—P. M. C. R.

***The Etching of Molybdenum by Alkaline Potassium Ferricyanide Solutions.** J. A. M. van Liempt (*Rec. trav. chim.*, 1936, **55**, (11), 989–990; and *Laboratoria N.V. Philips' Gloeilamp. Eindhoven, Separaat* **1153**, 1936, 2 pp.).—[In German.] The action of ternary mixtures of sodium hydroxide, potassium ferricyanide, and water on molybdenum is shown in a ternary diagram by lines of equal rate of attack. The best etch is obtained with a solution of 360 grm. of the ferricyanide and 36 grm. of the hydroxide in 1 litre of water; immersion for 5–10 seconds is sufficient for metallographic sections.—A. R. P.

***An Etching Reagent for Zinc and Zinc Alloys.** J. Schramm (*Metallurgist* (Suppt. to *Engineer*), 1936, **10**, 175).—A summary of a paper by S. in *Z. Metallkunde*, 1936, **28**, 159; see *Met. Abs.*, this vol., p. 357.—R. G.

***Veining and Sub-Boundary Structures in Metals.** L. Northcott (*J. Inst. Metals*, 1936, **59**, 225–253; discussion, 253–255).—A network structure, termed veining, which occurs within the crystals has been studied in several pure metals and in many alloys of copper, and methods for its production are discussed. The structure is shown to be due to the precipitation from solid solution, in a network form, of the oxide of the metal during cooling. The influence of alloying additions on veining in copper has been examined and the effect of heat-treatment and recrystallization on veining correlated with changes in hardness. Similar structures referred to as sub-boundary structures have been observed in a number of other alloys. These structures are due to the precipitation, also during cooling, of a constituent of the alloy.—L. N.

***Theory of Metallic Crystal Aggregates [Density and Energy Changes in Cold-Worked Copper and Iron].** Charles G. Maier (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **122**, 121–170; discussion, 170–175).—See *Met. Abs.*, this vol., p. 359.—S. G.

Notes on the Crystallization of Copper. Alden B. Greninger (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **122**, 74–85; discussion, 85–89).—See *Met. Abs.*, 1935, **2**, 586.—S. G.

***On Free Crystallization of Magnesium (Crystallization Without the Influence of Gravity).** A. Glazunov and N. Lazarov (*Stroj. Obzor*, 1935, **15**, (12), 81–84).—Cf. *Met. Abs.*, this vol., p. 496. The influence of gravity and of the walls of the mould on crystallization has been eliminated by melting metallic magnesium in a mixture of 85% of lithium chloride and 15% of lithium fluoride. The sp. gr. of this mixture at the melting point of magnesium (650° C.) being identical with the sp. gr. of the metal (1·60), the molten magnesium formed in this mixture a suspended floating mass of a spherical form. Amounts of magnesium ranging from 20 to 30 grm. were used for the tests and were melted in fire-clay crucibles in an ordinary gas-fired furnace. After solidification, the metal was removed from the bath in the shape of a regular sphere and was cooled in water. Photomicrographs showed that there was no difference in the structure of the interior of the sphere and of its surface, neither were there any cavities in the metal. The authors intend to apply similar methods for the free crystallization of other metals and alloys.—O. Q.

***Influence of Recovery on Recrystallization.** M. Kornfeld and W. Pavlov (*Physikal. Z. Sowjetunion*, 1934, **6**, (6), 537–548; *Sci. Abs.*, 1935, [A], **38**, 336).—[In German.] Cold-drawn aluminium wires of 1·90 mm. diameter are deformed by stretching and are annealed at 450° C. The following problems are studied, and the results given graphically: the relations between grain-size and both time and temperature of the recovery process; the relation between the grain-size and the degree of deformation; and the difference between specimens which have been subjected to a recovery process and those which have not. The rate of growth of new grains and the "incubation period" are discussed, and it is shown that the former is not affected by recovery whilst the latter is very much greater for specimens subjected to a recovery process.—S. G.

Remarks on the Paper by A. I. Kitaygorodskiy [on Recrystallization of Copper–Zinc Alloys with Low Zinc Content]. M. V. Jakutovich (*Zhurnal Tehnicheskoy Fiziki* (*J. Tech. Physics*), 1936, 6, (2), 377.)—[In Russian.] Cf. *Met. Abs.*, this vol., p. 303. The rate of growth is considered to be a function of the height of the energy barrier and not of the surface energy. —S. G.

***Oxide Layer on a Polished Copper Surface.** S. Dobinski (*Nature*, 1936, **138**, (3479), 31).—D. points out that the similarity between the electron diffraction patterns obtained with polished surfaces of different metals may be due to the similarity of the lattice constants of their oxides. It is shown that if copper is polished under benzene or pentane a different pattern results, which changes to the usual one on exposure to air. This indicates that the usual polished surface possesses the lattice constants of the oxide.—B. C.

Oxide Layer on Polished Surface. L. H. Callendar (*Nature*, 1936, **138**, (3485), 291).—Support is given to a letter by S. Dobinski (see preceding abstract) on the grounds that solution potential measurements of polished surfaces have also indicated that an oxide layer is present.—B. C.

***Kikuchi Lines from Etched Copper Crystal.** William Cochrane (*Nature*, 1936, **138**, (3483), 202–203).—It is shown that the diffraction pattern obtained by a beam of fast electrons on an etched copper surface consists of the Kikuchi lines as well as the cross-grating pattern. This indicates that the cross-grating pattern is not due to imperfections in the lattice.—B. C.

***Eddy Arrangement of Microcrystals in a Metallic Wire Caused by Drawing.** T. Fujiwara and Y. Seiki (*Hiroshima J. Sci.*, 1936, **6**, 307–312).—[In English.] The arrangement of microcrystal grains in the cross-section of drawn wires of aluminium and tungsten is studied by means of X-ray radiographs and microscopic examination. It is found that in the cross-section of the drawn wire the microcrystal grains crushed by wire-drawing are rotated somewhat around the axis of the wire. The amount of angular displacement of each crystal grain is so varied that the displacement is greater the nearer the layer in which the crystals are situated lies to the surface, and as a whole arrangement it seems as if the crystal grains are deformed in an eddy shape by wire-drawing.—S. G.

***Mechanism of Plastic Deformation. II.—Effect on the Phase Changes.** A. W. Stepanow (*Physikal. Z. Sowjetunion*, 1934, **5**, (5), 706–713).—[In German.] Additional evidence is brought forward to show that in a permanently deformed crystalline solid the phase changes occur at the slip planes. Factors affecting permanent changes in properties are considered. —S. G.

***Influence of Slip-Plane Traces on Temperature Emission.—II.** H. Mahl and D. Schenk (*Z. Physik*, 1936, **101**, (1/2), 117–120).—Electron-microscope photographs are given of surfaces of nickel covered with barium, tungsten with thorium, and molybdenum with barium; the photographs show linear markings which are interpreted as being due to slip lines.—B. C.

Application of X-Rays to the Study of the Annealing of Aluminium. J. J. Trillat (*Met. Ind.* (*Lond.*), 1936, **49**, (2), 27–32; and *Light Metals Research*, 1936, **5**, (4), 86–87).—Read at the Chemical Engineering Congress of the

World Power Conference, 1936. Recrystallization phenomena in rolled silver, copper, and aluminium sheet are briefly contrasted. The influence on recrystallization of inter-crystalline and dissolved impurities is illustrated by a series of comparative X-ray studies of commercial, and of highly refined, aluminium. A *bibliography* is appended.—P. M. C. R.

***X-Ray Examination of Aluminium and Copper Test-Pieces Broken under Dynamic Forces.** E. Brandenberger (*Eidgenössische Materialprüf. E.T.H. Zürich, Ber.*, 1935, (95), 11–14).—[In German.] See *Met. Abs.*, 1935, **2**, 685. —S. G.

Addenda to Work on the Lattice Constant of the Purest Aluminium. A. Ievins and M. Straumanis (*Z. physikal. Chem.*, 1936, [B], **34**, (5), 402–403; cf. *Met. Abs.*, this vol., p. 528).—The lattice constant of the purest aluminium was determined in a Debye–Scherrer camera 86 mm. in diameter. The results obtained agreed well with previous values obtained by I. and S.—E. J. G.

***X-Ray Determination of the Coefficients of Thermal Expansion of Beryllium and Tin.** G. F. Kossolapov and A. K. Trapeznikov (*Z. Krist.*, 1936, **94**, (1), 53–59).—[In German.] See abstract from another source, *Met. Abs.*, this vol., p. 528.—W. H.-R.

On Crystal Orientations in Electrolytic Chromium Deposits. V. I. Arharov (*Zhurnal Tehnicheskoy Fiziki* (*J. Tech. Physics*), 1936, **6**, (10), 1777–1781).—[In Russian.] The crystallites in chromium plate may be oriented so that (*a*) the (100) plane, or (*b*) the (111) plane is parallel to the surface; the former orientation results in deposits obtained from solutions at room temperature and the latter in deposits from solutions at 50°–80° C. The regularity of the orientation depends on the current density, increasing at first and then decreasing with increase in current density. As the temperature is increased the more regular deposits are obtained at higher current densities. The hardness of chromium plate is related to the texture.—N. A.

***The Crystal Structure and Composition of the Trigonal Chromium and Manganese Carbides.** A. Westgren (*Jernkontorets Ann.*, **1935**, (6), 231–240).—X-ray crystal analysis of the structure of these compounds leads to an approximate determination of their spatial arrangement, and to the composition Cr_7C_3 and Mn_7C_3 for the two compounds.—E. v. S.

***On the Nature of the Eutectoid Transformation in the Aluminium Bronzes.** Ichiji Obinata (*J. Mining Inst. Japan*, 1934, **50**, (592), 649–662).—[In Japanese.] The kinetics of the eutectoid transformations in aluminium bronzes is discussed, both in equilibrium and in the unstable state after quenching and annealing of the alloys. The paper is mainly a shorter version of the communication published previously (*J. Inst. Metals*, 1930, **43**, 456), but some new results are incorporated. A *bibliography* of 25 references is given.—S. G.

Powder Diagrams of Magnetized Nickel Crystals. S. Kaya and J. Sekiya (*Z. Physik*, 1935, **96**, 53–61).—Discontinuities are shown by the cubic and dodecahedral surfaces, according as magnetization is along the tetragonal or diagonal axis.—S. G.

Structures and Alterations of Structure of NiS and NiSe. G. R. Levi and A. Baroni (*Z. Krist.*, 1935, **92**, 210–215; *C. Abs.*, 1936, **30**, 2449).—[In Italian, with German summary.] Various forms of NiS were prepared and studied by X-rays and electron diffraction methods. γ-NiS is identical with millerite; $a = 9{\cdot}61$, $c = 3{\cdot}15$ A. β-NiS corresponds to the usual synthetic NiS, $a = 3{\cdot}42$, $c = 5{\cdot}30$ A. It becomes well crystallized only on standing. α-NiS, precipitated with $(NH_4)_2S$, is amorphous. It alters on exposure to air, but does not become crystalline. NiSe is similar: α-NiSe is amorphous; β-NiSe is the usual synthetic material, with $a = 3{\cdot}66$, $c = 5{\cdot}33$ A.; and γ-NiSe (detected only with electron rays) is isomorphous with millerite, with $a = 9{\cdot}84$, $c = 3{\cdot}18$ A. The spontaneous change from γ to α at room temperature can be observed by electron interference; in NiS the change is a matter of days, in NiSe it is a matter of hours. If these compounds are not prepared in the absence of air, NiS_2 and $NiSe_2$ are obtained.—S. G.

***X-Ray Analysis of Crystal Orientation in Eutectic Melts of Zinc and Cadmium.** D. M. Zagorodskikh (*Zvetnye Metally* (*Non-Ferrous Metals*), 1935, **10**, (7), 114–120; *C. Abs.*, 1936, **30**, 8114).—[In Russian.] An eutectic alloy containing cadmium 83 and zinc 17% was used. Eutectic single crystals were obtained by withdrawing molten metal from a crucible by means of a copper wire. Debye photograms taken of pure zinc and cadmium and of eutectic single crystals led to the conclusion that the unit cells of cadmium and zinc in the eutectic single crystals possess definite orientation with respect to each other, the relative positions being in the [100] direction.—S. G.

***X-Ray Study of Iron–Nickel Alloys.** Eric R. Jette and Frank Foote (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **120**, 259–272; discussion, 272–276).—See *Met. Abs.*, this vol., p. 76.—S. G.

***The Lattice Spacings of Certain Primary Solid Solutions in Silver and Copper.** William Hume-Rothery, George Farley Lewin, and Peter William Reynolds (*Proc. Roy. Soc.*, 1936, [A], **157**, (890), 167–183).—Accurate measurements are made of the lattice spacings of the primary solid solutions of cadmium, indium, tin, and antimony in silver, and of zinc, gallium, and germanium in copper. In the majority of cases the curve connecting the lattice spacing with the atomic percentage of solute is not exactly a straight line, the lattice distortion in the more concentrated solid solutions being slightly greater than that required by a linear relation. In each series of alloys, increasing valency results in increased lattice distortion at equal atomic percentages of the solute elements. In dilute solid solutions in silver, equal atomic percentages of cadmium, indium, tin, and antimony expand the lattice of silver by amounts proportional to 2 : 3 : 4 : 6, respectively; this whole number relation holds to an accuracy equivalent to 1 part in 20,000 in the lattice spacings, and ±0·05%, in the composition of the alloys. In the dilute alloys of the copper series, equal atomic percentages of zinc and germanium expand the lattice of copper by amounts proportional to 3 : 4, but the corresponding factor for germanium is 4·8 and not 5.—W. H.-R.

Asymmetry in Metallic Zinc and Cadmium. K. Herrmann. G. W. Brindley (*Nature*, 1936, **138**, (3485), 290–291).—H. gives reasons to indicate that the discrepancies in the X-ray scattering factors for zinc and cadmium are due to asymmetry of the atom and not of the lattice vibrations. B., in reply, supports his previous contention (*Met. Abs.*, this vol., p. 304) that the discrepancies are due to asymmetric lattice vibrations.—B. C.

Anomalous Values of Lattice Spacings Obtained by Electron Diffraction. E. Pickup (*Nature*, 1936, **137**, (3478), 1072).—Attention is directed to discrepancies between the relative values of lattice constants as measured by electron diffraction and by X-rays. It is suggested that the anomaly is in the electron diffraction values owing to the small size of the crystals concerned. The importance of these discrepancies in interpreting electron diffraction data is emphasized.—B. C.

***Fine Structure of X-Ray Absorption Edges in Close-Packed Cubic and Close-Packed Hexagonal Crystal Lattices.** D. Coster (*Physica*, 1935, **2**, (7), 606–610; *C. Abs.*, 1936, **30**, 347).—[In English.] The fine structure of X-ray absorption edges was compared for calcium and titanium of cubic and hexagonal close-packing, respectively. By reducing the distances of the maximum and minimum absorption for titanium by a factor $(2{\cdot}91/3{\cdot}97)^2$, corresponding to the distances of neighbouring atoms in the two structures, the calcium and titanium curves are found to be identical. Likewise, curves for α and ε-brasses are identical after reduction to a common distance between atoms. Thus, the positions of the edges in the spectrum are found to be the same; however, there still are typical differences in the form of the maximum and minimum due to the difference in lattice.—S. G.

Discussion of the Forms of the X-Ray Absorption Edges in Metals and Insulators. Toshinosuke Muto (*Rikwagaku Kenkyū-jo Iho* (*Bull. Inst. Phys. Chem. Res.*), 1936, **15**, (7), 444–450).—[In Japanese.] A brief English summary is given in the supplement to *Sci. Papers Inst. Phys. Chem. Res.* (*Tokyo*), 1936, **29**, 632–635.—S. G.

Isotropy Planes in Cubic System Crystals. G. I. Aksenov (*Zhurnal eksperimentalnoy i teoreticheskoy Fiziki* (*J. Exper. Theoret. Physics*), 1936, **6**, (8), 877–880).—[In Russian.] The reciprocal of the modulus $1/E$ in cubic system crystals represented as a radius-vector, describes a surface of the 10th order. A space model $1/E$ for an iron crystal is given.—N. A.

Elementary Deduction of an Expression for the Width of Debye–Scherrer Rings. V. A. Kolpinskiy (*Zhurnal eksperimentalnoy i teoreticheskoy Fiziki* (*J. Exper. Theoret. Physics*), 1936, **6**, (8), 881–882).—[In Russian.] With the aid of a Ewald inverse lattice, the expression for the width of the ring of X-ray and powder photograms, is worked out simply.—N. A.

On the Focussing of X-Rays as by a Convergent Lens. V. I. Arharov (*Zhurnal Tehnicheskoy Fiziki* (*J. Tech. Physics*), 1936, **6**, (10), 1771–1776).—[In Russian.] A method is described in detail for focussing X-rays on a surface instead of a line.—N. A.

***A Systematic Method of Investigating Superstructures, Applied to the Arsenopyrite Crystal Structural Type.** M. J. Buerger (*Z. Krist.*, 1936, **94**, (6), 425–438).—[In English.]—W. H.-R.

Structure-Factor Graphs for Crystal Analysis. W. L. Bragg (*Nature*, 1936, **138**, (3487), 362–363).—Describes a method of using contoured graphs for determining crystal structures.—B. C.

Crystal Structure: Bibliography. P. Niggli and W. Nowacki (*Z. Krist.*, 1936, **94**, 321–326, 419–424).—Covers the literature of X-ray methods and crystal structure from Jan. 1 to June 30, 1936.—S. G.

IV.—CORROSION

(Continued from pp. 533–545.)

***The Corrosion of Aluminium.** J. M. Bryan (*Dept. Sci. Indust. Res. Rep. Food Invest. Board*, **1935**, 170–180).—The view is maintained and supported by experiment that aluminium hydroxide forms soluble basic complexes with the anions of hydroxyorganic acids. At 25° C. the film on the surface of aluminium is highly protective against dilute solutions of citric acid; breakdown, however, occurs at 75° C. and $0{\cdot}06N$ citric acid shows more marked corrosion up to periods of 9 days than acid of $0{\cdot}15N$ strength. Corrosion ceases because of acid saturation rather than by the formation of a film on the surface of the metal. Corrosion in the presence of dilute citric acid is increased by the addition of either sodium citrate or sodium chloride, the increase in both cases being due to the breakdown of the protective film and being most marked with sodium citrate at the lowest citric acid concentrations. Corrosion tests with sodium citrate, sodium tartrate, and sodium acetate lead to the general conclusion that the salts of the hydroxy acids but not those of the non-hydroxy acids, dissolve the film of oxide or hydroxide on the surface of the metal; if, however, the film is broken down by the salts of the hydroxy acids, then those of the non-hydroxy acids can play some part in the corrosion. The corrosion by the salts of the hydroxy acids cannot be related to p_H or to the number of hydroxide groups in the molecules.—W. D. J.

***The Diffusion of Hydrogen Through Mild Steel [and Aluminium] Sheet.** T. N. Morris (*Dept. Sci. Indust. Res. Rep. Food Invest. Board*, **1935**, 164).—Experiments with citric acid solutions have indicated that the inhibiting effect of gelatin on the corrosion of mild steel sheet is due to the prevention of deposition rather than the evolution of hydrogen. Small additions of phosphorous or sulphurous acids have little influence on the rate of corrosion. Sheet aluminium tested in the manner previously described for steel showed no indications of hydrogen diffusion in 9 days.—W. D. J.

***On the Influence of Purity of Aluminium on the Corrosion in Hydrochloric Acid of Different Concentrations.** W. J. Müller and E. Löw (*Anz. Akad. Wiss. Wien, Math.-naturw. Klasse*, 1936, **73**, 87–88; and *Light Metals Research*, 1936, **5**, (9), 203–205).—For abstract of a full account of this work see *Met. Abs.*, this vol., p. 533.—S. G.

***A Note on the Influence of Salt-Bath Heat-Treatment on the Corrosion-Resistance of Duralumin Sheet.** A. J. Sidery and B. Evans (*J. Inst. Metals*, 1936, **59**, 65–71).—Some experiments were carried out to provide information as to whether the use of a nitrate salt-bath as the medium in the final heat-treatment of Duralumin has any deleterious effect on the corrosion-resistance of the material as compared with that of material which has been heat-treated in an electric furnace. Further, the influence of salt residues on the surface of the sheet during prolonged storage was investigated with special reference to the development of intercrystalline corrosion. It was found that the use of nitrate salt-baths in the heat-treatment operation has no deleterious effect on the corrosion-resistance of Duralumin, but that salt residues are merely liable to foster local surface pitting of the material during storage.—A. J. S.

Influence of Magnesium, Manganese, and Titanium on the Corrosion Resistance of Aluminium. W. O. Kroenig and S. E. Pavlov (*Tehnika Vosdushnogo Flota* (*Tech. Air Fleet*), **1936**, (10), 19–29).—[In Russian.] Addition of 0·2% magnesium to commercial 99·5% aluminium increases its resistance to corrosion, especially by sea-water, but small additions of manganese or titanium have the opposite effect. The 0·2% magnesium alloy is recommended for plating.—N. A.

†**Corrosion-Resistant Aluminium Casting Alloys.** [R.] Sterner-Rainer (*Internat. Giessereikongress, Düsseldorf*, 1936, *Tech.-wiss. Vorträge*, **1936**, (22), 8 pp.; and (summary) *Aluminium and Non-Ferrous Rev.*, 1937, **2**, (6), 219).—[In German.] See *Met. Abs.*, this vol., p. 535.—S. G.

***Dissolution of " Vacuum Films " in Acids. I.—Dissolution of Chromium in Sulphuric Acid.** M. A. Rosenberg, K. E. Avaliani, and F. B. Jurkovskaja (*Dokladi Akademii Nauk S.S.S.R.*, 1936, **4**, (3), 133–136 (Russian); and *Compt. rend. Acad. Sci. U.R.S.S.*, 1936, [N.S.], **4**, (3), 135–139 (German)).—Chromium films 15–62·8 mμ obtained by thermal dispersion of pure electrolytic chromium in a vacuum (1×10^{-4} mm.) dissolve in a few seconds in 0·5 or $2N$-sulphuric acid provided that they have not been exposed to the air, but after contact with air become passive and do not dissolve even after 12 hrs. Passive films are also obtained by dispersion of chromium in a vacuum on a surface heated at 200° C. and they cannot be activated. None of the films dissolves in $0{\cdot}001N$-sulphuric acid.—N. A.

On the Corrosion of Copper. L. W. Haase (*Metallwirtschaft*, 1935, **14**, (2), 32–33).—Corrosive attack on copper parts of hot-water installations is examined from the point of view of (*a*) the material, and (*b*) the water. Tinning should be avoided, except as a protection from combustion products, as non-porous coatings usually contain lead, the presence of which results in local attack. Corrosion at soldered joints is obviated by using hard solder on plain copper. Water containing ferric oxide is highly destructive. Water-line attack may be avoided by suitable design.—P. M. C. R.

Combating Corrosion in Condensers. K. Adloff (*Wärme*, 1935, **58**, 195; *C. Abs.*, 1936, **30**, 7528).—The causes of uniform surface corrosion are still little known. Zinc dissolves in the presence of acid, the solution being accelerated by high temperatures and dissolved oxygen, and occurring with oxygen contents of 0·5 mg./litre. The copper remaining becomes brittle and spongy. Pipes containing little zinc on iron are relatively resistant to corrosion and can be strengthened by the addition of 0·02% arsenic. The resistances of 4 brasses and 2 aluminium bronzes are given. A brass consisting of copper 83, iron 0·5, nickel 0·75, aluminium 1, silicon 1, and zinc 13·75% is particularly resistant to corrosion and is suitable for condensers which are cleaned by a hydrochloric acid process.—S. G.

***Studies on the Corrosion of Condenser Tubes.—III.** Tomojiro Tanabe and Goro Koiso (*Sumitomo Kinzoku Kōgyō Kenkyu Hōkoku* (*Res. Rep. Sumitomo Metal Industries, Ltd.*), 1936, **2**, (6), 585–608).—[In Japanese.] 100 pieces of condenser tubes of 3 kinds, *viz.* Albrac, Admiralty metal, and cupro–nickel (30% Ni), were tested for about 10,000 hrs. in the same model condenser as previously used, and the construction and running of which are described in the second report (*Met. Abs.*, this vol., p. 536). In the present case, however, the mean velocity of the cooling water was increased to about 4 m./second, and the violent erosion took place on the inlet side. The superiority of Albrac over Admiralty metal was confirmed, even with this severe test, with the temperature on the steam side at 70°–80° C. and mean velocity of cooling water 4 m./second. Several thousands of tons of Albrac tubes in use in many power plants and ships in Japan, Manchukuo, and China have given the same result. The corrosion-resistance of cupro–nickel was also found to be very high.—S. G.

***A Study of the Phenomena of Abnormal Corrosion in Condenser Tubes [—II].** Kurazo Fukagawa and Ken'ichiro Kamiyama (*Rikwagaku Kenkyū-jo Iho* (*Bull. Inst. Phys. Chem. Res.*), 1936, **15**, (7), 641–654).—[In Japanese.] Cf. *Met. Abs.*, this vol., p. 537. Among the 5 types of abnormal corrosion of condenser tubes previously described, two types—the horse-shoe and the letter V type corrosion figures or pitting corrosion figures—have been experimentally investigated. It is found that: the diameter of the loop head of the horse-shoe type corrosion figures is about 4–0·2 mm.; the diameter of the upper part of the V-type corrosion figures is about 3–1 mm.; the time taken to produce corrosion of these two types is 19–11 days. Such large dimensions for the corrosion figures of these types and such short periods for their production have not previously been reported. It is found that there is an intermediate state between the V and the horse-shoe types of corrosion figures.—S. G.

***The Corrosion of Lead by Foods.** Franco Lorenzola (*Chim. ind. agr. biol.*, 1930, **12**, 242–245; *C. Abs.*, 1937, **31**, 1890).—Sheets of lead, copper and aluminium were immersed in various liquids (vinegar, broth, beer, wine, fruit juices, &c.). Lead was the most soluble, and is the most dangerous because of its toxicity. Aluminium was 0·1–0·01 times as soluble as lead.—S. G.

Test of Electrolytic Corrosion of Lead-Covered Cable. Ebonite-Lead-Covered Cable and Ebonite-Sheathed Wire in Manhole Water. R. Shimizu and E. Misago (*Denki Gakkwai Zasshi* (*J. Inst. Elect. Eng. Japan*), 1936, **56**, (2), 87–89).—[In Japanese.]—S. G.

***The Corrosion of Lead Alloy Coated Steel Cylinders Used as Fire Extinguishers.** W. L. Hewlett (*Chem. and Ind.*, 1935, **54**, (51), 1094–1095).—The principle and design of the soda–acid and "foam" types of extinguisher are described. Attack on the lead–tin alloy coating of the outer cylinder is traced to the presence, usually in the make-up water of the charges, of substances likely to inhibit protective film formation on areas exposed by local corrosive attack. The inclusion of sodium phosphate in the charge encourages film formation and tends to prevent local attack.—P. M. C. R.

†Contribution to the Question of the Chemical Behaviour of White Bearing Metals. Second Report of the Committee on [the Corrosion of] Non-Ferrous Metals. —— (*Korrosion u. Metallschutz*, 1936, **12**, (3), 50–52).—Pure lead,

lead bearing metals containing alkaline earth metals, and zinc-base bearing metals are relatively rapidly attacked by lubricating oils, the loss in weight after 30 weeks in oil at 80° C. being 0·456, 0·668, and 0·642 grm./cm.^{2}, respectively. Addition of 5–13% antimony or up to 20% tin to lead reduces the loss in weight practically to zero. Only the lead-base alloys hardened with alkali or alkaline earth metals are at all readily attacked by an indoor atmosphere, and this may be prevented by coating them with oil or wax.—A. R. P.

***On the Oxidation of Metallic Magnesium at High Temperature.** Yutaka Suzuki (*Rikwagaku Kenkyū-jo Iho* (*Bull. Inst. Phys. Chem. Res.*), **1936, 15,** (3), 147–165).—[In Japanese.] The increase in weight of metallic magnesium at about 560° C. in air was plotted graphically against time by means of the thermobalance. The relation was found to be linear, the initial (atmospheric) corrosion film of the sample and the oxide film produced having measurable resistance to the oxidation reaction. The heat of reaction was found to have a rather large influence on the measurement. Only a trace of nitride was detected in the reaction product. S. failed to determine quantitatively the reaction $Mg + O \longrightarrow MgO$.—S. G.

***Corrosion of Elektron Alloy at Low Temperatures.** V. M. Fokeev (*Vestnik Ingenerow i Tehnikow* (*Messenger Eng. and Tech.*), **1936,** (10), 604–606).—[In Russian.] No corrosion of Elektron (aluminium 7–8, manganese 0·48, zinc 0·73%, magnesium remainder) occurs in tests at the temperature of liquid air in 4 days, but at 0° C. in air considerable corrosion occurred in 6 days; at lower temperatures corrosion was reduced, reaching a minimum at − 30° C. Between − 20° and − 40° C. the strength was reduced from 25·7 to 23·5 kg./mm.^{2} and the elongation from 39·5 to about 35% by atmospheric corrosion in 6 days.—N. A.

***On the New Non-Corrodible Magnesium Alloys.** Isamu Igarashi and Hyoji Nakata (*Sumitomo Kinzoku Kōgyō Kenkyu Hōkoku* (*Res. Rep. Sumitomo Metal Industries, Ltd.*), 1936, **2,** (6), 510–533).—[In Japanese.] See *Met. Abs.*, this vol., p. 539.—S. G.

***The Corrosion of Tin.** J. M. Bryan (*Dept. Sci. Indust. Res. Rep. Food Invest. Board*, **1935,** 163–164).—Corrosion of tin containing antimony or bismuth in 0·5% citric acid solutions in the presence of air is minimal with 0·5% of antimony and 0·4% of bismuth. Both metals reduce the grain-size of the etch-pattern produced.—W. D. J.

***The Effect of Sugar on the Corrosion of Tinplate in Canning.** T. N. Morris (*Dept. Sci. Indust. Res. Rep. Food Invest. Board*, **1935,** 165–169).—The corrosion of steel, tin, and the tin–iron couple in syrups containing pure sucrose and citric acid buffered over the p_H-range 2·4 to 5·5 with sodium citrate has been compared with that of plain solutions of citric acid buffered over the same p_H-range. It is concluded that sucrose is a weak inhibitor of the acid corrosion of iron and a powerful inhibitor of the acid corrosion of tin in the presence of air. Sucrose reduces the power of tin salts to act as inhibitors of the acid-corrosion of steel. In the case of the tin-iron couple the results depend on the type of steel and on the relative areas of tin and iron exposed to the corroding medium. These results are employed to explain the increase in hydrogen swells which follows an increase of sugar content.—W. D. J.

***The Internal Rusting of Cans.** G. Horner (*Ann. Rep. Fruit Vegetable Preservation Res. Sta. Campden*, **1932–1933,** 43–52; *C. Abs.*, 1937, **31,** 473).—With reprocessed fruit salad and single-processed plums packed in plain cans, the oxygen content of the headspace decreased from 19·2 to 0·1% and from 11·6 to 1·53%, respectively, in 15 days. With plums in lacquered cans the oxygen decreased from 13·0 to 10·08% in 15 days. The disappearance of oxygen is not dependent on the formation of rust, but is a consequence of the normal corrosion which takes place in cans of fruit. The percentages of carbon dioxide and nitrogen in the headspace increase as the oxygen disappears, and the total quantity of gas present decreases. As the vacuum increases more carbon dioxide passes into the headspace, causing the ratio of carbon dioxide to nitrogen to increase. The carbon dioxide may be passing out of solution or it may be derived from the tissues of the fruit. Staining is less noticeable in fruits packed in the fresh state than in reprocessed fruits. This appears to be due to the action of the carbon dioxide present in the tissues of fresh fruits, and the process of rusting is arrested if the ratio of carbon dioxide to oxygen exceeds about 1·0. Staining proceeds most rapidly during the first day of storage and cans removed from the cooling tank and stacked at 120° F. stain more rapidly than those stacked at 90° F. However, staining will occur in cans stacked at 40°–50° F. Rusting can be overcome to a considerable extent by inverting the cans after they have been in storage for not less than 1 week.—S. G.

Corrosion of Tinned Copper Screen on a Well Filter by Water Containing Hydrogen Sulphide. G. Nachtigall and H. Schröder (*Vom Wasser*, 1935, **10**, 197–200).—Gives photographs and analyses of screen corroded by hydrogen sulphide after 4 years' use. The analyses for water are given, with hydrogen sulphide as " trace."—S. G.

***On the Corrosion of Tin and Tinned Materials with the Formation of Black Specks.** Sven Brennert (*Korrosion u. Metallschutz*, 1936, **12**, (3), 46–49).—Black specks may develop at the anodic areas on tin or tinplate where differential aeration is possible, *e.g.* at the water line or around solid or semi-solid surface contaminations, or where the metal is in contact with a more noble metal, *e.g.* in the case of porous or imperfect tinplate. The specks develop only when the potential difference between the anodic and cathodic areas exceeds 0·207 v.; hence their formation may be prevented by contact with a less noble metal, *e.g.* aluminium or zinc, or by thickening the natural protective film by anodic oxidation. Analysis showed the specks on tinplate to consist of stannous oxide 76, stannic oxide 18, iron oxide 1, and water 5%. —A. R. P.

The Corrosion of Galvanized Steel Articles and of Galvanized Sheet (Roofing, Channels, &c.), and Its Cause. E. Deiss and W. Böhm (*Angew. Chem.*, 1935, **48**, (29), 464–465; also *Stahl u. Eisen*, 1935, **55**, (32), 865–866; and *Sheet Metal Ind.*, 1935, **9**, (102), 627).—A description of corrosion phenomena in ordinary and moist air and in zinc chloride, as observed on zinc coatings with or without lead. Special types of attack are noted on rolled and on hot-dipped sheet. Accelerated tests are briefly described.—P. M. C. R.

***The Resistance of Galvanized Iron to Corrosion by Domestic Water Supplies.** S. C. Britton (*J. Soc. Chem. Ind.*, 1936, **55**, 19–22).—In waters having a p_H value between 7·5 and 9·5 and containing calcium bicarbonate, but having a very low content of sulphates, chlorides, and nitrates, the attack on zinc is soon stifled, but that on iron may continue evenly distributed over the metal surface. In waters low in calcium bicarbonate or containing appreciable quantities of sulphates, chlorides, or nitrates, zinc is liable to suffer a pitting form of attack, although on iron the corrosion is well spread out. The difference in behaviour of the two metals is due to the fact that in the case of zinc an insoluble carbonate layer tends to form on the attacked areas and, being partly protective, limits their size, whereas in the case of iron the corresponding product becomes removed from the metal surface. Zinc affords electrochemical protection to iron when it is clean, but when coated with a resistant layer of corrosion products the maximum distance at which it will give protection becomes much decreased. Zinc protects the alloy layer of a galvanized coating where it has been laid bare, but the alloy layer will not afford electrochemical protection to bared iron. The calcium carbonate which is deposited on an alloy or on iron in the course of electrochemical protection is itself protective, and the ultimate success of the electrochemical protection of any exposed area appears to depend on the building up of the protective effect of this chalk layer at a greater rate than that at which protection is lost by dissolution of zinc from the area adjacent. The thickness of the zinc layer, the calcium bicarbonate content, p_H value, and conductivity of the water seem to be the deciding factors.—S. G.

Failure of Metals Due to Cavitation. H. N. Boetcher (*Trans. Amer. Soc. Mech. Eng.*, 1936, **58**, 355–360).—Metallurgical examination has supported the results of hydraulic research in so far as the mechanical character of cavitation is concerned. Rockwell hardness tests showed that with many metals appreciable hardening of the surfaces is caused by cavitation, and in copper alloys and austenitic steels by strain lines, and by the type of failure. As a small area only is affected the term " cavitation-fatigue " is suggested. To have a high resistance to cavitation fatigue the metal should have a high corrosion-resistance in the water in which it is used, and physical and metallurgical properties which result in high fatigue-resistance. It should be homogeneous and free from inclusions. It should have high fatigue strength. This involves high initial hardness, with satisfactory toughness, or susceptibility to considerable strain-hardening. Photomicrographs are given of failures due to cavitation.—S. G.

Report of Joint Committee [of A.S.T.M. and Amer. Electroplaters' Soc.] on Exposure Tests of Plating on the Non-Ferrous Metals. William Blum (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 212–218).—Describes the general plan of exposure tests now under way at 6 test locations representing different types of atmospheric conditions. Detailed information is given on the compositions of the base metals, which include steel, grey iron, malleable iron, copper, brass, nickel-brass, rolled zinc and zinc-base die-castings. Detailed tables are given of the schedule of the deposited coatings, which comprise nickel, copper, and chromium.—S. G.

Accelerated Tests Aid in Selection and Comparison of Metal Finishes. —— (*Steel*, 1936, **98**, (14), 42–43).—An account is given of the accelerated corrosion testing of coatings of electro-deposited zinc, baked aluminium of different thicknesses on sand-blasted steel, and baked aluminium on phosphate-treated steel. The test cycles included: roof exposure; exposure to ultra-violet light together with water spray under abruptly varying temperature conditions: exposure to artificial industrial atmospheres; attack by aerated water; storage at high temperature and high humidity. The results are tabulated in each case.—P. M. C. R.

†**Deformation, Heat-Treatment, Solubility. First Report of the Committee on [the Corrosion of] Non-Ferrous Metals.** —— (*Korrosion u. Metallschutz*, 1936, **12**, (1/2), 1–28).—From a critical review of the literature, covering 118 references, the following conclusions are reached: The dissolution of non-ferrous metals in acids is determined by their structure and by heat and mechanical treatment; that of cold-drawn, single phase copper-zinc and copper-nickel alloys follows the Heyn solubility law and is not affected by the degree of extension in drawing nor by intermediate anneals, but the position and direction of the upward trend in the solubility curve are determined by the degree of deformation and the concentration of the acid, so that it is possible, by making certain assumptions, to draw conclusions as to the method of manufacture from the behaviour of the metal in dilute acids. Cold-drawn alloys dissolve more readily than annealed alloys, and in the latter case grain-size has a somewhat variable effect on the rate of dissolution. The transition from the elastic to the plastic range causes no change in the solubility of drawn alloys. Methods for evaluating the relative solubilities of alloys by conductivity, and potential measurements are discussed.—A. R. P.

***Reduction of the Endurance Strength of Non-Ferrous Metals under Stress.** K. Matthaes (*Luftfahrtforschung*, 1935, **12**, 176–179; *Eng. Abs.*, 1936, (66)).

—The failure of a light metal air-propeller in 1933 was found to be due to a fatigue fracture caused by erosion and corrosion, and this led M. to resume investigations commenced in 1931 to determine the effect of friction and corrosion on fatigue strength. M. studied particularly the cause of the reduction in endurance, and hence means to improve the strength of Duralumin, Elektron, and copper. The experiments consisted of rotational loading and friction tests, with fixed and movable collars, on straight and coupled specimens, and tests to ascertain the effect of corrosion on the dynamic properties. Corrosion had a marked effect in the tests with friction collars and coupling bosses, the endurance of the light alloys being reduced by 40%; the effect on copper was much less (about 10%). This effect is considerably greater when a corrosive agent (*e.g.* water) is added, and even more so if the friction collar is not free to move. With a fixed collar, copper specimens broke under the collar, whilst with a collar free to rotate, fracture occurred beyond the collar although corrosion was strongly in evidence. The effect of corrosion on endurance can, in favourable cases, be almost entirely inhibited, even when corrosion is very apparent. This may be accounted for on the assumption that the pressure does not lead to surface injury, and that the compressed zone is not completely broken through by the corrosion cracks. The use of a supplementary layer between the coupling and the specimen did not result in the rapid destruction of the layer or in causing the specimens to break eventually in the coupling. With sufficiently soft intermediate layers the effect of corrosion may be inhibited, but the method is practicable only if the stress is so low that these layers are not destroyed, or when they can be changed sufficiently often. M. concludes that the cause of the reduction of the endurance by corrosion is the to-and-fro effect on the surface of the material in the direction of the applied stress, and the resulting overstressing of the edge-zone. This effect occurs only if the direction of corrosion coincides with that of the stress; if it is perpendicular to the stress the effect is small, although the corrosion cracks act as notches.—S. G.

Corrosion and Construction. Kurt Adloff (*Wärme*, 1936, **59**, (3), 39–42; *C. Abs.*, 1936, **30**, 2898).—General conditions affecting corrosion, construction, and fatigue-resistance are discussed. Previous knowledge as to what corrosion conditions will be for the structure enable the construction to be carried out more intelligently in respect of the choice of materials. The galvanic effect of different metals should be considered. The choice of protective coatings is discussed with respect to the prevention of corrosion and decreasing the possibility of fatigue. Stray currents should be tested for the determination of the amount of current flowing; if the current is less than 0·1 ma. it is not dangerous to the structure. A table is given showing the tensile strength and endurance limit under non-corrosive and corrosive conditions, and under conditions of protective coatings in corrosion conditions for various carbon and alloy steels. The percentage efficiency of the protective coating is shown, and it is interesting to note that electrolytic zinc is 100% efficient in corrosion-fatigue, while hot-dipped zinc and cadmium coatings are 59 and 62% efficient, respectively, when applied to a plain carbon steel of 0·47% carbon.—S. G.

The Corrosion of Metals by Liquid Organic Binary Systems. Ljudevit Sladovic (*Monatsh.*, 1934, **64**, (1), 35–40).—By means of corrosion measurements on various metals, the relative corrosive effects of liquid organic binary systems which form molecular compounds, and those which do not form such compounds, are determined. Whilst in the case of iron and aluminium no marked corrosion occurred with either the pure substances or the binary mixtures, in the case of aniline–phenol, aniline-nitrobenzene, or pyridine-phenol, such systems attacked copper more vigorously than the pure substances. The system benzene–aniline, which does not tend to form a molecular compound, exhibited, with few exceptions, lower corrosive effects than the pure components.—E. J. G.

Corrosion [Problems in Rayon Manufacture and in Textile Dyeing and Finishing]. —— (*Silk and Rayon*, 1935, 9, (1), 11; (2), 29–34; (3), 77–82; (4), 96–97; (5), 131–136; (6), 183–184).—Corrosion problems assume especial importance in the rayon industry, where the use of corrosive materials must be accompanied by the minimum degree of attack, and where certain processes may be vitiated or inhibited by the presence of corrosion products. Structural materials are roughly classified according to their corrosion-resistance. This series of articles contains reviews of special aspects of the problem, as follows: corrosion in relation to water supply; attack on ferrous materials, zinc, and lead by commercial waters; water softening; inhibitors; "detectors"; atmospheric corrosion, and the protection of metallic surfaces; acid-resistant materials, especially those used in the "viscose" process.
—P. M. C. R.

***Corrosion of Metals During Chlorination of Toluene.** Z. N. Suirkin and E. E. Pugachev (*Anilinokrasochnaya Promishlennost*, 1935, 5, 162–167; *C. Abs.*, 1936, 30, 7528).—[In Russian.] Corrosion increases in the series chromium, Monel metal, iron–chromium, chromium steel, Aterite, lead, lead–tellurium, lead–antimony; considerable formation of tarry products is observed in all cases except those of lead, Monel metal, and iron–chromium.
—S. G.

***Effect of Metals on Fly Sprays.** David G. Hoyer (*Soap* (*Sanitary Products Sect.*), 1936, 12, (1), 105, 107; *C. Abs.*, 1936, 30, 1894).—Samples of standardized pyrethrum fly sprays in flint glass bottles were treated with 1% by weight of confectioner's glaze, flux, tinplate, and combinations of these, and stored for 10 months in darkness. All samples were shaken at intervals and later analyzed by the Seil method for pyrethrins I and II and tested on house flies by the Peet-Grady method. Confectioner's glaze or combinations of it with other materials caused considerable changes in colour and about $\frac{1}{3}$ loss of pyrethrins and toxicity. H. found some metals contaminated with more glaze than used in his tests. Flux caused a small loss; tinplate scarcely any. The effect of small strips of copper, zinc, tin, lead, aluminium, and iron on the pyrethrum fly sprays was also tested in a 2-weeks' test. Copper and lead both lost some weight and caused 8–13% loss in pyrethrins. There was little change with the other metals, but these are being tested for longer periods.—S. G.

***Metals in the Food Industry.** A. Johnston (*Chem. and Ind.*, 1935, 54, (15), 342).—On immersion in sugar syrup (*d* 1·33) from pineapple chunks for 6 weeks of plates approx. 100 cm.^{2} in size, the losses in weight per square cm. were: aluminium 0·000077, nickel 0·000145, and stainless steel 0·000060.
—S. G.

***Metals in the Food Industry.** Robt. C. Tranent (*Chem. and Ind.*, 1935, 54, (16), 378).—Metal sheets 20 cm. square immersed in a sterile solution of glucose (*d* 1·10, p_H 6·8) for 3 weeks showed the following losses in weight: copper 0·66, zinc 0·054, tin 0·008, aluminium 0·045, and iron 0·383%.—S. G.

Corrosion in the Sugar Industry. U. Stark (*Chem. Apparatur*, 1935, 22, (4), 7–9).—Diffused water which was returned to the extraction system in a beet-sugar factory caused severe attack on tubing, pumps, and valves of ferrous material; the use of copper tubing, zinc-free bronze for pumps, manganese–bronze for pump shafts, and brass for the pulp conveyor spiral and in the H.P. valve is said to have obviated further damage.—P. M. C. R.

***Dissimilar Metal Corrosion in Soils.** F. A. Hough and A. B. Allyne (*Gas*, 1936, 12, (5), 18–21, 90; *C. Abs.*, 1936, 30, 7529).—Copper pipe brazed to steel pipe in an underground system was studied to determine the possibility of bimetallic corrosion due to these dissimilar metals. Polarization of copper–steel cells was found much more effective in reducing current flow in soils than in salt water in motion. The residual p.d. between polarized copper and steel was much greater in some soils than in others, varying from 0·005 to 0·20 v. In the former, soil corrosion would be negligible, and of uncertain importance in the latter. The relative area of the copper and steel electrodes is a very important factor in determining the rate of corrosion of the steel. It was found that as great or even greater potential differences than observed with the copper–steel cells could be obtained by oxygen concentration cells, while the resistance of the former was 5 to 7 times the probable resistance of the latter, when the two metal surfaces are separated at least 3 ft., as they would be in the distribution system. These facts seem to make it improbable that dissimilar metal corrosion would be the determining factor in fixing the life of steel pipe used with copper pipe, but this conclusion must be confirmed by long-time tests.—S. G.

The Use of Non-Ferrous Metals Underground. K. H. Logan (*Oil and Gas J.*, 1936, **35**, (19), 137, 174–176, 178–179; *C. Abs.*, 1936, **30**, 8132).—No non-ferrous metal has been found suitable for all soil conditions, but for each condition one or more metals are available which resist soil corrosion. The materials must be selected to suit the soil condition.—S. G.

Corrosive Action of Refrigerating Salts on Metals. W. Mohr and R. Kramer (*Alluminio*, 1934, **3**, 84–89).—See *Met. Abs.*, 1934, **1**, 499.—S. G.

***A Comparison of Certain Metals Regarding Their Resistance to Corrosion by a Natural Strong Brine.** Harold B. Salt (*J. Soc. Chem. Ind.*, 1936, **55**, (29), 205–207T).—Corrosion tests by total immersion and spray methods were carried out on a number of nickel alloys, copper alloys, stainless steels, pure metals, and plated metals in Droitwich Spa brine containing sodium chloride 305·27, magnesium chloride 0·517, sodium sulphate 1·82, calcium sulphate 4·62, and calcium bicarbonate 0·033 grm./litre (p_H 7·7). The results are shown as loss (or gain) in weight over periods of up to 30 weeks. In general, the copper alloys were badly corroded while the nickel alloys were only slightly corroded, the 70 : 30 and 80 : 20 copper–nickel alloys showing the most resistance. Nickel and tin were only slightly attacked, whereas copper, iron, and especially zinc were severely corroded.—A. R. P.

***Corrosion of Metal Ware in Cooking and Storing of Vegetable Juices and Purées.** N. A. Izgarishev, I. I. Sidorishin, and G. A. Maksimov (*Korrozia i Borba s Ney* (*Corrosion and the Fight Against It*), 1935, **1**, (1), 21–38).—[In Russian.] Tests were carried out on various steels, pig iron, copper, and aluminium bronze (10% aluminium) for resistance to corrosion in the cooking of fruit and vegetable juices and purées, and also of the quality of the produce cooked in receptacles of various metals. Copper and bronze were found to be less resistant than nickel–chrome steel.—D. N. S.

***The Behaviour to Metals of Solutions of Sulphur and of a Number of Its Organic Derivatives in Saturated Hydrocarbons.** L. G. Gindin, I. I. Torsuev, and V. A. Kazakova (*Dokladi Akademii Nauk S.S.S.R.*, 1936, **3**, (5), 219–223 (Russian); and *Compt. rend. Acad. Sci. U.R.S.S.*, 1936, [N.S.], **3**, (5), 219–223 (German)).—Steel and commercial lead are completely unattacked after immersion for 16 months in a 0·355% solution of sulphur in hexane, but fire-refined copper under the same conditions is rapidly converted into cupric sulphide.—N. A.

Alkaline Corrosion of Metals in the Aniline Dye Industry. Z. N. Suirkin (*Anilinokrasochnaya Promishlennost*, 1934, **4**, 570–573).—[In Russian.]
—S. G.

Corrosion in the Petroleum Industry. —— Rech and —— Fürst (*Bohrtech.-Zeit.*, 1935, **53**, 285–291; *C. Abs.*, 1936, **30**, 8133).—Acid, film, peroxide, colloid, biological, and electrolytic theories have been proposed to explain corrosion but the electrolytic theory best accords with the facts. Air should be excluded from petroleum-storage tanks and pipes leading to them if salt water is present. In tests on pure carbon steel, galvanized carbon steel, bare and galvanized weld iron, steel tubes with asphalt or cement coating, and tubes of weld iron with cement coating, only the cement coated tubes were completely intact after 1 year. The pipe connections should also be made to resist corrosion by the use of a lead or cement ring at the joint. Cement covered pipes in the field can be used for salt- or fresh-water, oil containing sulphur, gas conduits, &c. Aluminium best resists corrosion by oil vapours in a tank, but as the floor of the tank it is soon eaten through. The deposit of soft FeS in wells causes little trouble, but strontium, barium and calcium sulphates in the waters, especially the latter two, may necessitate pulling the whole string because the crusts prevent the removal of the pump valve and cylinder. There have been instances where it was impossible to reconstruct the column because the hard firmly adhering crusts could not be removed. Sodium carbonate is a strong neutralizing agent for the acid constituents in well waters, but it reacts readily with the calcium and magnesium salts. Sodium cresolates, compounds of sodium with cresols, check the action of the acids, react but slowly with the calcium and magnesium salts and can be distributed quickly through the water. In special cases where corrosion is due to oxidation but no hydrogen sulphide is present, chromates, dichromates, and chromic acid can be used, especially as they passivate the iron.—S. G.

***Fuels and Corrosion.** Sandro Doldi (*Chimica e Industria*, 1936, **18**, (5), 226–229).—D. reviews the work done on the subject, and gives a description of his tests, and the results obtained. Tests were carried out at room temperature on aluminium, copper, bronze, brass, Monel metal, and soft and hard steels for a period of 2 to 8 months. Corrosion was measured by direct examination and by weighing. The unit used was the loss in grm./m.^{2}/day. It is concluded that: (1) hydrated alcohols attack much more than the anhydrous ones; (2) ethyl alcohol attacks less than methyl alcohol; (3) denatured alcohols attack much more than pure ones, and the denaturing agent induces greater corrosion; (4) Monel metal was the most resistant to corrosion, followed by bronze, brass, hard steel, and aluminium in order of decreasing corrosion-resistance; (5) the least corrosive mixture consists of equal parts of benzine and absolute ethyl alcohol; (6) benzine is the least corrosive liquid fuel; next comes benzol free from sulphur; (7) in practice, apart from a few exceptions, the corrosion due to alcohol substitute fuels is negligible.—J. K.

***The Corrosion of Metals During the Process of Sulphonation of Phenols.** —— (*Vennaya Khimiya* (*Military Chemistry*), 1935, **3**, (1), 7–9).—[In Russian.] —S. G.

The Problem of Corrosion of [Oil] Well Screens. H. O. Williams (*Johnson Nat. Drillers J.*, 1933, **5**, (3), 1).—S. G.

Corrosion from Zero Softened Waters. Ray L. Derby (*J. Amer. Water Works Assoc.*, 1935, **27**, (5), 627–630).—Cases of corrosion in galvanized iron or in joints of iron to brass or copper are associated with the installation of zeolite softeners in the water system, especially in heating plant. The p_H at which galvanized zinc is attacked is discussed in relation to temperature. A safe, but not excessive, degree of hardness may be maintained by by-passing a known proportion of untreated water into the softened product. Recommendations are made regarding uniformity of metallic materials.—P. M. C. R.

Corrosion of Metallic Materials in Water Works. G. Wiegand (*Vom Wasser*, 1935, **10**, 142–154).—See *Met. Abs.*, this vol., p. 542.—S. G.

Prevention of Corrosion Damage by Industrial Effluents. H. Stoof (*Vom Wasser*, 1935, **10**, 129–141).—See *Met. Abs.*, this vol., p. 542.—S. G.

Cylinder Wear in Gasoline Engines. C. G. Williams (*S.A.E. Journal*, 1936, **38**, (5), 191–196).—A series of investigations, the results of which are discussed and recorded graphically, demonstrates the importance of cylinder-wall temperature and of the use of thermostats, the effect of load, the mutual influence of corrosion and abrasion, especially under cold-running conditions, and the effect of additions to the lubricant of various inhibitors. The width of piston rings is also shown to be an important factor.—P. M. C. R.

Materials for Corrosion-Resistance. R. H. Berriman (*Commonwealth Eng.*, 1936, **24**, (2), 51–56).—Corrosive agents encountered in the electrolytic production of zinc are enumerated. The properties of ordinary and aluminium bronze, a copper–aluminium–silicon casting alloy, hard lead, and a number of ferrous alloys are discussed with reference to specific applications; tables are given of the mechanical properties of 4 varieties of aluminium bronze in different conditions, and of the tensile properties of hard lead and of the casting alloy.—P. M. C. R.

†**Water-Line Corrosion.** U. R. Evans (*Chem. and Ind.*, 1936, **55**, (11), 210–213).—Recent work and theories of water-line corrosion are critically surveyed and E.'s theory is explained in detail. Water-line corrosion of copper in dilute sulphuric acid is very intense; this is attributed to the solubility of the corrosion products in the acid and the drawing-in of fresh acid by the sinking of the heavy copper sulphate solution down the metal. In the case of metals which form hydroxides soluble in alkali (lead, tin, zinc, and aluminium) differential aeration in sodium chloride solution first leads to water-line immunity since the film of hydroxide first formed prevents access of the solution to the metal, but when the alkali has accumulated sufficiently in the aerated parts attack of the metal rapidly occurs; these effects are observed when a glass bead is placed on a lead surface kept wet by a film of sodium chloride solution and by zinc partly immersed in $2N$-potassium chloride.—A. R. P.

[Correspondence on Evans's Paper on "Water Line Corrosion."] Guy D. Bengough and F. Wormwell. Kenneth G. Lewis. R. B. Mears. U. R. Evans (*Chem. and Ind.*, 1936, **55**, (13), 262; (16), 313; (25), 510; (30), 599; (33), 647–648).—B. and W. reject Evans's alkali-sensitivity theory (preceding abstract) to account for the heavy attack which develops in time at an aerated water-line in sodium chloride solutions, pointing out that it may occur on mild steel which is not sensitive to alkalis, and also that the gradual increase of alkalinity which occurs in the corrosion of zinc causes a slow decrease in the rate of corrosion. L. upholds Evans's theory. M. points out that the rate of corrosion of zinc decreases with increasing p_H up to 12 and rapidly increases again between p_H 12·5–13·5. Electrolysis of $0{\cdot}1N$-potassium chloride solutions at 0·5 m.a./cm.^{2} using zinc or aluminium cathodes causes marked cathodic attack; these and other results are discussed from the point of view of E.'s theory. B. and W. reaffirm their belief that corrosion distribution is generally determined by the distribution of protective films and that differential aeration is only one factor, and often not the most important, which influences film-formation. E. replies to B. and W.'s criticism by pointing out that films stifle attack only when deposited in physical contact with the metal, and further explains the apparently "inconsistent behaviour" of oxygen in corrosion problems.—A. R. P.

Topochemical Features in Corrosion Phenomena. V. Kohlschütter (*Korrosion-Ber. Korrosionstagung*, 1936, **5**, 16–25; and *Korrosion u. Metallschutz*, 1936, **12**, (5/6), 118–123).—The form and distribution of corrosion products depends essentially on the nature, and hence on the characteristic formation, of the material attacked; the shape and state of aggregation of the products also influence to an important extent the further development of corrosive attack.—P. M. C. R.

The Physical and Chemical Relations in Fluid Phase Heterogeneous Reaction. Paul S. Roller (*J. Physical Chem.*, 1935, **39**, (2), 221–237).—The postulates of the Nernst theory of fluid-phase heterogeneous reaction are criticized. In particular, independent experimental evidence is brought forward against the assumed existence of a stationary film. In this paper the measured rate of fluid-phase heterogeneous reaction is considered to be simply the resultant of two simultaneous processes—of chemical reaction at the interface and of physical transport to or from the interface—with no arbitrary assumptions as to mechanism. To determine the functional relationship between the chemical and physical factors, the ordinary diffusion equation has been solved with one of the boundary conditions that of first-order reaction at the interface. The solution permits accurate calculation of the true chemical rate constant, knowing the value of the diffusion coeff. and the dimensions of the vessel. The solved equation is brought into relation to the first-order rate equation that is usually found to apply. An implicit, and finally an explicit equation, connecting the usual measured rate constant, true chemical velocity constant, and diffusion coeff. are deduced, and the range of validity is indicated. By regarding diffusion as a special mode of molecule transport, the explicit equation is generalized to the following expression for the measured rate constant K, $K = S(1 - e^{-k/S})$, where k is the chemical reaction velocity constant, and S the coeff. of physical transport of reactant or product of reaction to or from the interface. For transport by mechanical stirring of the liquid phase, it is found that $S = As^{0 \cdot 8}$, where A is a constant and s is the stirring speed. Exponent 0·8 agrees with that commonly found for the fluid velocity in the expression for the coeff. of heat transfer. The values of K, measured as a function of the stirring speed for 5 typical reactions, are compared with the calculated values, and excellent agreement is obtained. k varies 35-fold between 0·078 and 2·80 for the different reactions, while A lies between 1·1 and 12×10^{-3}. The form of the curve of K against r.p.m. is considered in terms of the ratio k/A. It is shown that the temperature coeff. of K must lie between the chemical coeff. and the viscosity coeff., depending on the ratio $k/As^{0 \cdot 8}$.—S. G.

***Fundamental Theories of Metal Corrosion.** Ichirô Iitaka (*Rikwagaku Kenkyû-jo Iho* (*Bull. Inst. Phys. Chem. Res.*), 1936, 15, (3), 131–146).—[In Japanese.] Only simple corrosion is treated in this paper; special types of corrosion are excluded. By simple but careful experiments over a period of 1 year, I. determined the necessary and absolute factors to promote corrosion in various metals and alloys.

Metals.	Necessary and Absolute Factors to Promote Corrosion.	Metals.	Necessary and Absolute Factors to Promote Corrosion.
Iron . .	Water, O_2	Zinc	Water
Aluminium .	Water, O_2, Cl^-	α-Brass	Water, Cl^-
Magnesium .	Water, Cl^-	α + β Brass	Water, Cl^-, O_2
Copper . .	Water, Cl^-		

Fundamental theories for corrosion, deduced from these experiments are:

Iron:

$$Fe + 2H^+ + (2OH^-) \longrightarrow Fe^{++} + (2OH^-) + 2H \quad . \quad . \quad . \quad . \quad . \qquad (1)$$

$$2H + \tfrac{1}{2}O_2 \longrightarrow H_2O \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \qquad (2)$$

$$2Fe^{++} + (4OH^-) + \tfrac{1}{2}O_2 + H_2O \longrightarrow$$
$$2Fe^{+++} + (4OH^-) + 2OH^- \longrightarrow \underset{\text{(deposit)}}{2Fe(OH)_3} \quad . \quad . \quad . \quad . \quad . \qquad (3)$$

Aluminium:

$$Al + 3H^+ + (3OH^-) \longrightarrow Al^{+++} + (3OH^-) + 3H \longrightarrow$$
$$\underset{\text{(deposit)}}{Al(OH)_3} + 3H \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \qquad (1)$$

$$2H + \tfrac{1}{2}O_2 \longrightarrow H_2O \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \qquad (2)$$

Magnesium :

$$\mathrm{Mg} + 2\mathrm{H_2O} + x\mathrm{Cl^-} \longrightarrow \boxed{\mathrm{Mg{\cdot}}x\mathrm{Cl^-{\cdot}2H_2O}}$$

(unknown intermediate compound)

$$\longrightarrow \mathrm{Mg^{++}} + x\mathrm{Cl^-} + 2\mathrm{OH^-} + 2\mathrm{H} \longrightarrow$$

$$\underset{\text{(deposit)}}{\mathrm{Mg\,(OH)_2}} + x\mathrm{Cl^-} + \underset{\text{(gas)}}{\mathrm{H_2}}$$

Copper :

$$x\mathrm{Cu} + y\mathrm{H_2O} + z\mathrm{Cl^-} \longrightarrow \mathrm{3CuO{\cdot}CuCl_2{\cdot}3H_2O} + \ldots$$

(deposit and in solution)

Chemical corrosion.

α-Brass :

Same as copper. Chemical corrosion.

α + β-Brass :

Chemical corrosion as in copper and electrochemical corrosion as in aluminium.

—S. G.

†***Some Aspects of the Modern Theories of Corrosion. I.—Water Line Corrosion. II.—The Distribution of Corrosion.** J. E. O. Mayne (*J. Chem. Soc.*, **1936**, (March), 366–368; (Aug.), 1095–1098).—S. V. W.

***On the Theory of Corrosion Phenomena. IV.—On the Application of the Theory of Local Elements to the Problem of Corrosion.** W. J. Müller (*Anz. Akad. Wiss. Wien, Math.-naturw. Klasse*, 1936, **73**, 89–91).—For a full account of this work see *Met. Abs.*, this vol., p. 400.—S. G.

***On the Causes of Electrochemical Corrosion of Iron and its Alloys in Moist and Aerated Media.** E. Herzog (*Arhiv za Hemiju Farmaciju*, 1936, **10**, (1–2), 1–11; (errata) (3–4), 54).—By studying the galvanic couples between iron and its compounds with sulphur, phosphorus, and oxygen, it is concluded that not only the compounds formed in the usual way by heating, but also the secondary products of corrosion reactions play the part of cathodes so long as they are sufficiently good conductors of electricity. From this it is explained why the speeds of corrosion of iron in distilled, fresh, and salt water are the same. The great speed of corrosion of non-ferrous metals (aluminium, magnesium, zinc) is explained by the high resistance of their oxides compared with the hydrated oxides of iron.—A. G. D.

The Electrochemical Mechanism of Corrosion. U. R. Evans (*Korrosion u. Metallschutz*, 1936, **12**, (5/6), 105–107).—A review of recent work designed to elucidate the mechanism of corrosion and the function of films.—A. R. P.

Chemistry of Corrosion. G. M. Crook (*Proc. 17th Texas Water Works Short School*, **1935**, 44–48).—Discusses the 3 main types of corrosion—self-corrosion, galvanic, and electrolytic—and means of preventing it.—S. G.

***Experimental Study of the Method of the Submerged Corrosion Test.** Yoichi Yamamoto (*Rikwagaku Kenkyū-jo Iho* (*Bull. Inst. Phys. Chem. Res.*), 1936, **15**, (7), 451–580).—[In Japanese.] This is the first report on the subject. The effect of testing conditions on the amount of corrosion of test-pieces immersed in corrosive solutions was observed. The amount of corrosion is reported as the average penetration corrected for volume change, since the change of volume of the test-piece by corrosion must be considered. When this investigation is completed, the full report will be published in English.
—S. G.

Soviet Russian Researches in the Fields of Corrosion and Corrosion Protection. M. von Pohl (*Korrosion u. Metallschutz*, 1936, **12**, (4), 89–94).—An outline of the researches on corrosion problems undertaken by the Russian Government under the second Five Years' Plan (1933–1937).—A. R. P.

The Development of Corrosion Research. In Memory of O. Bauer. G. Masing (*Angew. Chem.*, 1936, **49**, (37), 661–662).—S. G.

V.—PROTECTION

(Continued from pp. 515–519.)

"Eloxal," a New Material. W. Birett (*Apparatebau*, 1936, 48, (7), 67–69).—A review of the possibilities of Eloxal (electrolytically oxidized aluminium) as a structural material.—P. M. C. R.

***On the Theory of Passivity. XXIX.—The Theory of the Rectifying Film (Sperrschicht) in Aluminium.** W. J. Müller (*Anz. Akad. Wiss. Wien, Math.-naturw. Klasse*, 1936, 73, (3), 22–24).—See *Met. Abs.*, this vol., p. 206.—S. G.

***On the Protection of Magnesium Alloys Against Corrosion.** Isamu Igarashi and Hyoji Nakata (*Sumitomo Kinzoku Kōgyō Kenkyu Hōkoku* (*Res. Rep. Sumitomo Metal Industries, Ltd.*), 1936, 2, (6), 474–509).—[In Japanese.] AZM plates, which had been subjected to various surface treatments, were painted with several kinds of paints by the spray method to protect them against corrosion. To test the protective value of the coatings, the specimens were immersed in a 3% sodium chloride solution. It was found that perfect protection after 1 month was given in the case of specimens which had been treated with hydrofluoric acid and with water vapour at high pressure or potassium dichromate followed by painting 3 or 4 times with one of the paints ("A") used in the investigation.—S. G.

Protection of Magnesium Against Corrosion. J. V. Baimakov (*Korrozia i Borba s Ney* (*Corrosion and the Fight Against It*), 1936, 1, (3), 143–152).—[In Russian.] A detailed review.—D. N. S.

Aluminium for Cable-Sheaths. J. Bally (*Leichtmetall*, 1936, (1), 14–15).—From *Rev. Aluminium*, 1936, 13, (80), 159–163; see *Met. Abs.*, this vol., p. 259.—L. A. O.

Aluminium Coatings on Iron. A. v. Zeerleder (*Light Metals Research*, 1937, 5, (11), 249–251).—Translated from *Korrosion u. Metallschutz*, 1936, 12, (10), 275; see *Met. Abs.* this vol., p. 545.—L. A. O.

The Protection of Lead in Contact with Wooden Structures. J. Mahul (*Génie civil*, 1934, 104, (12), 274–275).—Lead sheet applied to wood is liable to attack either by larvæ or, in the case of certain woods, by acetic acid. Woods subject to larval attack are enumerated, and suitable protective compositions are indicated: acetic acid attack may be obviated by using only dry seasoned material, which should preferably be protected from direct contact by asphalt paper.—P. M. C. R.

"Homogeneous Lead-Coating" Practice. Ernst Greger (*Apparatebau*, 1936, 48, (3), 24–26).—The application of molten lead to iron in order to produce a firmly adherent coating of uniform thickness is considered preferable to the use of lead in sheet form. The process is described.—P. M. C. R.

Tests on Tinplate. L. H. G. Barton (*Chem. and Ind.*, 1936, 55, (28), 564).—Porosity in tinplate can readily be detected by boiling the metal for 2 hrs. in a solution containing 1–5 p.p.m. of copper as $CuSO_4$; pores are revealed by the development of spots of rust and copper.—A. R. P.

Diffusion of Hydrogen Through Mild Steel Sheet and Tinplate. T. N. Morris (*Dept. Sci. Indust. Res., Rep. Food Invest. Board* 1934, 1935, 186).—Coatings of tin retard the diffusion of hydrogen which takes place through thin sheet steel; lacquer has little effect.—S. G.

***The Protection of Tinplate by Lacquer.** T. N. Morris (*Dept. Sci. Indust. Res. Rep. Food Invest. Board*, 1935, 169–170).—The spraying of the insides of ordinary double-lacquered cans with a quick-stoving lacquer after fabrication has led to an improvement in the preservation of certain types of English fruits which normally give trouble.—W. D. J.

The Tinning of Cast Iron. M. Cymboliste (*La Fonte*, 1935, (18), 680).—An informative article, dealing with the tinning of cast-iron by the methods of hot-dipping and electrolysis. Difficulties are discussed, and C. makes suggestions for overcoming them.—S. G.

How to Tin Grey Iron Castings. J. R. Swanton (*Foundry*, 1936, 64, (6), 26–27, 87).—Workshop notes on the operation of tinning grey iron and malleable iron castings.—J. C. C.

Hot Tinning Difficulties Avoided by Adherence to Good Shop Practice. J. R. Swanton (*Steel*, 1936, **99**, (4), 40 and 42).—Imperfect tinning of grey cast iron is attributed to defective cleaning or fluxing, or to inadequate temperature control. Correct methods are briefly indicated.—P. M. C. R.

Remarks on Hot-Dip Galvanizing. A. Forny (*Galvano*, 1936, (52), 19–21).—Brief notes are given on the effects of impurities in the zinc, the temperature of the bath, the dipping operation, and the heating of the bath.—A. R. P.

The Various Methods of Hot-Dip Galvanizing by Hand. —— (*Galvano*, 1936, (46), 27–30).—Describes methods involving dipping the dry articles into an uncovered zinc bath, and pickled articles into a zinc bath covered with ammonium chloride.—A. R. P.

Notes on Fluxes for Hot-Galvanizing. A. T. Baldwin (*Steel*, 1936, **99**, (7), 49–50, 53; (8), 48–49, 51).—The preparation of sheet for hot-galvanizing by successive treatments with a suitable acid, water, cold dilute hydrochloric acid, and a sal-ammoniac flux is criticized. The use of electrolytic pickling, effective rinsing, and a flux of zinc ammonium chloride is suggested. The preparation of the flux is described, and densities and compositions of zinc ammonium chloride solution are tabulated. Suitable concentrations are recommended for different classes of work.—P. M. C. R.

Heavy Coated Galvanized Sheets. George C. Bartells (*Sheet Metal Worker*, 1935, **26**, 197–201).—S. G.

Galvanizing Kettle Heated Through Gas-Fired Vertical Alloy Tubes in Walls. W. H. Spowers, Jr. (*Steel*, 1936, **98**, (23), 56, 58).—See *Met. Abs.*, this vol., p. 461.—P. M. C. R.

Faulty Ferrous Metal as a Cause of Poor Deposits on Galvanized and Enamelled Steel Sheet. Hans Fromm (*Forschungsarb. Metallkunde u. Röntgenmetallographie*, 1934, (**11**), 10–24).—Precautions to be observed in the manufacture of steel sheet for galvanizing are discussed, and the effects of inclusions of slag scale and sulphides and phosphides on the quality of the zinc deposit are illustrated and described.—A. R. P.

Faults in Galvanizing. Hermann Schörg (*Forschungsarb. Metallkunde u. Röntgenmetallographie*, 1934, (**11**), 47–50).—Briefly discusses: composition and structure of the iron or steel sheets, effects of pickling and other pretreatment, effects of temperature and purity of the zinc bath.—A. R. P.

***The Action of Molten Zinc on Iron and Steel.** I. Musatti and A. la Falce (*Metal Treatment*, 1936, **2**, (8), 170, 171–172).—Abridged translation from *Congrès Internat. Mines Mét., Géol.*, 1935; see *Met. Abs.*, this vol., p. 364.
—J. C. C.

Testing of Galvanized Sheets by Glazunov's Method. Josef Teindl (*Hornický Věstník*, 1935, **17**, (reprint)).—[In Czech, with English summary.] The structure of hot-galvanized iron sheet, and the effect of added elements—such as aluminium, tin, cadmium, &c.—are determined. Methods are described for measuring the thickness of zinc-coated iron sheets by chemical and electrochemical means. With coatings that protect the base metal by self-sacrifice (*e.g.* zinc-coatings on iron) tests may be made, by Glazunov's method of anodic dissolution, not only of the thickness of the whole coating, but also that of the intermediate layer. The galvanized iron sheet is made the positive pole in the electrolyte (*e.g.* conc. zinc sulphate solution; the sheet being covered with wax, except for 1 sq. cm.), a cylinder of platinum surrounding the sheet being the cathode. The ampèrage and voltage are measured. If the time and ampèrage are observed, the thickness of the coating and that of the intermediate layer can easily be ascertained. Comparative study of chemical and electrochemical methods indicates that Glazunov's method can be recommended for general acceptance and control tests.—S. G.

***Porosity Tests for Zinc-Coated Iron and Steel.** W. A. Koehler and R. O. Burford (*Trans. Electrochem. Soc.*, 1936, **70**, 397–400).—See *Met. Abs.*, this vol., p. 461.—S. G.

Visit to Messrs. Stewarts and Lloyd's New Steelworks at Corby, Northamptonshire [Galvanizing Steel Tubes]. —— (*J. Inst. Fuel*, 1936, **9**, (48), 387–401).—Contains a brief description of the hot-dip galvanizing of steel tubes.—A. R. Pe.

Metal Plating by Electro-Rubbing. I. I. Varshavski (*Korrozia i Borba s Ney* (*Corrosion and the Fight Against It*), 1936, **1**, (3), 153–159).—[In Russian.] A review.—D. N. S.

A Contribution to the Study of Metal Coating with the Pistol. J. Fassbinder and P. Soulary (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **5**, 1206–1218 (in French), 1219–1231 (in English); discussion, 1232; also *Met. Ind.* (*Lond.*), 1936, **49**, (2), 35–40; (4), 89–93; and (summaries) *Metallizer*, 1936, **5**, (6), 10–11; *Gas J.*, 1936, **215**, 112–113).—The authors have studied the peculiar structure that exists in deposits made by metallization with the pistol, and put forward certain methods for assessing the mechanical properties and the resistance to corrosion so obtained. These methods are applied in making comparisons between the layers of metal formed with the wire pistol and the powder pistol, and in investigating the effect of certain methods of procedure on the homogeneity of the layers.—S. G.

Metallizing in Industry [Aluminium Coating of Cracking-Still Reaction Chambers]. H. R. Leland (*Refiner and Natural Gasoline Manuf.*, 1935, **14**, 567–570; *C. Abs.*, 1936, **30**, 2891).—There have been considerable advances in the spraying of molten metal on glass, wood, steel, paper, cement, and various other surfaces. The coating can be ground, machined, polished, or treated in any way in which the original metal can be treated. It is necessary properly to prepare the surface which is to receive the molten metal before a perfect bond can be obtained. Porous materials such as plaster, cement, and wood require no preparation, other than the removal of oil, pitch, or grease. Non-porous articles such as glass, steel, iron, &c., require preliminary sandblasting before coating, to produce the necessary roughness into which the metal can bond. Special precautions are described for metal coating the interior of cracking-still reaction chambers with aluminium.—S. G.

***Some Observations on the Metal Spraying of Copper.** W. E. Ballard and D. E. W. Harris (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **5**, 1233–1237; and *Met. Ind.* (*Lond.*), 1936, **49**, (20), 482–486).—Since the invention of the process, metal spraying has made steady headway in most countries in the world, particularly in the cases of zinc and aluminium. More recent developments have led to the adoption of the higher melting point metals for the building up and the salvage of worn parts and also the protection of fabricated structures against erosion by the production of hard coatings. Industry has also found applications where metal-sprayed tin and lead play an important part and to some extent the copper alloys such as bronze and brass have been used for ornamentation. Copper has been used to a limited extent in ornamentation and in the repair of worn copper parts. This paper gives the results of some experiments undertaken to discover the possibility of improving the coatings of copper to bring them in line with the excellent results obtained by coatings of the other metals.—S. G.

Tests on the Constitution of Sprayed Metal.—III–IV. A. Dagory (*Metalliseur*, 1936, **1**, (3), 1–4; (4), 1–4).—Cf. *Met. Abs.*, this vol., p. 310. (III.—) Deals with the speed of projection of sprayed metals and gives a theoretical basis for the determination of the speed. The speeds found vary from 284 m./second with lead to 886 m./second with copper. The conditions necessary for the preparation of the surface to receive sprayed metals are also discussed. (IV.—) Directs attention to the increased hardness which is obtained with sprayed metals and the decrease of density. The microscopic structure of sprayed metals is also described and photographs are given of the copper deposit.—W. E. B.

Metal Spraying in the Petroleum Industry. J. Cauchetier (*Métalliseur*, 1936, **1**, (4), 5–7).—An illustrated description of the metallizing of parts of petroleum plant, such as fractionating towers, with aluminium.—W. E. B.

Metal Spraying of Lock Gate at Havre, 1936. J. Cauchetier (*Métalliseur*, 1936, **1**, (3), 5–8).—A full description of the methods used in the metallizing with zinc of a lock gate, with photographs of the work being carried out. —W. E. B.

Electrolytic Iron Provides Bond in Cladding with Special Alloys. Raymond R. Rogers (*Steel*, 1936, **98**, (6), 34–35).—The resistance to heat, abrasion, and corrosion of nickel, Stellite, and certain ferrous alloys is most economically utilized by incorporating thin sheets of these materials with a backing of ordinary steel. Adhesion is improved by the electrodeposition of a thin intermediate layer of iron. A description of the whole process is given.—P. R.

Hard Facing Helps to Keep New Equipment Productive. E. E. Levan (*Steel*, 1936, **99**, (4), 52).—A brief review of the economies effected by the Stelliting of surfaces exposed to hard wear or abrasion.—P. M. C. R.

Metallic Coatings as Protective Media. S. Robson and P. S. Lewis (*Chem. and Ind.*, 1935, **54**, (26), 605–616).—Reviews and discusses critically recent work on the preparation, properties, and corrosion-resistance of coatings of zinc, tin, lead, aluminium, nickel, and cadmium on iron.—S. G.

Surface Treatment and Finishing, Selection, Application and Use of Finishes for Metals. —— (*Steel*, 1936, **98**, (11), 32–35; (13), 53–57; (15), 48–49, 56; (17), 48–52; (19), 70–72; (21), 50–52; (23), 40–46; (25), 47–50).—The factors involved in the selection of protective finishes for metal surfaces are reviewed, and the principal types of coating are considered under the headings: metallic coatings (a tabulated comparison of the properties, uses, and usual thicknesses of coatings of 13 non-ferrous metals or alloys is given); organic coatings, including metallic powder paints, lacquers, enamels, and miscellaneous coatings; finishes involving surface conversion, including phosphate, oxide, and chromate finishes and anodic oxidation; and the testing of organic coatings, with a tabulated summary of the properties of three "synthetic enamels."—P. M. C. R.

Polish and Corrosion Protection. —— Plücker (*Metallwaren-Ind. u. Galvano-Tech.*, 1934, **32**, (18), 406–408).—A review and discussion.—S. G.

Protecting Pressure Vessels with Rupture Discs. M. E. Bonyun (*Chem. and Met. Eng.*, 1935, **42**, (5), 260–263).—From a paper read before the American Institute of Chemical Engineers. Tests on very thin diaphragms of pure and alloyed metals are described, and a tabulated summary illustrates the irregular physical constants of alloyed materials at very low thicknesses. The pressure-breaking area relation at atmospheric temperature is shown graphically for silver, copper, aluminium, nickel, and platinum. A partially empirical method of calculating breaking stresses for diaphragms of given diameter is developed. —P. M. C. R.

***Cementation of Iron Alloys with Beryllium.** J. Laissus (*Compt. rend.*, 1934, **199**, (24), 1408–1410).—The presence of carbon does not appear to modify the effects noted on diffusing beryllium into pure iron. Diffusion of pure beryllium or 80% ferro-beryllium into iron is accompanied by the formation of successive zones; diffused layers 0·6–0·7 mm. in thickness may be obtained, while in the case of carbon steels, a decarburized zone extending for several mm. is produced under these conditions. Cementation with beryllium or 80% ferro-beryllium increases surface hardness, resistance to oxidation at

high temperatures, resistance to atmospheric attack, and resistance to corrosion by fresh and salt water both with continuous and intermittent exposure.
—E. J. G.

***On the Chemical Polarization of the Hydrogen Electrode by Oxygen and the Problem of Electrolytic Corrosion Protection.** Arthur E. Lorch (*Trans. Electrochem. Soc.*, 1936, **70**, 401–406; discussion, 406–408).—See *Met. Abs.*, this vol., p. 461.—S. G.

Painting on Copper. J. Meyral (*Cuivre et Laiton*, 1935, **8**, (162), 471–474).—The early use of copper as a base for ornamental painting was restricted owing to cost; the corrosion of the base metal below the paint coating, which is induced by modern industrial atmospheres in the case of iron and zinc, is inappreciable when copper is used as base, and the practicability of using very thin sheet has revived the painting of copper on a commercial scale. Methods of application are described.—P. M. C. R.

Tar–Aluminium Paints and Their Use on Metal Structures. Jules Roux (*J. Marine marchande*, 1936, **18**, (880), 277–278).—See *Met. Abs.*, this vol., p. 208.—P. M. C. R.

Selection and Methods of Application of Bituminous Paints. H. Walther (*Korrosion-Ber. Korrosionstagung*, 1936, **5**, 83–94).—The physical properties of asphaltic bitumen and coal-tar pitch suitable for use in paint are summarized. The materials may be melted and applied hot, or may be used in the form of solutions or emulsions. Aluminium bronze powder pigment is recommended on account of its light-reflecting properties and its tendency to collect near the outer surface, leaving a dense coherent layer of bitumen, &c., beneath. In the *discussion*, the alleged acid attack by phenolic products on galvanized zinc is attributed to the access of water to incompletely coated areas.—P. M. C. R.

VI.—ELECTRODEPOSITION

(Continued from pp. 550–556.)

Aluminium Plating. H. Krause (*Tech. Zentr. prakt. Metallbearbeitung*, 1936, **46**, (9/10), 362).—Aluminium may be plated by casting aluminium on to the base metal and then rolling the composite metal. For already prepared work, deposition may take place from a fused bath which is less dense than aluminium, and contains halogen salts of the latter together with chlorides of the alkalis or alkaline earths. Denser deposits may be obtained if a small quantity of a nobler metal whose solution potential is not more than 0·6 v. from that of aluminium—*e.g.* manganese, zinc, cadmium, chromium, tin, copper, or lead—is deposited simultaneously with the aluminium. Anodes of pure aluminium may be used. Aluminium alloys may be plated with aluminium by heating layers of the two materials to temperatures above 500° C. If a layer of cadmium, lead, or tin as little as 0·0002 mm. in thickness be interposed, better adhesion may be obtained.—W. A. C. N.

Addition Agents in [Cadmium] Plating. Dangers and Advantages of Their Use. J. Liger (*Galvano*, 1935, (**40**), 15–18; (**41**), 17–20; (**42**), 17–19; (**43**), 17–19; 1936, (**45**), 17–18; (**46**), 17–19; (**47**), 17–18).—The effects of gelatin, dextrin, nickel sulphate, and Turkey-red oil in cadmium plating baths are discussed. In a dilute cadmium bath gelatin causes irregular results and, with more than 0·1 grm./litre, very poor plating, but in solutions with a high concentration of cadmium and cyanide small quantities of gelatin produce very good plates. Dextrin, however, is a better addition agent than gelatin and can be used within wider concentration ranges. Nickel sulphate additions permit the use of high current densities, but are liable to produce irregular results at times; these irregularities disappear and extremely brilliant plates are obtained if a quantity of Turkey-red oil is added as well as the nickel sulphate. With nickel sulphate 1·5 and Turkey-red oil 12–20 grm./litre the bright range is 1–2 amp./dm.^{2}; at higher current densities the plate tends to blacken at the edges and at lower current densities it becomes matt.—A. R. P.

Electrolytic Cadmium or Zinc Plate? A. Darlay (*Galvano*, 1936, (49), 17–19).—Tests on cadmium-plated and zinc-plated steel of various thicknesses in the salt-spray, in a dry outdoor atmosphere, and in a humid outdoor atmosphere show that cadmium plate affords superior protection in the first two cases and zinc plate (from a sulphate bath) is best in the third case.—A. R. P.

***The Electrolytic Deposition of Cerium from Non-Aqueous Organic Solvents.** I. A. Atanasiu and M. Babor (*Bul. Chim. Soc. Române*, 1934, 37, 67–77; *Brit. Chem. Abs.*, **1935**, [B], 730).—[In German.] Electrolysis of alcoholic solutions of $CeCl_3$ or $Ce(NO_3)_3$ gives cathodic deposits with a high content of organic matter; from EtOH with a lead or platinum cathode the deposit contains 66·6% cerium and deposition of the metal as $Ce(OH)_xEt_{3-x}$ is complete. The deposit from MeOH contains 55% cerium and readily flakes from the cathode, and that from $CH_2Ph{\cdot}OH$ contains 50·35% cerium and is gelatinous and almost insoluble in dilute sulphuric acid. Cerium salts appear to deposit the metal on electrolysis of their solution in *iso*-$C_5H_{11}{\cdot}OH$, but the yield is small owing to the low solubility of the salts and the poor conductance of the solution. Electrolysis of cerium salts in NH_2Ph, C_5H_5N, $HCO{\cdot}NH_2$, and NH_2Ac affords organic complexes containing 12–81% cerium.—S. G.

The Electrodeposition of Cerium from Organic Solvents in the Presence of Reducing Agents. I. A. Atanasiu and M. Babor (*Bul. Chim. Soc. Române*, 1934, **37**, 115–128; *Brit. Chem. Abs.*, **1935**, [B], 730).—[In German.] Alloy deposits of cerium and zinc can be obtained from MeOH and EtOH solutions of cerium salts containing $Zn^{\cdot\cdot}$, 2–3% $NH_2{\cdot}OH,HCl$, and lactic, butyric or *iso*butyric acid; deposition is never complete, since the hydrochloric acid liberated decomposes the electrolyte, but if CH_2O is added the liberated hydrochloric acid may be neutralized in stages with NH_3, and the cerium deposition is then practically complete. The composition of the deposit depends on the solvent, reducing agent, current density, acidity, and $[Ce^{\cdot\cdot\cdot}]$ and $[Zn^{\cdot\cdot}]$; a maximum cerium content of 10·7% cerium can be obtained from 0·2*N*-$CeCl_3$ in MeOH.—S. G.

Mechanical Chromium Plating. R. Tiquet (*Galvano*, 1936, (49), 20–24)—The value of chromium plating for tools and other mechanical parts is discussed.
—A. R. P.

***Electrodeposition of Chromium under Pressure.** V. V. Schischkin and E. L. Krasnopolskaja (*Zhurnal Prikladnoi Khimii* (*J. Applied Chem.*), 1934, **7**, 314–320; *Brit. Chem. Abs.*, **1935**, [B], 28).—[In Russian.] The yield of chromium from aqueous CrO_3 diminishes with increasing pressure, whilst the proportion of Cr^{III} and Cr^{IV} in the electrolyte increases. These results are ascribed to the formation of a hydrosphere rich in Cr^{III} around the electrode, which prevents free diffusion of Cr^{IV} to the surface of the electrode; at atmospheric pressure the bubbles of hydrogen evolved from the electrode break the continuity of the hydrosphere.—S. G.

Defects in Chromium Plating: Their Probable Causes, How They Appear, Possible Remedies. A. Darlay (*Galvano*, 1935, (44), 23–25; 1936, (45), 19–21; (46), 20–22).—A review.—A. R. P.

Some Notes for the Use of Chromium Platers. A. Darlay (*Galvano*, 1936, (47), 23–25).—Emphasis is laid on the importance of correct current density, temperature and time of immersion in the plating bath, cleanliness of the anode surface, correct regeneration, and need for efficient washing of the plated articles.—A. R. P.

Chromium and Cadmium Plating. —— (*Ericsson Bull.*, **1936**, (8), 34–36).—Chromium and cadmium plating practice is briefly described, and the advantages and disadvantages of the two processes are briefly discussed. While chromium plating is employed in the telephone industry (several instances are given), little use has been made of cadmium plating up to the present. —E. V. W.

Chromium Plating of the Interior Surface of Small Hollow Iron Articles. N. N. Grazianski (*Ukrainskii Khemichnii Zhurnal* (*J. Chim. Ukraine*), 1934, 9, 437–440).—[In Ukrainian.]—S. G.

Chromium Plating in Automobile Construction. O. Bauer, H. Arndt, and W. Krause (*Mitt. Material.*, 1934, 281–284).—Compares nickel and chromium plating and describes tests developed to meet special requirements. —S. G.

The Importance of the Nickel Underlay in Chromium Plating. —— (*Nickel Bull.*, 1936, 9, (4), 81).—S. G.

Brass Plating Prepares Steel Surfaces to Receive Heavy Coating of Rubber. —— (*Steel*, 1936, 99, (10), 49–50).—Rubber-coated steel parts are much used in automobile manufacture. The adhesion of the rubber is improved if the steel is first coated with brass. The cleaning, pickling, and plating of the steel pieces are described, with particulars of bath composition and current density. —P. M. C. R.

The Processes of Plating in Relation to the Gold and Silver Trades. S. Field (*Sci. and Tech. Factors on Production of Gold and Silverwork* (*Worshipful Company of Goldsmiths*), 1935–1936, 77–89; and (summary) *Jeweller and Metalworker*, 1936, 62, (1501), 469–470).—A lecture. An elementary account is given of the scientific principles on which silver-, gold-, and rhodium-plating processes are based, and of the operation of the plating baths.—A. R. P.

***The Electrodeposition of Molybdenum from Aqueous Solutions.** Wm. P. Price and O. W. Brown (*Trans. Electrochem. Soc.*, 1936, 70, 423–429; discussion, 429).—See *Met. Abs.*, this vol., p. 405.—S. G.

Discussion on Bright Nickel Plating. S. Field. B. Caplan. C. F. Francis-Carter. Dudley Weill. E. D. Lyons. A. W. Hothersall (*J. Electrodepositors' Tech. Soc.*, 1936, 11, 199–206; and *Met. Ind.* (*Lond.*), 1936, 48, (9), 283–287).—The chief advantages of bright nickel plating appear to be that high current densities can be used, the ease with which the operation of the solutions can be controlled, the suitability of the deposit for subsequent chromium plating, and the lower cost of polishing small articles. On the other hand more careful control of the composition of the baths is required, and there appears to be a greater tendency for the deposits to be more highly stressed than usual. —A. R. P.

***On the Question of the Influence of Colloids on Cathode Polarization. Electrodeposition of Nickel in the Presence of Paal's Mixture.** G. S. Vozdvizhenskiy and F. F. Faizulin (*Zhurnal Fizicheskoy Khimii* (*J. Phys. Chem.*), 1936, 8, (3), 472–476).—[In Russian.] Under conditions precluding a change in the dissolution potential of nickel anodes, it was shown that maximum polarization is obtained at a definite concentration of colloid in the electrolyte due to changes in the concentration of active nickel ions.—N. A.

On the Influence of Certain Factors on Electrolytic [Nickel] Deposits. M. Vaudroz (*Galvano*, 1936, (45), 22–24; (46), 23–27; (47), 25–28; (48), 25–29; (49), 24–26; (51), 18–20; (52), 17–18).—The effects of current density on the nature of nickel deposits obtained from baths of different p_H is illustrated by photomicrographs of the deposits and by graphs showing the resistance of the coating to corrosion by acids and salt-spray. The best deposits are obtained at 1–3 amp./dm.^{2} when the p_H is 5·2–7 and at 2 amp./dm.^{2} when the p_H is 4–4·3. The best throwing power is obtained at p_H 5·2–5·6.—A. R. P.

Improvements in Bath and Deposits Increase Use of Black Nickel Plate. C. B. F. Young (*Steel*, 1936, 99, (6), 40, 42–43).—The lacquering of black nickel deposits is said to prevent cracking, peeling, and discoloration. Bath compositions are given for black and grey deposits, and a method of analysis is briefly indicated for sulphocyanide solutions.—P. M. C. R.

The Prevention of Porosity in Electroplated Nickel Deposits. W. Eckardt (*Oberflächentechnik*, 1934, **11**, (16), 178).—Porosity in high-temperature nickel plating is prevented by substituting boric acid and certain organic and other additions for nitric acid; the correct bath composition is given.—P. R.

Engineering Uses of Electrodeposited Nickel. R. E. Wilson (*Nickel Bull.*, 1936, **9**, (3), 53–56).—Discusses the Fescolizing process and some of its applications.—S. G.

***New Observations on the Influence of Colloids on the Rate of Crystallization of Cathodic Deposits [Silver].** A. Glazunov and E. Drescher (*Chem. Listy*, 1936, **30**, (11/12), 145–149).—Various theories of the influence of colloids on KG_1 of cathodic silver deposits are mentioned. The practical object of the study was to find a method for the evaluation of the necessary additions of colloids on the basis of their effects on the factors of electrolysis. Using silver nitrate as electrolyte solution, the authors find that too small a quantity of colloids can have an unfavourable influence on KG_1. The results, in the form of tables and diagrams, show that the presence of very small quantities of gelatin has an increasing effect on KG_1 which, having attained a maximum, decreases with increasing addition of gelatin at first rapidly and then slowly. An explanation is given of this phenomenon.—O. Q.

New Researches and Experiences in the Field of Electrolytic Tinning. Hugo Krause (*Kalt-Walz-Welt*, 1936, (8), 61–63).—Recent improvements in the alkali stannate and in sulphate and sulphonic acid baths are reviewed. —A. R. P.

Recent Developments Open Path to Wider Fields of Bright Zinc Plating. M. B. Diggin (*Steel*, 1936, **98**, (16), 44 and 46).—Although the corrosion-resistance of cadmium coatings is less than that of zinc, the easy control of the plating operations and the bright finish of the deposit cause cadmium to be preferred for some purposes. It is claimed that the use of an alloy anode under certain conditions, which are outlined, results in the formation of bright zinc deposits. Their rates of deposition at 5 current densities are tabulated in comparison with those of cadmium.—P. M. C. R.

Current Practices in Wire Galvanizing as They Affect Ductility and Other Properties. C. W. Meyers (*Steel*, 1936, **99**, (15), 78, 80, 107; (16), 50–52).—From a paper presented before the Edison Electrical Institute, Detroit. The acceleration of electrodeposition methods by the use of high current densities may result in porosity, especially if the base material is imperfectly cleaned or of unsuitable composition. The importance of the type of flux, method of wiping, and regulation of heat-treatment are considered, and examples of satisfactory and defective coatings are illustrated.—P. M. C. R.

Electrolytic Zinc Plating. A. Darlay (*Galvano*, 1936, (51), 15–17).—The compositions of various sulphate and cyanide baths are given and their behaviour is discussed briefly.—A. R. P.

Control of Quality of Galvanostegic Zinc Plating. J. L. Vertzman (*Zavodskaya Laboratoria* (*Works' Lab.*), 1934, **3**, 944–946; *Brit. Chem. Abs.*, **1935**, [B], 65).—[In Russian.] A drop of 9*N* sulphuric acid is placed on the zinc surface, washed off after 30 seconds, the plate dried, and the process repeated until the underlying metal becomes visible; the thickness in mm. of the zinc coating = the number of drops × 0·004 – 0·006.—S. G.

***Effect of Germanium in the Electrolysis of Zinc Sulphate Solutions.** Pietro Guareschi (*Industria chimica*, 1934, **9**, (11), 1466–1476; *Brit. Chem. Abs.*, **1935**, [B], 154).—Cf. *Met. Abs.*, 1935, **2**, 607. When aqueous zinc sulphate containing traces of germanium is electrolyzed, the deposit of zinc suffers considerable corrosion. The effect is reduced by addition of $Ca(CN)_2$, C_5H_5N, $N(C_2H_4{\cdot}OH)_3$ and urea, and by increasing the current density. Hydrogen peroxide and potassium permanganate have little effect. Addition of too great a concentration of basic nitrogen compounds produces corrosion of a different type. In the case of ammonium sulphate, this corrosion was shown to occur even in the absence of germanium.—S. G.

***The Electrolysis of Aqueous Solutions of Sodium and Zirconyl Sulphates. I.—A Preliminary Report.** W. E. Bradt and Henry B. Linford (*Trans. Electrochem. Soc.*, 1936, **70**, 431–439; discussion, 440).—See *Met. Abs.*, this vol., p. 463.—S. G.

Thick Electrolytic Deposits and Their Applications. D. Müller (*Apparatebau*, 1935, **47**, (8), 82–83).—An account of the properties of the thick nickel deposits utilized in the Fescolizing process.—P. M. C. R.

Galvanic Deposits on Aluminium. H. Krause (*Tech. Zentr. prakt. Metallbearbeitung*, 1935, **45**, (17/18), 462–466).—Two only of the older processes survive—the acid ferric chloride dip and the alkaline zincate bath. Canac and Tassily have suggested a modification of the former, using 1 grm. of iron in 500 c.c. of hydrochloric acid and 500 c.c. of water. For alloys containing manganese a bath containing manganese sulphate is suggested. The time of immersion is comparatively short, and is dependent on the temperature of the solution—an increase of 10° C., from 30° to 40° C., causing the time to be halved. The concentration of the bath should be constantly checked. With alloys containing silicon, a bath containing nitric acid and hydrofluoric acid is used. The alkali zincate bath consists of a mixture of zinc sulphate and caustic soda solutions. After pre-treatment in one of these baths aluminium is then mostly subjected to nickel deposition, preceded by a flash of copper. A brass deposit has also been used intermediately instead of copper. These methods have largely been superseded by processes which depend on the development of an aluminium oxide layer. These are briefly discussed.—W. A. C. N.

Some Aspects of Research in Electrodeposition in Great Britain. D. J. Macnaughtan (*Monthly Rev. Amer. Electroplaters' Tech. Soc.*, 1935, **22**, (7), 49–54, 56–59).—S. G.

Report of Research Work on Electrodeposition at the National Bureau of Standards. Wm. Blum and P. W. C. Strausser (*Monthly Rev. Amer. Electroplaters' Tech. Soc.*, 1935, **22**, (9), 10–13; discussion, 13–18).—S. G.

***The Co-Deposition of Metals of the Same Valence in Acid Solutions.** W. George Parks and I. Milton Le Baron (*Trans. Electrochem. Soc.*, 1936, **70**, 373–377).—See *Met. Abs.*, this vol., p. 463.—S. G.

***Motion of Liquid Around an Obstacle During Electrodeposition.** E. P. Harrison and H. Gollop (*Nature*, 1936, **137**, (3458), 234–235).—The formation of ridges of copper on copper cathodes moved steadily through the electrolyte during electrodeposition is used to reveal the flow-lines when projections of various shapes obstruct the flow. Photographs of the ridges formed in various cases are included.—B. C.

***The Formation and Growth of Pits in Electrodeposited Metals.** Michel Cymboliste (*Trans. Electrochem. Soc.*, 1936, **70**, 379–394; discussion, 394–396; and *Met. Ind.* (*Lond.*), 1936, **49**, (20), 493–496).—See *Met. Abs.*, this vol., p. 463.—S. G.

Effect of Ultrasonic Radiation on Electrodeposits. William T. Young and H. Kersten (*J. Chem. Physics*, 1936, **4**, (7), 426–427).—Rippled deposits were obtained from solutions subjected to sound waves having a frequency of about 1700 kilocycles.—C. E. R.

On the Mechanism of the Action of Certain Colloids in Electrolytic Plating Baths. Pierre Jacquet (*Compt. rend.*, 1935, **200**, 381–383).—The action of colloid additions to plating baths permits their classification into (*a*) proteins and their breakdown products, (*b*) gums and dextrin, and is associated by J. with their molecular structure.—P. M. C. R.

Rack Coating Minimizes Electrical and Metal Losses in Electroplating. H. E. Fritz and G. R. Milligan (*Steel*, 1936, 99, (3), 46, 48).—See *Met. Abs.*, this vol., p. 555.—P. M. C. R.

Surface Treatment and Finishing, Control of Electroplating. —— (*Steel*, 1936, 98, (4), 37–38; (5), 43–44, 69; (6), 36–38; (7), 44–45).—The weight of electrodeposited coatings of different thicknesses is summarized graphically for iron and 10 non-ferrous metals. Analytical methods of determining the thickness of coatings are described for nickel and copper (on ferrous and on non-ferrous materials), chromium, zinc, tin, silver, and gold.—P. M. C. R.

***Oxidation Processes at the Cathode.** O. K. Kudra and K. N. Ivanov (*J. Physical Chem.*, 1936, 40, (6), 769–777).—An X-ray examination was made of the powdery deposits obtained from aqueous solutions of various salts of copper, zinc, cadmium, and silver at high current densities. Such deposits contain a high percentage of dispersed oxides, formed as the result of secondary reactions at the cathode. The oxide content depends on the oxidizing capacity of the anion of the salt, and also on the readiness with which the deposited metal is oxidized, *i.e.* on its position in the electromotive series.—C. E. R.

The Passivity of Metals; Its Application in Electroplating. I.—The Phenomenon of Passivity. II.—Passivity of Anodes. III.—Anodic Passivity in Cyanide Baths. J. Liger (*Galvano*, 1936, (53), 16–19; (54), 15–19; (55), 15–18).—(I.—) The nature of chemical, physical, and mechanical passivity is explained and theories which have been advanced to account for passivity phenomena are discussed briefly. (II.—) Anodic passivity causes poor corrosion of the anode, upsets the equilibrium in the bath, results in a loss of efficiency, and produces disintegration and flaking of the anode. These effects are discussed with especial reference to nickel-plating baths; they may be prevented by using a bath of suitable composition, using numerous anodes of large surface, selecting anodes of good physical structure, and by adding small amounts of chloride and preventing ingress of oxidizing agents to the bath. (III.—) Carbonation of silver cyanide baths and a low content of free cyanide favour passivation of the silver anodes. In copper cyanide baths a small excess of free cyanide is necessary to keep the anodes active, but a large excess results in a low cathode efficiency; the anode area should be as large as possible and small amounts of copper cyanide should be added from time to time to maintain the copper concentration. Cadmium cyanide baths should contain 25–30 grm./litre of free cyanide and a few grm./litre of sodium chloride is beneficial.—A. R. P.

***Determining the Thickness of the Layer of an Electrolytic Coating on Iron Instruments.** I. V. Radchenko and F. K. Shestakovskii (*Zhurnal Tehnicheskoy Fiziki* (*J. Tech. Physics*), 1935, 5, 1372–1375; *C. Abs.*, 1936, 30, 8038).—[In Russian.] By measuring the current necessary to tear away a magnetized needle from the electrolytically coated iron instrument, the uniformity and thickness of the coating were determined. The greatest sensitivity is at 0·0005 to 0·02 cm. thickness of coating. The force required decreases less rapidly than a linear inverse function of the layer thickness.
—S. G.

***Determination of p_H in Almost Unbuffered Solutions.** Halvard Liander (*Iva*, 1934, (3), 57–67).—Discussion of p_H determination by electrolytic methods and by indicators, with particular reference to errors in the latter method due to the p_H of the indicator solution itself.—E. v. S.

The Measurement of p_H Values. L. G. Groves (*J. Sci. Instruments*, 1936, 13, (7), 209–214).—S. G.

Attention Called to Health Hazards in Industrial Electroplating Plants. C. B. F. Young (*Steel*, 1936, 99, (1), 63–64, 66).—Excessive gassing from cyanide baths used in brass and copper plating is attributed to the presence of a high proportion of organic material in the bath. Methods of control are suggested, and directions are given for administering a recently developed antidote for cyanide poisoning.—P. M. C. R.

Cyanide Poisoning. K. K. Chen, C. L. Rose, and G. H. A. Clowes (*J. Amer. Pharmaceutical Soc.*, 1935, **24**, 625; and *Met. Ind.* (*N.Y.*), 1936, **34**, (8), 346).—The symptoms of poisoning by inhaling cyanide fumes are described. Summarized directions are given for an amyl nitrate–sodium thiosulphate treatment, and precautions in handling solid or dissolved cyanide are enumerated. —P. M. C. R.

Dust in Plating Baths and Its Elimination. R. Tiquet (*Galvano*, 1936, (55), 21–24).—The deleterious effects of dust in plating baths are discussed, and various methods of filtering the baths are described.—A. R. P.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition.)

(Continued from pp. 556–557.)

***On the Electric Discharge Between Rotating Copper Electrodes.** Alojzy Kotecki (*Acta Physica Polonica*, 1934, **3**, 105–114).—[In French, with Polish summary.] An arc can be struck between the edges of rotating copper disc electrodes, but not between similar aluminium electrodes owing to the presence of the natural oxide film which is a poor conductor. In the case of copper discs, the arc forms either a continuous line round the edge or a disconnected series of points between which it jumps; in some cases the arc takes the form of a luminescent discharge. The voltage drop across the arc remains very steady irrespective of the type of discharge or the speed of rotation of the electrodes. These results and the nature of the spectrum of the arc are explained on the basis of the theory of auto-electric emission of electrons by the cathode.—A. R. P.

Electrochemistry of Polonium. M. Haissinsky (*Trans. Electrochem. Soc.*, 1936, **70**, 343–371).—See *Met. Abs.*, this vol., p. 311.—S. G.

On the Mechanism of the Potential Jump of Platinum in Silver Salt Solutions. A. Obrucheva and A. Frumkin (*Dokladi Akademii Nauk S.S.S.R.*, 1936, **4**, (1), 11–13 (Russian); and *Compt. rend. Acad. Sci. U.R.S.S.*, 1936, [N.S.], **4**, (1), 11–13 (German)).—According to O. Essin and M. Lozmanowa, smooth platinum and gold electrodes in silver salt solutions acquire a silver potential within a few minutes. Platinized electrodes behave similarly, but the potential is reached more slowly. When the silver potential has been established, needle-shaped silver crystals often appear on the electrode. A silver nitrate solution, which has lost the power to impose a silver potential on platinum, may be "regenerated" by heating it at 50° C. with silver powder or exposing it to strong light for several hours, thus showing that the phenomenon is caused not by silver ions but by the small quantities of reducing agent in the solution.—N. A.

***Observations on the Effect of Mechanical Agitation on Electrode Potential.** F. O. Koenig (*J. Physical Chem.*, 1935, **39**, (4), 455–463).—The electrokinetic theory of the effect of mechanical agitation on electrode potential is critically discussed. It is pointed out that this theory is not the only possible explanation, an alternative being the theory that irreversible chemical processes are partly or wholly responsible for the effect. Experiments with silver electrodes in potassium chloride solutions saturated with silver chloride and in silver nitrate solutions are described which lend support to the chemical theory of the effect.—S. G.

***The Potential Differences at Metal–Vapour, Vapour–Liquid, and Liquid–Metal Interfaces of Partially Immersed Electrodes.** Colin G. Fink and Richard

C. Dehmel (*Trans. Electrochem. Soc.*, 1936, **70**, 281–320; discussion, 320–322). —See *Met. Abs.*, this vol., p. 464.—S. G.

***On the Course of the Anodic Dissolution of a Mechanical Mixture of Metals.** A. Glazunov and J. Teindl (*Chem. Obzor*, 1935, **10**, (7), 121–123).—The gentle course of the curve illustrating the changes of potential during anodic dissolution of a mechanical mixture is due to the weakening contact between the electrolyte and the metal being dissolved. In the case of a protective metallic coating, when the protective and the base metal form merely a mechanical mixture in accordance with their thermal diagram, or when their relation is very complicated (unless they form a continuous series of solid solutions) the continuity of the curve is caused by the weakening contact between the electrolyte and the phase being dissolved (the phase with the highest potential among those present on the surface of the anode at the given moment). When the relation between the protective metal and the base metal is complicated, the individual intermediate layers are not composed of separate phases, but of a mixture of phases, *e.g.* the case of galvanized metal.—O. Q.

***Alkaline Storage Battery. VII.—Alkali Zincate Storage Battery with Mercury Cathode. VIII.—, IX.—Alkali Zincate Storage Battery with Nickel Mesh Cathode.** S. Tanaka and K. Yoshimoto (*J. Electrochem. Assoc. Japan*, **1934**, (2), 240–247; (3), 350–358; (4), 385–393; *C. Abs.*, 1935, **29**, 1721).—[In Japanese.] (VII.—) Zinc in amalgam solidifies during charge when a definite concentration (approx. 2·3 grm. of zinc per 100 grm. of mercury) is attained, and the decrease in [zinc] results in a sudden increase in e.m.f. to 2·6 v. This occurs more readily at high current densities. If the battery is charged at a current density sufficiently low to prevent this voltage increase, discharge of $H^{\cdot}$ and $K^{\cdot}$ does not occur, and the zinc amalgam is stabilized. A large surface area of mercury and a small depth of electrolyte are necessary to attain the theoretical value of the amp.-hr. efficiency at high voltage discharge. (VIII.—) A nickel mesh (130 meshes/cm.^{2}) washed with sulphuric acid was used. The optimum conditions were: a 7·5 cm. layer of electrolyte (7*N*-KOH; ratio KOH : ZnO = 12; 136 c.c.) and 184 sq. cm. of cathode area for 100 c.c. of electrolyte solution. (IX.—). Current-e.m.f. curves are plotted for the above solution under varying conditions. With a nickel mesh cathode covered with mercury, chemical dissolution occurs slowly, and the mean discharging voltage is lower.—S. G.

***Studies on Overvoltage. VIII.—Overvoltages at Bright Platinum Electrodes in 2-Normal Sulphuric Acid for Low Current Densities Determined with an Oscillograph.** A. L. Ferguson and G. M. Chen (*J. Physical Chem.*, 1935, **39**, (2), 191–198).—A study was made of overvoltage phenomena at both anodes and cathodes of bright platinum in 2*N* sulphuric acid. An oscillograph was used to obtain charge and discharge curves. Curves were obtained which show the influence of time and current density. A comparison is made of the direct method, the commutator method, and the electromagnetic interrupter. An attempt is made to distinguish between discharge curves due to a pure resistance, those due to true polarization, and those due to a combination of the two.—S. G.

Hydrogen Overvoltage and the Reversible Hydrogen Electrode. J. A. V. Butler (*Proc. Roy. Soc.*, 1936, [A], **157**, 423–433).—In the discharge of hydrogen ions at metallic cathodes, adsorbed hydrogen may be formed at a lower potential than "free" hydrogen liberated according to Gurney's mechanism. There is a p.d. at which the rates of transfer of hydrogen ions to adsorption positions and the reverse are equal, and it is shown that in favourable cases the activation energy of the reversible transfer is sufficiently low to give rise to a practically reversible electrode. Hydrogen can, however, only be continuously evolved by this process with currents which are less than the rate of desorption of hydrogen from a saturated surface, and with greater currents an alternative mechanism must come into action. It is suggested that at high overvoltage electrodes the rate of desorption is small, and hydrogen is formed by Gurney's or some similar mechanism.—S. G.

***Studies on Overvoltage: The Effect of Fusion of the Cathode and the Effect of Temperature on Gas Polarization.** Allison Butts and W. A. Johnson (*Trans. Electrochem. Soc.*, 1936, **70**, 259–274; discussion, 274–279).—See *Met. Abs.*, this vol., p. 465.—S. G.

Industrial Applications of Electrolysis. H. J. T. Ellingham (*Chem. and Ind.*, 1935, **54**, (41), 895–902).—Anode and cathode reactions are reviewed in relation to the electrochemical series of the metals. Processes involving electrodeposition of metals include the extraction of aluminium, zinc, and copper, electrolytic refining, electroplating and electroforming. Processes which do not involve deposition of metals include the electrolysis of chloride or alkaline solutions and a variety of anodic oxidation methods, which may or may not cause attack on the anode. The economic aspect of electrolytic processes and their organization are reviewed.—P. M. C. R.

VIII.—REFINING

(Continued from pp. 557–558.)

The Rhokana Electrolytic Copper Refinery. Archer E. Wheeler and Henry Y. Eagle (*Trans. Inst. Min. Met.*, 1936, **45**, 439–457; discussion, 457–474).—See *Met. Abs.*, this vol., p. 210.—S. G.

***Modified Betts Process Yields Refined Lead Bullion.** T. E. Harper, Jr., and Gustave Reinberg (*Eng. and Min. J.*, 1935, **136**, (3), 119–120).—By limiting the corrosion period of the anode to values depending on the impurities present, it is stated to be possible to refine lead to a purity of at least 99·99%. Acid loss is kept to a minimum by recovery by counter current dip washing of the concentrated fluosilicate solution remaining in the pores of the slime blanket on the anodes. The original bullion contains approximately 10% impurities, principally antimony and bismuth with lesser amounts of silver, copper, arsenic, and tellurium.—R. Gr.

IX.—ANALYSIS

(Continued from pp. 558–565.)

Report of [A.S.T.M.] Committee E-3 on Chemical Analysis of Metals. G. E. F. Lundell and H. A. Bright (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 539–541).—Reports the preparation of a draft of analytical methods for the determination of Ni and Si in brass ingots and sand-castings (for inclusion in the Standard Methods of Chemical Analysis of Brass Ingots and Sand-Castings—B45–27) and that consideration is being given to procedures for the determination of Pb, Sn, and Fe in these alloys. A method for the determination of Al in Fe–Cr–Al alloys (37·5% Cr and 5% or more Al) is being developed.—S. G.

Microanalytical Research for Foundry Products. M. Niessner (*Internat. Giessereikongress, Dusseldorf, 1936, Tech.-wiss. Vorträge*, 1936, (32), 5 pp.).—[In German.] The principles of microchemical work are outlined and some drop tests are described which are applicable to the examination of castings, *e.g.* the use of iodine and sodium azide for identifying sulphide inclusions; ammonium molybdate and zinc chloride for showing phosphorus segregation; and potassium ferrocyanide for detecting oxide inclusions in iron and steel. Quantitative microanalysis is recommended for the investigation of slags.
—H. W. G. H.

Microchemical and Special Methods of Analysis in Communication Research. Beverly L. Clarke and H. W. Hermance (*Bell System Tech. J.*, 1936, **15**, 483–503; and *Bell Telephone System Tech. Publ., Chemistry, Monograph* **B-957**, 1936, 21 pp.).—S. G.

***A Photometric Method Suitable for Spectrum Analysis.** D. H. Follett (*J. Sci. Instruments*, 1936, **13**, (7), 221–228).—A method is described for determining the relative intensities of 2 spectral lines of nearly the same wave-length; it is based on the use of a " stepped wedge " made by depositing Pt on fused silica. Microphotometric readings are taken of the density of two consecutive steps on one line of the pair, and a similar reading on a step of intermediate density on the other. An expression is derived from which the relative intensities of the lines can then be calculated. Tests show that the accuracy of the method is such that the probable error of a single determination is about 1½%. Preliminary results are given of an application of the method to the quantitative analysis of Pb in Sn. Certain conclusions are reached which are of general interest in spectrum analysis; they concern the effects of background in the spectrum, and the regularity of light emission from sparks run on the conventional circuit.—S. G.

Report of [A.S.T.M.] Committee E-2 on Spectrographic Analysis. H. V. Churchill and C. C. Nitchie (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 537–538).—A brief progress report.—S. G.

The Accuracy of Quantitative Spectral Analyses. H. Kaiser (*Z. tech. Physik*, 1936, **17**, (7), 227–229).—An accurate method is described for the quantitative spectral analysis of lead alloys containing Sn, Sb, and Cd. It is shown that errors involved in the measurements are amenable to Gauss's law. The contribution to the total error made by apparatus is investigated, together with conditions of excitation and homogeneity of samples.—E. J. G.

Problems and Methods in Industrial Spectroscopy. S. Judd Lewis (*J. Soc. Chem. Ind.*, 1935, **54**, 427–432).—A review of industrial applications of quantitative spectroscopic analysis and spectrophotometry. Metallurgical investigation and analysis are more advanced than the examination of non-metallic materials, the consistency, low conductivity, and heterogeneity of which necessitate modified practice. Reference is made to the estimation of Cd in Zn, of Sn in Pb, Fe in Al, and Ge in electrolytic Zn liquor, and to the study of local defects in metals.—P. M. C. R.

The Use of the Spectrograph in Metallurgical Analysis. D. M. Smith (*Analyst*, 1935, **60**, (706), 17–22; discussion, 22–23).—A review.—S. G.

X-Ray Determination of Admixtures to Metals. V. I. Arharov and P. M. Scharoiko (*Zavodskaya Laboratoria* (*Works' Lab.*), 1934, **3**, 1040–1041; *Brit. Chem. Abs.*, **1935**, [B], 272).—[In Russian.] The Cu_2O line of the X-ray spectrum of Cu–Cu_2O mixtures ceases to be visible at $[Cu_2O] < 0{\cdot}5\%$.—S. G.

The Use of Tin Amalgam in the Analysis of Alloys. I. V. Tananaeva and E. Davitashwili (*Zavodskaya Laboratoria* (*Works' Lab.*), 1936, **5**, (7), 819–820).—[In Russian.] (1) *Estimation of copper in bronze.* An aliquot part of a weighed amount of bronze dissolved in hot, concentrated H_2SO_4 is shaken with a 10% tin amalgam, for 5 minutes at 60°–70° C., in a Someya apparatus. After removing the amalgam, the univalent Cu is titrated with $K_2Cr_2O_7$, using diphenylamine as indicator. Tin is determined by difference from $\Sigma Cu + Sn$, which is determined in the same way after adding HCl to a concentration of $1{\cdot}5N$. (2) In the *analysis of Babbitt* the sum of Cu, Sb, and Sn can be determined after reduction in a solution containing H_2SO_4 and HCl by titration with $K_2Cr_2O_7$, Cu after reduction with Bi–Hg and the Sb by direct titration with $KBrO_3$. In 1–$2N$ HCl, the $PbSO_4$ can be reduced with Sn–Hg and determined by titration with $K_2Cr_2O_7$.—D. N. S.

Industrial Analysis of Nickel Silver. R. Villière (*Rev. Nickel*, 1936, **7**, (5), 144–147).—The need for correct sampling is emphasized. Owing to segregation phenomena, care must be taken to take portions across the whole area of the section. Sn is estimated as the dioxide, Cu and Pb by electrolysis, Fe, Al, and Mn in the remaining solution as their hydroxides, Ni by dimethylglyoxime, Zn as the oxide, and Co by precipitation with nitroso-β-naphthol. —W. A. C. N.

***Analysis of Elektron.** Ubaldini Ivo and Mirri Giuseppina (*Industria chimica*, 1934, **9**, (11), 1476–1480; *Brit. Chem. Abs.*, **1935**, [B], 153).—The alloy is treated with HNO_3 (d 1·2). Sn is determined in the insoluble portion by heating with NH_4Cl, and Si by heating with HF. Cu and Pb in the solution are determined electrolytically. On subsequent addition of concentrated H_2SO_4 the soluble Si is precipitated and weighed as SiO_2. The filtrate is neutralized (to tropæolin) with aqueous NH_3, and Zn precipitated as ZnS and weighed as ZnO. The ZnS must be washed with acidified aqueous $(NH_4)_2SO_4$ to remove Al and Mg. Al is precipitated as $Al(OH)_3$ by adding aqueous NH_3 until the end-point for bromothymol blue is reached. The $Al(OH)_3$ is washed with H_2O containing a little NH_4NO_3 and NH_3 to remove Mg and weighed as Al_2O_3. In order to determine Fe, another sample is dissolved in HCl. Group II metals are precipitated with H_2S, and the Fe is determined iodometrically. Mn is oxidized to $HMnO_4$ by means of $(NH_4)_2S_2O_8$ and determined colorimetrically. Ca is determined by Stolberg's method. Mg is determined by difference.—S. G.

Determination of the Fineness of Silver Bullion. M. R. Bercovitch (*Chemist-Analyst*, 1936, **25**, (1), 11, 14).—Three portions of exactly 1·04 grm. of the bullion are dissolved in 20 c.c. of 1 : 1 HNO_3 and 100 c.c. of NaCl solution (= 1 grm. Ag) are slowly added from a pipette. The remainder of the Ag is titrated with NH_4CNS solution (1 c.c. = 0·001 grm. Ag). Two similar trials are made with pure Ag for standardizing the solutions.—A. R. P.

***Composition of Compounds Resulting from A. Martini's Microchemical Reactions.** J. V. Dubský and A. Langer (*Chem. Listy*, 1936, **30**, (17), 227–230).—A. Martini (*Mikrochemie*, 1929, **7**, 231–234) published some methods for detecting metals by use of pyridine and aniline. Employing these methods the authors isolated the resulting products and investigated their composition. The compounds did not correspond to those shown in Table I, but regularly to those in Table II.

Table I.	Table II.
$Co(SCN)_2(pyr.\ HSCN)_3$	$Co(SCN)_2(pyr.)_4$
$Cu(NH_3)_4(SCN)_2(pyr.\ HSCN)_3$	$Co(SCN)_2(pyr.)_4(HSN)_2$
$Cu(NH_3)_4(SCN)_2(chin.\ HSCN)_3$	$Co(SCN)_2(anil.)_2$
$Cu(NH_3)_4(SCN)_2(anil.\ HSCN)_2$	$Cu(SCN)_2(pyr.)_2H_2O$
$Ni(NH_3)_4(SCN)_2(anil.\ HSCN)_4$	$Cu(SCN)_2(anil.)_2$
$Cd(NH_3)_4(SCN)_2(anil.\ HSCN)_2$	$Ni(SCN)_2(anil.)_2(NH_3)_2$
$ZnCl_2.anil.HCl$	$Cd(SCN)_2(anil.)_2$
	$H_2SO_4(anil.)_2$

—O. Q.

***Drop Method of Detection of Bismuth.** N. A. Tananaev and A. V. Tananaeva (*Zhurnal Prikladnoi Khimii* (*J. Applied Chem.*), 1935, **8**, (8), 1457–1460; *Brit. Chem. Abs.*, **1936**, [A], 444).—[In Russian.] $SnCl_2$ is added to the solution, when a brown coloration is given by $\not< 2 \times 10^{-6}$ grm. of Bi (Hg interferes). Alternatively, Ag and Pb are precipitated by saturated aq. $NaCl-Na_2SO_4$, and $SnCl_2$ and KI are added to the solution, when a yellow to orange precipitate is obtained in presence of $\not< 10^{-5}$ grm. of Bi. A third method consists in conversion into the chloride, followed by dilution, when BiOCl is precipitated ($\not< 5 \times 10^{-5}$ grm. of Bi). The limitations of the methods and their applications to special cases are discussed.—S. G.

***A New Method for the Detection of Cadmium.** F. I. Trischin (*Zhurnal Prikladnoi Khimii* (*J. Applied Chem.*), 1935, **8**, (7), 1269–1270; *Brit. Chem. Abs.*, **1936**, [A], 303).—[In Russian.] Ag, Pb, Hg, Bi, Fe, Al, Cr, Mn, and Sn are precipitated by adding dilute aq. KI, concentrated aq. NH_3 and 5–6 drops of H_2O_2 to 1 c.c. of solution; the solution is filtered, and excess of KCN and a few drops of aq. Na_2S are added to the filtrate (containing Zn, Co, Ni, Cu, and Cd), when a yellow precipitate is obtained in presence of $\nless$ 0·00056 mg. of Cd.—S. G.

***A New Microchemical Reaction for Cæsium, and Its Use in Colorimetric Microchemistry.** E. S. Burkser and M. L. Kutschment (*Zhurnal Prikladnoi Khimii* (*J. Applied Chem.*), 1936, **9**, (1), 145–147; *Brit. Chem. Abs.*, **1936**, [A], 578).—[In Russian.] A drop of the solution is placed on a drop of concentrated aq. $AuBr_3$–$PtBr_3$ on filter paper, when a black stain due to the *compound* $Cs_2Au_2PtBr_{12}$ (decomp. 175°–180° C.) is formed in presence of $\nless 0{\cdot}25 \times 10^{-6}$ grm. of Cs. $NH_4^{\cdot}$, K, Na, and Li do not interfere, but Rb gives a similar reaction when present in considerable amount. The amount of Cs may be determined by comparing the intensity of the stain obtained with a series of standards.—S. G.

***A Qualitative Reaction for the Rapid Detection of Vanadium.** E. I. Kretch (*Zhurnal Prikladnoi Khimii* (*J. Applied Chem.*), 1935, **8**, (6), 1092–1094; *Brit. Chem. Abs.*, **1936**, [A], 45).—[In Russian.] 5–100 mg. of powdered salt or alloy are mixed with 0·05–0·1 grm. of wood C and 0·2–0·5 grm. of anhyd. $AlCl_3$, and the mixture is gently heated for 1–2 seconds in a test-tube having a plug of glass-wool moistened with 75% H_2SO_4 inserted at about 7 cm. from the bottom, when an orange colouration indicates V ($\nless$ 0·01 mg. as V_2O_5). Other elements not giving coloured chlorides volatile at $<$ 150° C. do not interfere.—S. G.

***Quantitative Spectrographic Determination of Antimony in Blister Copper.** B. A. Lamakin and A. L. Ostashevskaja (*Zhurnal Tehnicheskoy Fiziki* (*J. Tech. Physics*), 1936, **6**, (10), 1782–1787).—[In Russian.] In the determination of 0·0005–0·1% Sb in Cu the intensity of the Sb line 2311·50 A. is compared with that of the Cu lines 2303·13 and 2319·6 A. The optimum current strength, voltage, and arc gap and the linear relation between the % Sb and the relative intensities of the above lines were established.—N. A.

***Analysis by "Internal Electrolysis." I.—Determination of Bismuth and Copper in Lead Alloys Containing Antimony and Tin.** Beverly L. Clarke, L. A. Wooten, and C. L. Luke (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1936, **8**, (6), 411–414; and *Bell System Tech. Publ., Metallurgy, Monograph* **B-974**, 1936, 9 pp.).—The apparatus of Collin and Sand (*Analyst*, 1930, **55**, 309, 312) has been modified by using an Alundum shell in place of parchment for the anode envelope and by weighing the Bi + Cu deposit on the Pt cathode; then dissolving in HNO_3 and titrating the Cu iodometrically, Bi being taken by difference. Full operating details and sketches of the apparatus are given in the original, but are too detailed for abstracting.—A. R. P.

Analysis by Means of Organic Compounds. VI.—A New Volumetric Determination of Copper by Means of Benzoinoxime. Masayoshi Ishibashi and Hideya Funahashi (*Nippon Kwagaku Kwai Shi* (*J. Chem. Soc. Japan*), 1935, **56**, (10), 1231–1233).—[In Japanese.]—P. M. C. R.

***The Spectrographic Estimation of Small Quantities of Copper, Lead, Arsenic, and Antimony in Nickel and Nickel Sulphate Solutions.** E. H. S. van Someren (*J. Soc. Chem. Ind.*, 1936, **55**, (20), 136–138T).—A direct spectrographic determination of metallic impurities in Ni and Ni electrolytes is impracticable because of the complexity of the Ni spectrum. The H_2S group metals are therefore concentrated by treating the acid solution with H_2S after addition of Cd and Sn equivalent to 500 and 20 mg./litre, respectively, and the precipitate is collected, washed, dried, and spectrographed in portions in a graphite arc; the intensities of the Cd and Sn lines are then used as internal standards for determining Cu, Pb, As, and Sb, thus: Cu 2230 = Sn 2232 for Cu : Sn = 1 : 20, Cu 2228 = Sn 2232 for Cu : Sn = 1 : 4; Pb 2833 = Sn 2814 for Pb : Sn = 1 : 100, Pb 2823 = Sn 2814 for Pb : Sn = 1 : 4, Pb 2873 = Cd

2868 for Pb : Cd = 1 : 90; As 2745 = Cd 2734 for As : Cd = 1 : 80; As 2745 = Cd 2749 for As : Cd = 1 : 15; Sb 2311·5 = Cd 2313 for Sb : Cd = 1 : 400, Sb 2598 = Sn 2594 for Sb : Sn = 1 : 40.—A. R. P.

***Quantitative Method for Indium in Dental Precious-Metal Alloys.** Leslie G. Wright (*J. Dental Research*, 1935, **15**, (3/4), 224–225).—Abstract of a paper read before the International Association for Dental Research. The solution of the alloy in appropriate acids is treated with H_2S to remove Pt, Pd, Au, Rh, Sn, Ag, and Ir and then oxidized with HNO_3 and treated with NH_4OH and NH_4Cl to remove Ni and Zn which remain in solution. The precipitate is dissolved in H_2SO_4 and the In–Fe precipitated as sulphide (no details of this procedure are given). The sulphide is redissolved in acid and the indium precipitated with NH_4OH for ignition to In_2O_3. [*Note by abstractor:* In is readily separated from Fe by boiling the slightly acid solution with $NaHSO_3$.] —A. R. P.

***The Spectrographic Determination of Magnesium in Aluminium Alloys.** W. R. Koch (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (II), 292–298; discussion, 299–300).—In order to compare the results of Mg determinations in Al alloys by several spectrographic methods using metallic electrodes, objective photometric measurements of the spectrograms were made photoelectrically. Suitable line pairs were selected for the determination of Mg within ± 10% of the amount present over the range of concentration from 0·1 to 4·0%. The results obtained by the spark method were more accurate than those obtained by the arc method, although the arc method offered satisfactory accuracy within a more limited range of concentration. The presence of approximately 1% of Cu, Fe, Si, or Mn made no significant variation in the intensity relations of the Al and Mg lines. In the several cases studied it was found that slightly greater accuracy results from the use of a pair of lines, both of which were spark lines, than from the use of a pair of lines one of which was arc and the other a spark line.—S. G.

Analysis by Means of Organic Compounds. IV.—Volumetric Determination of Nickel by Means of Dimethylglyoxime Solution. Masayoshi Ishibashi and Atsushi Tetsumoto (*Nippon Kwagaku Kwai Shi* (*J. Chem. Soc. Japan*), 1935, **56**, (10), 1221–1227).—[In Japanese.]—P. M. C. R.

Analysis by Means of Organic Compounds. V.—Separation and Determination of Nickel and Cobalt by Means of Dimethylglyoxime and Sodium Anthranilate. Masayoshi Ishibashi and Atsushi Tetsumoto (*Nippon Kwagaku Kwai Shi* (*J. Chem. Soc. Japan*), 1935, **56**, (10), 1228–1230).—[In Japanese.] —P. M. C. R.

***A New Colorimetric Procedure Adapted to Selenium Determination.** Kurt W. Franke, Robert Burris, and Robert S. Hutton (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1936, **8**, (6), 435).—Freshly precipitated $BaSO_4$ is collected on a paper disc 2 cm. in diameter placed in a special filter tube, and the solution containing the Se in a colloidal form prepared by adding SO_2 to an HCl solution of SeO_2 is filtered through the $BaSO_4$ on the surface of which it is adsorbed to give a red film. The colour of this is compared with a series of standards prepared similarly.—A. R. P.

***Determination of Sulphur in Refined Copper.** M. R. Bercovitch (*Chemist-Analyst*, 1936, **25**, (1), 4–5).—Drillings of the metal (200 grm.) are heated at 900° C. in a current of pure dry H_2 for 8 hrs. whereby all the S is evolved as H_2S, which is collected in Cd acetate solution, the CdS being subsequently determined iodometrically.—A. R. P.

A New Method for Determining Tin in White Metals. M. F. Skokou (*Konservnaya Promishlennost* (*Canning Industry*), **1935**, (12), 31–35; *C. Abs.*, 1936, **30**, 4783).—[In Russian.] The sample is treated with $0{\cdot}1N$ $FeCl_3$ for 20 minutes at 75° C. and the loss in weight assumed to be dissolved Sn.—S. G.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

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

(Continued from pp. 565–566.)

A Simple Apparatus for the Determination of the Thermal Conductivity of Metals. Helmut Krainer (*Z. tech. Physik*, 1936, **17**, (8), 281–282).—A cylindrical, guard-ring type of apparatus, designed for the measurement of the thermal conductivities of metals, in which heat is supplied electrically at the rate of 1200 w., and in which a temperature of 600° C. can be attained, is described. Temperature gradient in the metal is determined by observations with thermocouples. The heat flow in the metal is radial, and the metal is employed in the form of an annulus.—J. S. G. T.

Apparatus for Producing Uniform Scratches on Metal Surfaces. R. B. Mears and E. D. Ward (*J. Soc. Chem. Ind.*, 1934, **53**, Dec. 14th, 382–384).—Uniform scratches on metal or painted surfaces may be produced by attaching the specimen to a movable platform; a standard type of needle, carried on an arm weighted to any desired extent, produces the scratch when the platform is pushed forward. Diagrams show the design of the platform and arm.
—P. M. C. R.

***The Use of Bimetallic Strips for Purposes of Radiation Measurement and Photometry.** Hans Klumb (*Z. tech. Physik*, 1936, **17**, (8), 279–280).—The use of iron–nickel bimetallic strip of thickness 0·04–0·08 mm. for the measurement of radiation and for the determination of optical constants in the visible and ultra-red spectral regions is described. Two forms of apparatus are described.—J. S. G. T.

***A New Dilatometer for High Temperatures.** S. Pyk, B. Stålhane, and T. Westberg (*Jernkontorets Ann.*, **1935**, (10), 401–411).—Describes a simple and inexpensive dilatometer for use up to 1200° C., consisting essentially of a silica-tube furnace, with a silica rod passing through a special gland at the top to transmit the changes in length of the test sample to a micrometer dial. The steel top of the furnace and a steel cap on the end of the silica rod are water-cooled.—E. v. S.

Evidence for the Occurrence of Errors in Images Formed by Electron Lenses, in the Case of Image Formation of a Point (Object). K. Diels and M. Knoll (*Z. tech. Physik*, 1935, **16**, (12), 617–621).—Experimental evidence of the occurrence of the following types of error in image formation by an electron lens is presented: astigmatism, error due to aperture, and coma. The form of the errors corresponds very markedly with the corresponding errors in photo-optics.—J. S. G. T.

A High-Temperature Vacuum Debye–Scherrer X-Ray Camera. John E. Dorn and George Glockler (*Rev. Sci. Instruments*, 1936, [N.S.], **7**, (10), 389–390).—S. G.

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

(Continued from pp. 567–570.)

Report of [A.S.T.M.] Committee E-1 on Testing. W. H. Fulweiler and P. J. Smith (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 513–526).—Makes recommendations for the adoption as standard of certain tentative methods and definitions.—S. G.

Proposed Recommended Practices for Designation of Numerical Requirements in Standards. —— (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 527–536).—Appendix to Report of Committee E-1 on Testing.—S. G.

The Cooperation of Technical Physics with Investigations of the Strengths of Materials, with a View to the Development of New Theories of Machine Construction. A. Thum (*Z. tech. Physik*, 1935, **16**, (12), 554–561).—T. considers that present-day methods of testing constructional materials, based on the classical theory of elasticity, are too idealistic in character. More especially, the classical theory considers that materials possess a homogeneity of structure and properties which is missing from actual constructional materials. Constructional materials quite commonly have their strength reduced by the presence of notches and by being subjected to periodic stresses. It is suggested that the field of lines of stress in materials can be plotted in a manner analogous to that used in representing lines of fluid flow, and examples of such a procedure are given. Lines of flow are revealed by sections of fractured material.—J. S. G. T.

Non-Destructive Materials Testing as Seen in Patent Specifications and Foreign Patents. Ernst Franke (*Warme*, 1936, **59**, 197–203; *Sci. Abs.*, 1936, [B], **39**, 283).—An account is given of the various methods in use for the non-destructive testing of materials. The methods described are taken from patent literature of Germany and other countries, and include X-ray, thermal, mechanical, magnetic, and electrical methods.—S. G.

***Tests of Engineering Structures and Their Models.** R. L. Templin (*Proc. Amer. Soc. Civil Eng.*, 1936, **62**, (8), 1155–1169).—The information which is obtainable from tests on actual structures and on small and over-sized models is discussed. Test methods are described, consideration being given to similarity conditions, model materials, and testing technique and apparatus. Reference is made to specific examples of full-scale and model tests, and details are given of tests on an oversize-model of a filleted, re-entrant, 90° corner specimen of "17 S–T" aluminium alloy plate, $1\frac{1}{16}$ in. thick, made to determine the magnitude and distribution of the stresses under loads insufficient to produce permanent distortion. By using angles of different proportions, a stress concentration factor was then determined.—J. C. C.

Inspection and Quality Control. M. C. Park (*Proc. Inst. Automobile Eng.*, 1936, **30**, 247–276; discussion, 277–295).—S. G.

†Modern Stress Theories. A. V. Karpov (*Proc. Amer. Soc. Civil Eng.*, 1936, **62**, (8), 1128–1153).—In designing structures, it is becoming necessary to secure closer agreement between evaluated and actual conditions. It thus becomes necessary to consider such factors as stress concentrations, fatigue, and creep phenomena. The properties of metals and alloys which are of importance in structural design are reviewed, comparative stress–strain and complete fatigue diagrams being reproduced for numerous ferrous and non-ferrous materials. —J. C. C.

Photo-Elastic Determination of Stress. J. H. A. Brahtz (*Proc. Amer. Soc. Civil Eng.*, 1936, **62**, (8), 1171–1182).—Methods of photo-elastic analysis are outlined, and its applications in structural design briefly discussed.—J. C. C.

Determination of the Coefficient of Linear Expansion by Means of the Chevenard Dilatometer. L. Glikman and P. Tschistovitsch (*Zavodskaya Laboratoria* (*Works' Lab.*), 1934, **3**, 998–1003).—[In Russian.]—S. G.

Wear Tests Relating to Hard Metals, Cast Iron, and Light Metals Carried Out With O. Nieberding's Wear-Test Machine. Reinhard Zimmer (*Forschungsarbeiten über Metallkunde u. Röntgenmetallographie*, 1935, (18), 68 pp.).—The development of a wear-test for metals is discussed, the difficulties in the way of designing such a test being pointed out. A number of wear-testing machines are referred to, and that designed by O. Nieberding is described in some detail. For this test, the test-piece is taken in the form of a cylinder with one end ground and polished to the form of a spherical cap of radius 25 mm. The wear of this cap by pure sliding-friction over a plane test-plate is ascertained. Tests by the Nieberding machine show that amongst the various hard "metals" tested, including Titanit, Widia, and Bohlerit, the carbides are extraordinarily resistant to wear as compared with all other materials. Tests of various cast irons indicate that their resistance to wear is increased by the addition of up to 0·5% of chromium or up to 1·3% of nickel. Amongst light metals, in general, the self-improving aluminium alloys (Quarzal and Zirkonal) are most resistant to wear; then follow the aluminium alloys of high silicon content, and last of all the older type of aluminium alloys. Results obtained with some cast aluminium alloys indicate that resistance to wear, like hardness, tends to increase with ageing to the max. value attained after 22 days. There is apparently no correlation between hardness and resistance to wear.—J. S. G. T.

***Investigation of the Abrasion of Metals.—I–II.** S. Saito and N. Yamamoto (*Sumitomo Kinzoku Kōgyō Kenkyu Hōkoku* (*Res. Rep. Sumitomo Metal Industries, Ltd.*), 1936, **2**, (6), 395–404; 405–421).—[In Japanese.] Deal with the abrasion of ferrous materials.—S. G.

A Direct Load Creep Test Machine. J. J. Curran and F. H. Morehead (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (II), 161–169).—With highly sensitive temperature control and strain measurement, the authors consider 2000 hrs. to be the minimum testing period, exclusive of 100 hrs. required by a steel specimen to attain thermal equilibrium. Improved apparatus does not require a constant-temperature room. The test and calibration specimens used conform to those described by Gillet and Cross. Heating is done in a forced convection furnace, which is compared with, and adjudged superior to, the conventional type. Temperature control is by means of a Chromel–Alumel couple and potentiometer; the effect of local temperature variations is eliminated by the use of Chromel–Alumel leads and switch-plugs. Each furnace is mounted in a separate steel frame, supported on independent concrete piers. The load is applied directly in 250 lb. units up to 30,000 lb. by a hydraulic jack. Elongation is read to 0·000022 in. per in. by a micrometer microscope. —E. J. G.

Regional Investigation of the Properties of Metals by the Micromachine of P. Chevenard. G. d'Ardigny (*Rev. Fonderie moderne*, 1936, **30**, 95–98).—Chevenard's micromachine for the determination of shear, tensile, or bend strength on specimens 1·0–1·5 mm. diameter is described (see *Met. Abs.*, 1935, **2**, 392). The instrument is suitable for tests on welds; it is motor-operated, uses a 3-point system of levers, and records photographically by a mirror system.—W. D. J.

The Examination of Metals in Thin Sheets by Cupping Tests. Henri Fournier (*Bull. Soc. d'Encour.*, 1936, **135**, (10/11), 585–592).—The results of a comparative study of the various forms of cupping test are summarized. It is concluded that the K.W.I. test of Siebel and Pomp is most sensitive for metals having very large elongations, whereas the Persoz or Erichsen tests are most valuable for metals having moderate values of elongation.—J. C. C.

Ductility Testing of Aluminium and Aluminium Alloy Sheet. R. L. Templin (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (II), 239–248; also *Met. Ind.* (*Lond.*), 1936, **49**, (5), 107–110; *Aluminium and Non-Ferrous Rev.*, 1936, **2**, (2), 58–62; and (summary) *Sheet Metal Ind.*, 1936, **10**, (112), 595–597).—See *Met. Abs.*, this vol., p. 315.—S. G.

Second Report of the Welding Research Committee [of the Institution of Mechanical Engineers] [Appendix V.—Machine for Repeated Stress Tests of Welds at Various Temperatures]. (*Proc. Inst. Mech. Eng.*, 1936, **133**, 5–98; discussion, 99–126).—The Report refers entirely to metallic arc welding of steel. Of interest to the non-ferrous welder are the conclusions regarding the effect of cavities and inclusions on fatigue strength, and Appendix V (p. 77), which describes a machine for repeated stress tests of flat specimens, under constant bending moment, at various temperatures.—H. W. G. H.

***Investigations of the Micro-Deformations under Dynamic Bending Stresses at High Temperatures.—II.** G. Welter and J. Kucharski (*Wiadomości Instytutu Metalurgji i Metaloznawstwa* (*Warszawa*), 1936, 3, (3), 137–141).—[In Polish, with German summary.] The first permanent deformation in Duralumin in the pendulum test is obtained with a blow of 2 cm.-kg./cm.^{2} at 20° C. and 1 cm.-kg./cm.^{2} at 300° C.; the corresponding values to produce a permanent bend of 1 minute are 3·1 and 2·0 cm.-kg./cm.^{2}, and a bend of 15 minutes 13·5 and 6·2 cm.-kg./cm.^{2}. The ratio of the blows required to produce the first permanent deformation for chromium–nickel steel, mild steel, and Duralumin is 8 : 2·5 : 1·2 at 20° C. and 8 : 0·8 : 0·5 at 300° C. The ratio of the Charpy impact values for the three metals is 1·36 : 1·1 : 1 showing that there is little difference between their behaviour in this test, which is therefore not such a good indication of the value of a material from the constructional point of view as the test involving the measurement of the work required to produce the first micro-deformation.—A. R. P.

***Endurance Tests by Bending, Tension, and Compression.—I.** G. Welter (*Wiadomości Instytutu Metalurgji i Metaloznawstwa* (*Warszawa*), 1936, 3, (3), 149–156).—[In Polish, with German summary.] Tests on various aluminium alloys, cast iron, and copper have shown that the results of endurance tests are modified to a considerable extent by the nature of the surface of the specimen, by the crystal structure in the surface layers, by the presence of internal stresses produced by working or heat-treatment, by the stresses produced in the outer layers during working and by surface oxidation during the test.—A. R. P.

***Hysterograph and the Torsion Endurance Limit.** Mititosi Itihara and Takasi Sugawara (*Trans. Soc. Mech. Eng. Japan*, 1936, 2, (8), 336–339).—[In Japanese, with English abstract in suppt., pp. 91–93.] A description of the hysterograph, an apparatus designed for the rapid determination of the torsion endurance limit of a test-piece, and the relation between the amount of energy loss of the hysteresis loop and the total number of repetitions. The test-piece is fixed between a torsional spring and a horizontal shaft, and the hysteresis loop is described on a glass plate by means of a point of light focussed through a lens and reflecting twice from two metallic plane mirrors fixed on either end of the test-piece and inclined 45° to the axis of the test-piece. A torsional strain of the test-piece of 1° is represented by 11·55 mm. length, and the stress scale corresponds to 1 kg./mm.^{2} = 0·77 mm.—J. W. D.

Radiotechnic Method for Studying the Fatigue of Metals. S. I. Schaposchnikov (*Zavodskaya Laboratoria* (*Works' Lab.*), 1934, 3, 927–935).—[In Russian.] Describes apparatus.—S. G.

On the Development of Fatigue Tests on Aluminium and Its Light Alloys. A. von Zeerleder (*Alluminio*, 1935, 4, (2), 95–105).—The various fatigue stresses to which materials may be subjected, and the machines used to study these stresses are discussed. Descriptions are given of the fatigue testing machines, as well as the dimensions of the test-pieces. Detailed information is given for carrying out, and of the methods used for interpreting the results of, the standard fatigue test—the repeated bending test. It is shown that fatigue tests are still far from the reach of every research worker, and that useful results can only be obtained by using very accurate and costly machines with the greatest care.—J. K.

***Flexure and Torsion Testing of Copper Wire.** S. E. Borgeson (*Proc. Amer. Soc. Test. Mat.*, 1936, 36, (II), 249–258; discussion, 259–262).—B. discusses the mechanical properties required by copper magnet wire and analyzes the various tests used to measure them. It is demonstrated that the torsion test permits the properties to be expressed in conventional units instead of arbitrary scale units. A simple type of direct-reading torsion tester is described, and a comparison is made of the results of tests by torsion and other methods.
—S. G.

The Testing of Rubber Insulated Lines and Cables. Dean Harvey (*Proc. Amer. Soc. Test. Mat.*, 1936, 36, (II), 671–683; discussion, 684–686).—See *Met. Abs.*, this vol., p. 373.—S. G.

***Measurement of Internal Shearing Stress in Cold-Twisted Metal Rods.** Tarô Uêda (*Trans. Soc. Mech. Eng. Japan*, 1936, 2, (8), 405–413).—[In Japanese, with English summary in suppt., pp. 110–112.] The surface layer of a cold-twisted bar is removed by acid solution in a specially constructed apparatus, instead of by machining. As a result, the equilibrium of internal stress is distributed, and to attain a new equilibrium state the bar twists itself, the angle being measured on a circular scale by means of a mirror on the test-piece, and a telescope, to an accuracy of 10^{-6} radians/cm. or 10^{-5} degree/cm. The distribution of internal shearing stress in the cross-section of cold-twisted Armco iron, 6 carbon steels, copper and magnesium bars is measured, and the relation between the twisting moment about the centre due to the internal shearing stress and the degree of cold-twisting determined. —J. W. D.

Dynamic Rupturing Tests on Aluminium and Copper. E. Honegger (*Eidgenössiche Materialprüf. E.T.H. Zürich, Ber.*, 1935, (95), 3–10).—[In German.] See *Met. Abs.*, 1935, 2, 715.—S. G.

***On the Question of the Upper and Lower Yield-Points and the Breaking Stress [of Metals].** G. Welter (*Wiadomości Instytutu Metalurgji i Metaloznawstwa* (*Warszawa*), 1936, 3, (1), 28–38).—[In Polish, with German summary.] With the usual type of tensile testing machine the load–elongation graph of some metals rises rapidly to a maximum, then falls slightly and finally rises in a smooth curve through a flat maximum to the breaking load, which is generally somewhat lower than the maximum stress. Experiments with several methods of applying the load have shown that the shape of these graphs is due to the indirect way in which the load is applied in the usual machines. By direct application of the load to the lower end of the specimen without the use of a lever and fulcrum the load–elongation graph shows a sharp inflexion at the yield-point, but there is no maximum or minimum, and there is no downward bend after the maximum stress. A somewhat similar type of graph is obtained by interposing a strong spring between the loading apparatus and the upper grips on the usual type of machine, or between the lower grips and the indicator mechanism. These results show that the concept of upper and lower yield-points is erroneous, and that the upper yield-point is not a property of the metal but a defect of the method of testing. The lower value is the true yield-point.—A. R. P.

***On Load–Elongation Diagrams and on the Rate of Deformation of Plastic Materials as a Function of the Type of Loading.** G. Welter and S. Gośkowski (*Wiadomości Instytutu Metalurgji i Metaloznawstwa* (*Warszawa*), 1936, 3, (2), 95–105).—[In Polish, with German summary.] Load–elongation diagrams obtained with three types of loading, rigid (usual type), elastic, and free (cf. preceding abstract), are shown for steel, Armco iron, annealed copper, annealed aluminium, lead, and Duralumin in various stages of age-hardening. The work required to fracture the specimen is somewhat greater with free loading than with rigid loading, and the rate of elongation above the yield-point increases rapidly with the load with elastic and free loading, whereas with rigid loading it remains approximately constant throughout the test. When Duralumin is tested just after quenching in the rigid type of machine the load–elongation diagram shows several points of inflexion where there is a momentary fall in the load attributed to twin formation, but in diagrams obtained with elastic or free loading these points appear as step-like discontinuities, showing that the metal exhibits flow phenomena followed by strengthening.—A. R. P.

Calculation of the Elongation at Fracture Determined in the Tensile Test to Other Test Lengths. Wilhelm Kuntze with Fritz Uebel and Fritz Gentner (*Arch. Eisenhüttenwesen*, 1936, **9**, 509–523; and *Mitt. Material.*, *Sonderheft* **28**, 1936, 79–93).—S. G.

Notched-Bar Testing. S. L. Hoyt (*Metals and Alloys*, 1936, **7**, (1), 5–7; (2), 39–43; (4), 102–106).—The present anomalies of notched-bar testing demand the development of improved testing methods and further study of the factors of impact brittleness. The work of Ludwik and Scheu on notch effects in test-bars of different design is summarized, and the influence of individual and combined variables is reviewed. The relation between the nature of the fracture and the energy absorbed was pointed out by Fettweiss, and the work of Kuntze related deformation and cleavage strength. Present methods of determining notch toughness are reviewed, and causes of some apparent anomalies are suggested.—P. M. C. R.

***Impact Bend Testing of Wire.** W. J. Farmer and D. A. S. Hale (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (II), 276–290; discussion, 291).—This paper comprises a discussion of a machine designed to make rapid determinations of the ability of wire to resist permanent deformation by bending. Two types of machine used in the industry for wire-bend testing are described, and their features are discussed with regard to their suitability for use as standard test methods. A bend tester operated by the impact of a pendulum has been developed by the Bell Telephone Laboratories in collaboration with Sub-Committee IV on Mechanical Tests of A.S.T.M. Committee B–4 on Electrical Heating, Electrical Resistance, and Electric Furnace Alloys. Results of typical tests with this machine are given, together with information gathered from ultra-rapid motion pictures taken of the machine in operation. It is concluded that the impact bending machine described offers a simple, rapid and accurate means of measuring the bending properties of wire, and that the information acquired from the test is directly applicable to design problems.
—S. G.

***Slow-Bend and Impact Tests of Notched-Bars at Low Temperatures.** H. F. Moore, H. B. Wishart, and S. W. Lyon (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (II), 110–115; discussion, 116–117).—See *Met. Abs.*, this vol., p. 268.
—S. G.

***High-Velocity Tension–Impact Tests.** H. C. Mann (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (II), 85–97; discussion, 98–109).—Data are presented to show definitely that high velocity tests are essential to reveal the true dynamic properties of materials. The results obtained further indicate that in the selection of materials for use under conditions involving dynamic loading 3 significant factors must be considered, viz. (1) the transition velocity within which normal material behaviour may be expected; (2) the ratio of total energy value to mass or volume of material involved; (3) the effect of surface irregularities such as tool marks, size and form of fillets, &c. The high-velocity tension–impact machine designed and built for this investigation is described, and an appendix gives the mathematical derivation of the equation used to calculate the energy required for rupture. Diagrams and photographs of typical fracture transitions are presented, showing the effect of velocity on both ferrous and non-ferrous materials (steels, rolled manganese–bronze, and rolled silicon–bronze).—S. G.

***Applications of the Wedge Extensometer.** Wilbur M. Wilson (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (II), 807–812; discussion, 813–814).—The wedge extensometer, as its name suggests, is an extensometer in which the properties of the wedge are used as a means of multiplying a very small change in distance between two points, thereby making possible a more accurate measurement of the change. The instrument when used by a skilled operator is both reliable and sensitive. It is limited in its field of application but, fortunately, can be used in situations to which other extensometers are not adaptable. W. describes several adaptations of the instrument as used by him and by assistants working under his direction.—S. G.

***Photoelectric Extensometer for Very Small Gauge-Lengths.** E. Lehr and H. Granacher (*Forsch. Ingenieurwesens*, 1936, **7**, 201).—Correction of the equation for *f* on p. 74 of the original paper (see *Met. Abs.*, this vol., p. 569).—S. G.

Hardness of Metals. Gastone Guzzoni (*Rivista d'Artigliera e Genio, Suppt. Tecnico*, **1935**, May, 141–160).—S. G.

***On the Relation of Various Types of Hardness Number.** Isamu Igarashi and Reijiro Taketomi (*Sumitomo Kinzoku Kōgyō Kenkyu Hōkoku* (*Res. Rep. Sumitomo Metal Industries, Ltd.*), 1936, **2**, (6), 558–584).—[In Japanese.] The relationships were determined by measurements of the hardness in various states of such alloys as Duralumin, nickel–bronze, dynamo bronze, and nickel–chromium–molybdenum steel. The results are given in the form of diagrams and tables.—S. G.

***Influence of the Thickness of the Specimen on Hardness Determinations.** G. Welter and A. Bukalski (*Wiadomości Instytutu Metalurgji i Metaloznawstwa* (*Warszawa*), 1936, **3**, (3), 142–148).—[In Polish, with German summary.] Vickers pyramid hardness tests on steel and Armco iron with a load of 5 kg. show that the minimum thickness of sheet for accurate hardness tests is 0·2 mm. for hard metals and 0·6 mm. for softer metals (V.P.H. 100–200). The values obtained vary somewhat with the nature of the surface, and with the presence or absence of a lubricant thereon.—A. R. P.

The Hardness of Metals at High Temperatures. A. M. Borzdika and N. M. Orlov (*Zavodskaya Laboratoria* (*Works' Lab.*), 1934, **3**, 1015–1023).—[In Russian.] Discusses methods of determination.—S. G.

***The Meaning and the Measurement of Hardness.** (Mahin.) See p. 641.

***A Hardness Tester for Microscopical Objects.** E. M. H. Lips and J. Sack (*Nature*, 1936, **138**, (3486), 328–329).—A description is given of a hardness tester of the Vickers diamond type, that can be applied exactly on the optic axis of a microscope. It is possible by this means to apply the test to any desired microscopic constituent of a specimen. Photographs are given to show the type of result obtained.—B. C.

New Hardness Testing Machines. Walter Hengemühle (*Stahl u. Eisen*, 1936, **56**, (37), 1017–1025).—A review of the improvements during the last decade in appliances for measuring hardness, with descriptions and illustrations of: Brinell machines for large pieces such as steel ingots and carriage tyres, for angular pieces up to 1000 mm. in depth; quick acting yet sensitive hand-worked machines; Rockwell machines for large pieces and also for thin plates for which the ordinary apparatus is not suitable; combination machines capable of giving Brinell, Rockwell, and Vickers numbers; the Monotron tester in which an arrangement is used to determine the hardness at a predetermined depth beneath the surface; various types of the Scleroscope machine, in the newest of which the hammer is held at the highest point it reaches; and the Sklerograph and Duroscope, which are modifications of the scleroscope principle. A discussion ensues on the relative accuracy of the hardness figures obtained with the better class machines.—W. A. C. N.

Hardness Testing. —— (*Metallurgist* (Suppt. to *Engineer*), 1936, **10**, 188–190).—A summary of papers by W. Hengemühle (preceding abstract); and by S. N. Petrenko, W. Ramberg, and B. Wilson (*Met. Abs.*, this vol., p. 411).—R. G.

Greater Rapidity with the Vickers Hardness Tester. —— (*Wild-Barfield Heat-Treat. J.*, 1936, **2**, (1), 6–7).—A sliding table attachment is used whereby, after the impression has been made, the object is moved to register exactly beneath the microscope.—W. A. C. N.

Diamond Hardness Testing. A. Meyer (*Tech. Zentr. prakt. Metallbearbeitung*, 1935, 45, (21/22), 636–637).—Short descriptions of one laboratory and two works' hardness testing machines. The necessary qualities in the diamonds used for indentation purposes are described, as is also the proper method of mounting.—W. A. C. N.

Tentative Method of Test for Flexivity of Thermoflex (Thermostatic Metals) (B 106–36T). —— (*Book of A.S.T.M. Tentative Standards*, 1936, 360–365; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 765–770).—This method is intended to cover the determination of the flexure–temperature characteristics of thermoflex (thermostatic metals) in the form of flat strips. The characteristics of thermoflex are determined as a whole when tested in the form of a flat strip. No account is taken of the characteristics of the individual components. The procedure involves changing the temperature of a strip of thermoflex and obtaining values indicating the response to temperature changes, or the flexivity, by calculation from the temperatures, dimensions of specimen, and relative movement of gauge-points on the specimen.—S. G.

A Photoelectric Apparatus for Delineating the Size Frequency Curve of Clays or Dusts. E. G. Richardson (*J. Sci. Instruments*, 1936, 13, (7), 229–233).—S. G.

Report of [A.S.T.M.] Committee A-6 on Magnetic Properties. Thomas Spooner and R. L. Sanford (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 114–118).—Recommends for adoption as standard the tentative definitions of terms, with units and symbols, relating to magnetic testing (see *Met. Abs.*, this vol., p. 50).—S. G.

***The Detection of Flaws in Ferromagnetic Materials by Means of the Filings [Feilspäne] Process.** Johannes Krause (*Forschungsarbeiten über Metallkunde u. Röntgenmetallographie*, 1934, (16), 54 pp.).—A suspension of very finely powdered iron in oil is spread over the polished surface of the material in a magnetic field. Flaws, superficial or deep-seated, in the material are revealed by non-uniformity of the superficial magnetic field, as revealed by the disposition of the iron particles along the lines of magnetic force. The method can be applied to either plane or rounded surfaces. 57 illustrations are given. —J. S. G. T.

RADIOLOGY.

†X-Ray Shadow Photographs of Metallic Plant and Their Densographic Valuation. Maximilian (Freiherr) von Schwarz (*Forschungsarbeiten über Metallkunde u. Röntgenmetallographie*, 1936, (8), 35 pp.).—X-ray photographs are given of metallic plant, principally of aluminium, aluminium alloys, and cast steel, taken in order to detect constructional flaws, and a method of evaluation of such photographs is described. Essentially, the method consists in illuminating successive parts of the X-ray photograph with light of a constant intensity. The transmitted light falls upon a light-sensitive cell, and the electric current generated is employed to deflect a galvanometer. The galvanometer deflection is recorded upon photographic paper, and a record of the transparency of the X-ray photograph in its various parts is thus obtained. The method has been applied to the determination of the thickness of concave and convex lenses, the contour and wall thickness of borings in aluminium, the porosity of castings, &c.—J. S. G. T.

Report on the Use of X-Rays in the Testing of Oxy-Acetylene Welds. L. C. Percival and C. Coulson-Smith (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, 2, 522–539; also (abridged) *Welding Ind.*, 1936, **4**, (5), 180–187; and *Mech. World*, 1936, **100**, (2588), 123–124, 126).—A frank account of the authors' first experience in the application of radiography to the testing of welds, which consisted of a thorough examination of

small test-welds, a complete welded container, and synthetic test-pieces. The test-welds and the container were sectioned and the results of micrographic and macrographic examination are compared exactly with the radiographs.
—H. W. G. H.

X-Ray Testing of Welds. R. Berthold (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc., 1936*, **2**, 543–551 (in German), 552–560 (in English)).—S. G.

On the Detection of Flaws and the Exposure Relation in Transmission X-Ray Photography. I.—The Detection of Flaws in Radiography of Iron. E. A. W. Müller and W. E. Schmid (*Z. tech. Physik*, 1936, **17**, (6), 190–197).—The estimation or detection of variations of faults in iron samples is described. The relation between exposure, thickness of iron, and density of image on the film is given, and quantitative results are obtained from these data.—B. C.

The Importance of X-Ray Examination of Macrostructures and Crystal Structure for the Foundryman. E. Schiebold (*Internat. Giessereikongress, Düsseldorf, 1936, Tech.-wiss. Vorträge*, **1936**, (31), 40 pp.).—[In German.] The nature of X-rays, methods of producing them, and their properties are explained at some length. Commercial outfits for engineering radiology and an elaborate mobile equipment are described. Applications of radiology to the examination of castings and control of foundry technique are discussed and illustrated by many radiographs and photomicrographs of typical defects. The use of gamma radiation and X-ray crystallography is discussed more briefly.—H. W. G. H.

X-Ray Technique in Metal Industry. F. Wever (*Tech. Zentr. prakt. Metallbearbeitung*, 1935, **45**, (17/18), 457–459).—X-ray examination of welding rods has shown that apparently similar materials have serious defects which would materially affect the work to which they were applied. Porosity and other bad features of the rods seem to be transmitted to the welds in such a manner that X-ray examination is the sole conclusive means for their detection. It is shown that the presence of these imperfections may be correlated with variations in mechanical properties.—W. A. C. N.

X-Rays in Industry. F. G. Brett (*Discovery*, 1935, **16**, (184), 109–111).—An illustrated review of industrial radiography, with special reference to the testing of castings and welds.—P. M. C. R.

XII.—TEMPERATURE MEASUREMENT AND CONTROL

(Continued from pp. 570–572.)

Developments in Temperature Measurement and Control. A. F. Brownlee (*Heat-Treat. and Forging*, 1936, **22**, (9), 465–469, 478).—A general survey of improvements in potentiometer-type pyrometers and systems of valve control. In modern furnaces, temperature oscillations have been reduced to as low as 2° F.—J. C. C.

Controlling the Rate of Heating. Adam M. Steever and L. A. Lindberg (*Indust. Heating*, 1936, **3**, (1), 51–54).—An automatically controlled system of heating, depending on the joint effect of a rotating cam and an attached carriage carrying a mercury switch. The latter is moved along the cam by a worm operated by the control pyrometer.—W. A. C. N.

An Adjustable Sensitive Thermoregulator. J. Y. Yee and R. O. E. Davis (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1936, **8**, (6), 477).—The regulator consists of a thin-walled (0·8 mm.) Pyrex tube with a number of thinner walled (0·2–0·3 mm.), inwardly-directed indentations regularly disposed in it—these account for the rapid response of the instrument. The tube is filled with mercury and has at the top a special adjusting mechanism sealed in, for details of which and a diagram of the apparatus the original must be consulted.
—A. R. P.

Working Temperature of Bimetal Thermostat. M. Oyama and K. Honda (*Denki Gakkwai Zasshi* (*J. Inst. Elect. Eng. Japan*), 1936, 56, (5), 677–678).—[In Japanese.]—S. G.

Studies in Optical Pyrometry. F. A. Cunnold (*Abstracts Dissertations Dr.-Phil. Univ. Oxford*, 1936, 8, 80–82).—Discusses the calibration of disappearing-filament pyrometers.—C. E. R.

Temperature Measurements With the Disappearing-Filament Optical Pyrometer. W. E. Forsythe (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **120**, 171–188).—Different forms of optical pyrometers are discussed, and their disadvantages for measuring high temperatures pointed out. The choice of the disappearing filament type for most work is justified. Attention is directed to the use of a monochromatic screen, calibration methods are described, together with accuracy tests and various corrections which must be applied. Treatment of non-radiating bodies, like black bodies, is discussed.—E. J. G.

A Precision Optical Pyrometer. M. Milford, R. J. Bracey, F. A. Cunnold, and A. C. Egerton (*J. Sci. Instruments*, 1935, 12, (3), 80–84).—Describes a disappearing filament pyrometer of rigid construction for precision work, giving alternative overall magnifications of 20 and 5 and provided with special monochromatic filters in the red and green and absorption screens for the measurement of very high temperatures.—S. G.

***A Simple Portable Aradiant Convection Pyrometer.** Frank T. Barr and Richard F. Berger (*Indust. and Eng. Chem.* (*Analyt. Edn.*), 1936, 8, (5), 393–395).—The instrument is designed for measuring the temperature of hot gases flowing from a furnace. Two types are illustrated, and typical calibration curves given.—A. R. P.

Mathematical Theory of the Thermoelectric Couple. A. Tichonov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1935, [N.S.], 4, (4/5), 177–182).—[In French.]—S. G.

Some Metallurgical Applications of the C–SiC Thermocouple. G. R. Fitterer (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **120**, 189–202; discussion, 202–216).—See *Met. Abs.*, this vol., p. 316.—S. G.

Porcelain Sheaths for Thermocouples. V. Taranenko (*Zavodskaya Laboratoria* (*Works' Lab.*), 1934, 3, 1038).—[In Russian.] By heating with borax and silica, a plate of porcelain is fused to one end of a porcelain tube.—S. G.

Pyrometry in Industry. Charles E. Foster (*Wild-Barfield Heat-Treat. J.*, 1936, 1, (8), 106–108).—S. G.

Recent Revisions of High Temperatures. H. T. Wensel (*J. Amer. Ceram. Soc.*, 1936, 19, (3), 81–86).—W. points out that, to convert temperature values recorded in the literature to the present International Temperature Scale, a correction must be applied which is calculated from the constants that define the particular scale on which the recorded values are expressed. Applying the same corrections to all previous scales leads, in many cases, to values which depart from the present scale more than the values actually recorded. Examples are given showing the proper method of converting temperature values based on Wien's law to the International Scale.—C. E. R.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

(Continued from pp. 572–580.)

Removal of Gases from Molten Metal. K. V. Peredelskiy (*Liteinoe Delo* (*Foundry Practice*), 1936, (8/9), 13).—[In Russian.] Describes the technique of removing gases from molten metal by vacuum treatment for 2–3 minutes before pouring.—N. A.

***Capillarity as a Factor in Foundry Practice.** Albert M. Portevin and Paul G. Bastien (*Proc. Inst. Brit. Found.*, 1935–1936, 29, 88–116; discussion, 117–118; and *Aluminium and Non-Ferrous Rev.*, 1936, 1, (10), 462–470).—See *Met. Abs.*, this vol., p. 317.—S. G.

The Evolution of the Chill-Casting. G. Rivoire (*Rev. Fonderie moderne*, 1936, 30, 138–140).—Read at the Foundry Congress at Brussels. An account of the development of chill-castings with particular reference to aluminium alloys, brass, and aluminium bronze.—W. D. J.

***Shrinkage During the Solidification of Aluminium Alloys.** Vaughan H. Stott (*J. Inst. Metals*, 1936, **59**, 73–82).—If a molten pure metal or a eutectic alloy be solidified upwards in a bottle-shaped vessel with a long narrow neck, it is possible to obtain an ingot free from cavities and to measure the shrinkage during solidification by direct observation of the descent of the liquid in the neck of the vessel. Measurements made in this way for aluminium and its eutectic with silicon are in close agreement with those of Edwards (*Chem. and Met. Eng.*, 1921, **24**, 61; 1923, **28**, 165), who used a different method. Calculations based on the data of Edwards and others, show that the shrinkage of the commercial aluminium-rich alloys not containing silicon, is usually between 6·5 and 8%. The presence of silicon results in a marked lowering of the shrinkage. It is pointed out that although these results have a bearing on the formation of pipes in castings, it must not be supposed that the size of a pipe in given circumstances is proportional to the shrinkage of the metal during solidification. For a detailed discussion of this matter the reader is referred to a paper by Edwards and Gammon (*Chem. and Met. Eng.*, 1921, **24**, 338).—V. H. S.

†**New Scientific Data and Practical Results with Silumin.** E. Scheuer (*Tech. Zentr. prakt. Metallbearbeitung*, 1936, **46**, (11/12), 406–410, 477–480, 552–555).—The fluidity of aluminium–silicon alloys, as determined by the method of Portevin, Bastien, and Courty, increases continuously from the limit of solid solubility of silicon in the aluminium, and is related to the peculiar type of the primary silicon crystals which separate. Verö has shown that hot-shortness is to be expected if less than 12–13% of still-fluid material surrounds already solidified crystals. If the amount is greater than this, there is the possibility of a crack already formed being re-filled with melt and thus healed. Spherical or radially elongated inter-granular holes form, respectively, in the free melt when the solidification interval is small, or in a network of crystals already in being. The necessity for adequate opportunity for the removal of gases from castings is illustrated by diagrams and microsections. It is observed that it might be advantageous to develop other eutectic alloys for castings, but it is also noted that in those alloys which lie near to the pure metals there is the danger that by small additions such eutectics may form several phases with intrinsically lower melting points whereby the advantage may become illusory. The mechanism of refining of the structure of Silumin by means of sodium or certain of its salts is discussed. The properties and characteristics of Silumin γ are reviewed and portrayed in a series of curves.—W. A. C. N.

Aluminium Alloys and Their Castability. R. Irmann (*Tech. Zentr. prakt. Metallbearbeitung*, 1935, **45**, (19/20), 502–505).—A study of castability from the points of view of fluidity, piping during solidification, hot-shortness, and contraction; such factors as casting and mould temperatures, speed of cooling, and nature of mould are also considered. Among other conclusions it is noted that the fluidity of Anticorodal at 700°–750° C. increases rapidly if the mould temperature is maintained above 500° C., while a higher casting temperature results in an almost linear increase in the fluidity; the use of a flux increases fluidity; as the silicon content increases, the fluidity first decreases and then increases sharply; the gain in fluidity by increasing the casting temperature may result in severe and dangerous piping. Comparative results are given for the tensile strength and elongation of Silumin, Peraluman II, and Alufont II, cast under varying conditions of melt and mould temperatures.—W. A. C. N.

Fiftieth Anniversary Marks Progress in Casting Aluminium. H. J. Rowe (*Foundry*, 1936, **64**, (2), 22–24, 63–64, 66, 69).—A general account of aluminium alloy foundry practice. The selection of moulding sands, the placing and design of gates and risers, the use of chills, and the control of melting and pouring temperatures are among the points discussed.—J. C. C.

Recent Developments in the Manufacture of Light Metal Castings. W. Linicus (*Internat. Giessereikongress, Düsseldorf, 1936, Tech.-wiss. Vorträge,* **1936**, (21), 7 pp.; and (abstract) *Aluminium and Non-Ferrous Rev.*, 1937, **2**, (4), 152).—[In German.] See *Met. Abs.*, this vol., p. 573.—S. G.

Aluminium for Plymouth Pistons. E. S. Chapman (*Automotive Ind.*, 1936, **74**, (18), 639–640).—Summary of a paper read before the Society of Automotive Engineers. The alloy used for casting the elliptical piston skirts of Plymouth engines contains 6·25–7·75% copper, 5–6% magnesium, and smaller amounts of iron, magnesium, and zinc. The casting, machining, drilling, and anodizing of the pistons are described.—P. M. C. R.

Points of View in the Use of Scrap in the Aluminium Foundry. R. Irmann (*Internat. Giessereikongress, Düsseldorf, 1936, Tech.-wiss. Vorträge,* **1936**, (23), 6 pp.).—[In German.] See *Met. Abs.*, this vol., p. 574.—S. G.

Founding Aluminium Bronze Castings. M. T. Ganzauge (*Foundry*, 1936, **64**, (6), 24–25, 82, 84).—In making aluminium bronze castings, chills and large risers must be provided to control solidification and allow for the large shrinkage of the alloy; and pouring must be steady and regular, horn gates being advisable, to prevent inclusions of the oxide film. Large moulds may be filled with carbon dioxide before pouring. Founding methods for producing solid balls, valve seats, and a large cylinder casting are described in detail.
—J. C. C.

The Properties, Use, and Manufacture of Lead–Bronze. F. Höhne (*Internat. Giessereikongress, Düsseldorf, 1936, Tech.-wiss. Vorträge,* **1936**, (20), 4 pp.).—[In German.] The miscibility gap in the lead–copper alloys causes segregation difficulties in casting. These may be reduced by superheating and by alloying with elements which reduce the gap, *e.g.* nickel and sulphur. The principal application of lead–bronzes is bearings, but they are also used for pressure castings and for resisting the corrosive action of sulphuric and sulphurous acids. For good wear-resistance, the lead content should be high (up to 25%) and the tin content low (less than 5%), but where good mechanical properties are required in addition to wear-resistance, a lead content of 12–15% with 8–10% tin is recommended. Wear-resistance of sand-castings is usually higher than that of chill-castings.—H. W. G. H.

Recommendations for Two Leaded Gun-Metals. Non-Ferrous Sub-Committee of the Technical Committee (*Proc. Inst. Brit. Found.*, 1935–1936, **29**, 349–359; and *Aluminium and Non-Ferrous Rev.*, 1936, **1**, (9), 423–426).—See *Met. Abs.*, this vol., p. 318.—S. G.

The Casting Alloys Elektron and Hydronalium. P. Spitaler (*Internat. Giessereikongress, Düsseldorf, 1936, Tech.-wiss. Vorträge,* **1936**, (24), 6 pp.).—[In German.] Typical magnesium casting alloys and their properties are tabulated. The special methods necessary for melting and casting are described, *viz.* the use of a special flux ("Elrasal") and the addition of sulphur and boric acid to the moulding sand. The effect of constitution on shrinkage phenomena, the advantages of side-pouring, and the detrimental effects of abrupt changes of section are discussed. The aluminium-base alloys of the Hydronalium type contain sufficient magnesium to necessitate foundry practice very similar to that required for Elektron. The characteristics of each group of alloys and some typical applications are described.—H. H.

Magnesium and the Ultra-Light Alloys. Paul Bastien (*Technique moderne*, 1936, **28**, (2), 39–41).—The characteristics of suitable fluxes for use in the melting of magnesium and its alloys are discussed, and brief accounts are given of the removal of impurities from the melt, and of the production of sand-, chill-, and die-castings.—P. M. C. R.

Manufacture of Nichrome. R. V. Popov (*Vestnik Metallopromishlennosti* (*Messenger Metal Ind.*), 1935, **15**, 87–103; *Chem. Zentr.*, 1935, **106**, (II), 3290; *C. Abs.*, 1936, **30**, 8129).—[In Russian.] A report on the manufacture of Nichrome in crucibles or in the electric furnace. The purity of the nickel and chromium to be used is of particular importance. The deoxidizing agents used, and heat-treatment and working of the Nichrome obtained are discussed.—S. G.

***The Deoxidation of Silver Alloys.** H. Roters (*Mitt. Forschungsinst. Edelmetalle*, 1936, **10**, (8/9), 89–96; 1937, **10**, (10/11), 101–108).—A lengthy summary of recent work of Raub, Klaiber, and Roters published in *Metallwirtschaft*, 1936, **15**, 765, 785 (*Met. Abs.*, this vol., p. 472).—A. R. P.

Eliminate Defects [in Castings] by Avoiding Common Pitfalls. N. K. B. Patch (*Foundry*, 1936, **64**, (9), 25, 73).—The ill effects of excess moisture in moulding sand, of loose or weak core prints, and improper pouring, are discussed. —J. C. C.

West Coast Shop Makes Castings in Wide Variety. Pat Dwyer (*Foundry*, 1936, **64**, (5), 42–44, 106, 109).—The equipment of the Enterprise Foundry Co., San Francisco, Cal., U.S.A., is described. Heavy non-ferrous castings, such as Admiralty bronze torpedo tube sleeves, are cast in the iron foundry, the alloy being melted in a cupola with a reduced charge and a low blast pressure. —J. C. C.

Melts Scrap Metal in Brass Foundry. —— (*Foundry*, 1936, **64**, (3), 26–27, 68).—An illustrated account of the equipment and operation of a typical American jobbing brass foundry.—J. C. C.

Cleaning Castings. P. W. Peel (*Engineer of India*, 1936, [N.S.], **4**, (2), 55–57).—The cleaning of castings in the rattling barrel and by means of sand-blasting is described, with a note on the protection of workers from dust.—P. M. C. R.

What Points Must Be Observed in the Construction of Moulding Boxes? Gustav Krebs (*Giesserei-Praxis*, 1936, **57**, (43/44), 476–478).—A continuation of the article (see *Met. Abs.*, this vol., p. 472). K. tabulates the standard dimensions of small and medium size moulding boxes, and discusses the strength and thickness of the walls, sand-retaining flanges and bars, the construction of moulds for large special castings and of screwed moulds, and the dressing of moulds.—J. H. W.

What Can Practice Expect from Moulding Machines? U. Lohse (*Internat. Giessereikongress, Düsseldorf, 1936, Tech.-wiss. Vorträge*, **1936**, (4), 11 pp.; also *Found. Trade J.*, 1936, **55**, (1058), 407–410; (1059), 433–435; and *Giesserei*, 1936, **23**, (19), 480–489).—[In German.] The importance of correct choice and treatment of sand for machine-moulding is emphasized, the superiority of the "aerator" over simple riddling being explained. The various types of machine available are then reviewed, *viz.* pin-lift with and without stripping-plate; plain squeeze with lowering of pattern; jolt-ram turnover, semi- and completely shockless jolt-ram; jolt-ram and squeeze; and sandslingers, mechanical and pneumatic. The principles and efficiency of the various ramming methods are briefly discussed with reference to the type of mould. A warning is given against the idea that any unskilled man can obtain 100% results from a moulding machine.—H. W. G. H.

***Action of Squeeze Type Moulding Machine.** Sigeyosi Tanaka (*Trans. Soc. Mech. Eng. Japan*, 1936, **2**, (7), 257–263).—[In Japanese, with English summary in suppt., pp. 73–74.] A cylindrical flask filled with moulding sand containing 10% moisture was squeezed in a squeeze type moulding machine by compressed air, the pressure of which at the air receiver was 4·22, 4·92, 5·62, 6·33, or 7·03 kg./cm.^{2}; and the initial upward velocity, time required to squeeze, sand thickness after squeezing, and the downward velocity were measured by kimographs of the ram motion. The maximum pressures and the work done increased directly in proportion to the air pressure. Sand was also squeezed in a flask without pattern, and the mould cut into halves and the mould hardness measured with a Dietert mould-hardness tester. The hardness increased with air pressure, the maximum hardness was at $\frac{2}{3}$ of the total height, and the softest part was at the circumference of the bottom.—J. W. D.

Oil[-Sand] Cores and Their Testing. H. Nipper (*Internat. Giessereikongress, Düsseldorf, 1936, Tech.-wiss. Vorträge*, **1936**, (29), 10 pp.; and *Found. Trade J.*, 1937, **56**, (1081), 368–370; (1082), 386–387).—[In German.] The influence of the various characteristics of sand and oil is described with reference to the properties of the oil-sand and the green core, the behaviour of the core during baking, and its properties in service. Details are given of a method of testing the binding strength of oils themselves: metal or quartz rings are stuck edge to edge by a film of oil, baked under standard conditions, and pulled apart. The test is said to be very sensitive and to enable the optimum drying conditions to be determined for different oils. Microscopic examination, compression, shearing, and permeability tests are discussed and a review is given of existing knowledge on gas evolution during baking and casting.
—H. W. G. H.

Foundry Parting Powder. Maurice Barrett (*Chem. and Ind.*, 1935, **54**, (41), 902).—The characteristics of a satisfactory "parting powder" are discussed; these depend on the presence of a water-repellent material and of fine sand. A method of incorporating aluminium stearate is described.—P. M. C. R.

Influence of the Amount of Compression of Moulding Sands on Their Foundry Properties. Fr. Píšek and B. Holman (*Internat. Giessereikongress, Düsseldorf, 1936, Tech.-wiss. Vorträge*, **1936**, (26), 13 pp.).—[In German.] Numerous tests are described from which the influence of compression on the permeability and bond strength of twelve moulding sands is shown. The importance of the degree of sensitivity, in these two properties, to variation in the amount of compression is emphasized and curves are given, relating "permeability-sensitivity" and "bond-strength-sensitivity" to more easily determined properties, such as the compressive strength.—H. W. G. H.

***Composition and Its Effect on the Properties of Mould and Core-Sand Mixtures at Elevated Temperatures.** F. Hudson (*Proc. Inst. Brit. Found.*, 1935–1936, **29**, 155–188; discussion, 188–201).—See *Met. Abs.*, this vol., p. 319.—S. G.

Soot in Moulding Sand. A. Rodehuser (*Gjuteriet* (*Foundry*), 1935, **25**, 99–103; *C. Abs.*, 1936, **30**, 2890).—[In Swedish.] Soot in moulding sand will prevent the sand from sticking to the metal. This sticking is caused by the oxides which are formed on the surface of the molten metal, and which react with the sand to form silicates. A given amount of soot will produce a reducing atmosphere in which the metal cannot oxidize.—S. G.

***Contribution to the Evaluation of the Bonding Agent in Moulding Sands.** Eugen Schneider and Max Paschke (*Internat. Giessereikongress, Düsseldorf, 1936, Tech.-wiss. Vorträge*, **1936**, (27), 8 pp.).—[In German.] The amount of "clay matter" determined by the flotation method is not a true criterion of the quality of the bond, which depends also on the grain-size and shape of the mineral constituents. By isolating the binders of three different grades of sand and using them to make synthetic sands with the same grade of quartzite, a measure of their true value as bonding agents was obtained. It was found that the binder with the highest content of colloidal clay gave the lowest bond strength results, and *vice versa*, and it is concluded that the structure of the clay matter and the colloidal substances present are important factors requiring investigation.—H. W. G. H.

***Test on the Improved Apparatus of M. Girardet for the Measurement of the Cohesion and the Work Done in Ramming.** J. Fox (*Bull. Assoc. Tech. Fonderie*, 1936, **10**, (4), 129–132).—Girardet's apparatus for the investigation of sand ramming has been modified to include a recording device, pressure being determined by means of a spring dynamometer and the load being applied by worm gearing. A method for the determination of mutual adherence of sand particles is described, curves are cited and some cases analyzed. —W. D. J.

Contribution to the Standardization of Sand Testing Methods. F. Boussard (*Internat. Giessereikongress, Düsseldorf, 1936, Tech.-wiss. Vorträge*, 1936, (28), 10 pp.).—[In French.] See *Met. Abs.*, this vol., p. 578.—S. G.

The Reconditioning of Used Foundry Sand. A. G. Larkin (*J. Record Trans. Junior Inst. Eng.*, 1936, 46, (11), 499–501).—S. G.

Reclamation, Conditioning, and Handling of Foundry Sands. Lester B. Knight, Jr. (*Iron Age*, 1936, 138, (23), 34–39, 119–120).—See *Met. Abs.*, this vol., p. 579—J. H. W.

Proposed Standard Methods for Testing and Delivery of Natural Moulding Sands, and for the Control of Synthetically Prepared Sands. J. Doskočil (*Stroj. Obzor*, 1935, 15, (4), 49–52; (6), 91–96).—A contribution to the standardization of moulding sands. Illustrations are also given of some testing devices developed by D.—O. Q.

Report of [A.S.T.M.] Committee B-6 on Die-Cast Metals and Alloys. J. R. Townsend and P. V. Faragher (*Proc. Amer. Soc. Test. Mat.*, 1936, 36, (I), 178–181).—Proposes the revision of the tentative specifications for aluminium-base alloy die-castings, involving the dropping of alloy No. VI, modification of the composition of alloy No. XII and changes in the tables of properties. The Committee reports the completion of the accelerated corrosion studies after 1 year's exposure to the salt-spray test of aluminium alloys Nos. IV, V and V*a*, and also physical test results. Consideration is being given to the conduct of tests to determine strength, hardness, and ageing properties of the lead- and tin-base alloy die-castings.—S. G.

The Surface Condition of Die-Castings. R. Schmitt (*Tech. Zentr. prakt. Metallbearbeitung*, 1935, 45, (15/16), 401–402).—The factors which are important in determining surface condition are the temperature of the metal and of the die, the casting pressure, and the nature of the alloy. Failure to control the evolution of gases from the melt results in surface blisters and other imperfections. Hard spots may be formed by exaggerated crystal growth of hard compounds. Discontinuities usually arise from an insufficiency in the metal stream, or the entrapping of air.—W. A. C. N.

Temperature Regulation in Die-Casting Operations. R. Schmitt (*Tech. Zentr. prakt. Metallbearbeitung*, 1935, 45, (21/22), 617–620).—It is now firmly established that a much stricter control of both melt and die temperatures is necessary so that properties superior to those of ordinary castings may be obtained. Emphasis is laid on the necessity of purity in raw materials, and the selection of the type of machine most appropriate to the work in hand. An automatic temperature regulator is drawn and described.—W. A. C. N.

On the Porosity of Die-Cast Sections. F. B. Lorand (*Liteinoe Delo* (*Foundry Practice*), 1936, (8/9), 14–16).—[In Russian.] The inevitable occurrence of pores and cavities in die-castings with the present level of technique is admitted, but in the great majority of cases porosity has no adverse effect on their performance in service.—N. A.

On the Question of the Porosity of Die-Cast Sections from Aluminium Alloys. B. A. Jungmeister (*Liteinoe Delo* (*Foundry Practice*), 1936, (8/9), 17).—[In Russian.] The use of piston machines with cold chamber in casting aluminium and magnesium alloys ensures the optimum results.—N. A.

Is Porosity Inevitable in Die-Cast Sections? E. E. Erenburg (*Liteinoe Delo* (*Foundry Practice*), 1936, (8/9), 18–21).—[In Russian.] A review.—N. A.

Normalization of Moulds for Die-Casting. V. M. Plazkiy (*Liteinoe Delo* (*Foundry Practice*), 1936, (8/9), 4–9).—[In Russian.] Four types of moulds are described: with ejection by cog transmission; with mechanized ejection; with removable inserts; with filling in the plane of the joint.—N. A.

Die-Casting. A. H. Mundey (*Proc. Inst. Brit. Found.*, 1935–1936, **29**, 452–470; discussion, 470–474).—See *Met. Abs.*, this vol., p. 52.—S. G.

Organization of the Foundry of the P.O.-Midi Railway at Saint-Pierre-des-Corps. L. Audo (*Bull. Assoc. Tech. Fonderie*, 1936, **10**, (7), 247–267; and (summary) *Usine*, 1936, **45**, (24), 25–27; also *Cuivre et Bronze*, 1936, **9**, (78), 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31–32).—A description of the lay-out of the foundry and the general internal organization, and of the costing and requisitioning operations. A detailed account is also given of time studies on typical operations as a basis for costing.—W. D. J.

Foundry Technology as an Introduction to the Education of Designers. A. Kessner (*Internat. Giessereikongress, Düsseldorf, 1936, Tech.-wiss. Vorträge*, **1936**, (3), 6 pp.).—[In German.] K. claims that the student should consider every line that he draws with vision of the subsequent patternmaking and founding problems, practical teaching of which should be an essential part of his training. Many examples are described and illustrated to show the effect of design on the structure of the metal in a casting, on internal stresses, and on moulding technique.—H. W. G. H.

Modern Statistical Foundry Management. Herbert Antoine (*Internat. Giessereikongress, Düsseldorf, 1936, Tech.-wiss. Vorträge*, **1936**, (30), 12 pp.)—[In German.] A description is given of the application of statistical methods to the control of personnel, wages, raw material, rejects, stock, and accounts. —H. W. G. H.

Apprenticeship. Franklin R. Hoadley (*Trans. Amer. Found. Assoc.*, 1936, **44**, 289–297). **Apprenticeship Plans for Detroit Industries.** H. W. Bolton (*ibid.*, 298–307). **Training Foundry Apprentices in Cleveland.** James G. Goldie (*ibid.*, 308–314). **Apprenticeship Training—Discussion** (*ibid.*, 315–323).—S. G.

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

(Continued from p. 580.)

The Preparation of Cast Blocks from Heavily Corroded Aluminium Scrap. Richard Thews (*Metall-Woche*, **1935**, (Dec. 7), 177–178; (Dec. 14), 197–198; **1936**, (Jan. 4), 1–2).—Corroded light-alloy scrap should preferably be cleaned and remelted before analysis. Methods of cleaning large and small scrap are suggested. Crucible melting is advisable, except for large scrap, but furnace design and melting procedure are discussed for direct-heating furnaces, as well as for crucible melting. Modified methods are indicated for high-silicon alloys. Porosity of the blocks may be avoided by suitable control of furnace atmosphere and temperature, and by the use of an appropriate flux, the composition of which is discussed. Approximate yields are indicated for common types of scrap.—P. M. C. R.

***Electrolytic Solder.** R. P. E. Hermsdorf and Max Heberlin (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **121**, 289–295; discussion, 295–298; and *Met. Ind.* (*Lond.*), 1936, **48**, (16), 469–471).—See *Met. Abs.*, this vol., p. 128.—S. G.

XV.—FURNACES AND FUELS

(Continued from pp. 580–582.)

Recuperation as Applied to Industrial Furnaces. Benjamin Sampson (*Indust. Heating*, 1936, **3**, (2), 102–104, 120).—Special heat-resisting alloys are needed for the recuperators; this results in greater efficiency of combustion, necessitating only a small percentage of excess air, better control of furnace temperatures and more uniform products.—W. A. C. N.

New Laboratory Research Probes Reducing Furnace Atmospheres. E. O. Mattocks (*Indust. Heating*, 1936, 3, (5), 315–316).—The broad outlines of a current research which involves micro-analyses of combustion products and an investigation of the relationship between the excess oxygen in flue gases required for complete combustion and flue gas temperature. The so-called spectral-line reversal method is employed for high temperature measurement of the flue gases.—W. A. C. N.

Measurement of Oil Flow to Furnaces. J. R. Ratcliff (*Wild-Barfield Heat-Treat. J.*, 1936, 2, (10), 23–26).—Choice of meter is determined by the conditions of firing. A flow indicator should be mounted as close as possible to the pipe-line to obviate solidification. Packed positive, rotating semi-positive, and mutating disc meters are described and illustrated.—W. A. C. N.

Trend of Industrial Gas Development in Coventry. W. Hind (*Gas World: Indust. Gas Suppt.*, 1936, 8, (8), 8–10).—H. discusses, *inter alia*, gas-heated furnaces for heat-treatment of aluminium alloys.—A. R. Pe.

The Application of Gas to Bright-Annealing. Ralph Halkett (*Gas J.*, 1936, 213, (3796), 483–484).—An account is given of the applications of town gas to the bright-annealing of sterling silver, pure copper, and nickel–brass.
—P. M. C. R.

Gas-Heated Tempering Furnaces. A. J. G. Smith (*Gas J.*, 1936, 215, 660).—Forced circulation by fan of the atmosphere of a furnace for temperatures up to 650° C. accelerates heat transmission and gives good constancy and uniformity of temperature.—A. R. Pe.

Liquefied Petroleum Gases Finding New Uses in Metal Treating Plants. Martin J. Conway (*Steel*, 1936, 98, (24), 34–36).—Abstract *in extenso* of a paper presented before the (U.S.) National Association of Power Engineers. The history of the U.S. natural-gas industry is summarized. The industrial use of natural-gas has increased, owing to improvements in distribution methods. Summarized specifications for "industrial" propane and for "commercial" propane and butane are quoted. Their uses include the enrichment of water gas and the cutting of metals where very high temperatures are unnecessary. The physical constants and combustion data of ethane, propane, and normal and *iso*butane are tabulated.—P. M. C. R.

The Welsh Tinplate Industry. W. Clark Jackson (*Gas J.*, 1936, 216, 141–143; and *Gas World: Indust. Gas Suppt.*, 1936, 8, (10), 20–22).—The development of the application of gaseous fuel in manufacture of tinplate and terneplate is outlined.—A. R. Pe.

Gas for Steam Raising, Snuff Making, Mould Drying, Cupola Lighting, Metal Melting, Immersion Heating, and Varnish Making. F. Bell (*Gas World: Indust. Gas Suppt.*, 1936, 8, (12), 12–16).—A description is given of an externally heated electrotype-metal melting pot and of immersion heaters for melting lead.—A. R. Pe.

Forced-Air Circulation. J. M. Oram (*Engineer of India*, 1935, [N.S.], 2, (10), 299–301, 321).—An account of the development and advantages of forced-air circulation furnaces and their controls and recording equipment.
—P. M. C. R.

A Graphical Method of Calculating Heat Loss Through Furnace Walls. Clarence E. Weinland (*J. Amer. Ceram. Soc.*, 1936, 19, (3), 74–80).—Covers the same ground as a paper previously published in *Trans. Amer. Soc. Metals*, 1935, 23, 434; see *Met. Abs.*, 1935, 2, 720.—C. E. R.

Wall Losses in Heating and Annealing Furnaces. Günther Barth (*Stahl u. Eisen*, 1936, 56, (38), 1151–1152).—These losses may be determined by direct measurement and calculation or from tables compiled by the "Wärmestelle Düsseldorf" for a great variety of furnaces. They depend on the construction, size, and interior temperature of the furnace, and increase in direct ratio with hearth area. Those of smaller furnaces are greater in proportion to their hearth area.—W. A. C. N.

Graphical Methods for the Calculation of Furnace Walls. W. Fischer (*Elektrowärme*, 1934, 4, (2), 32–38; *Ceram. Abs.*, 1934, 13, 122).—Formulæ for calculating furnaces with plane walls and tubular furnaces of large sizes for which the heat losses should not exceed a given maximum are developed with and without taking into account the temperature coeff. of the material.—S. G.

Mounting of Furnace on Vibration Absorption Material Prolongs Refractory Life. R. G. Hess (*Indust. Heating*, 1936, 3, (6), 373–374).—H. advocates mounting the furnace base or legs on material with good damping characteristics.—W. A. C. N.

Using Refractory Concrete in Annealing Furnaces. —— (*Steel*, 1936, **99**, (5), 34–37).—The proportioning, mixing, pouring, and curing of concrete containing a high proportion of aluminous cement are described. Examples of furnace parts are illustrated, and the extended use of the material in annealing furnaces is recommended.—P. M. C. R.

Modern Industrial Ovens Designed to Suit Individual Requirements. Ralph Byron (*Steel*, 1936, **99**, (5), 50, 52, 55, 56).—The use of "insulated panels," consisting of two sheets of metal enclosing refractory material, permits a wide range of design and material for low-temperature industrial ovens.
—P. M. C. R.

The Rotary Furnace in Foundry Practice. R. Boutigny (*Met. Ind.* (*Lond.*), 1935, **47**, (18), 445–448).—Read before the International Foundry Congress, Brussels. The design, working conditions, type of fuel, temperature range, and in some cases the heat losses and fuel consumption of rotary furnaces are considered in connection with the melting of bronzes, nickel, and cupro-nickel, the remelting of bronze, brass, or aluminium turnings, the refining of copper, and the reduction of lead, antimony, and bismuth oxides.—P. M. C. R.

An Introduction to the Theory of Eddy Current Heating. James Greig (*World Power*, 1936, **25**, (149), 246–251; (150), 315–316).—The relation between the wattage per unit area and per unit volume and the field strength and radius of charge in eddy current heating is elucidated by a theoretical analysis of the properties of a long single-layer solenoid with a long coaxial solid cylindrical charge.—P. M. C. R.

Experiences with High-Frequency Electric Furnaces. N. Broglio (*Internat. Giessereikongress, Düsseldorf, 1936, Tech.-wiss. Vorträge*, 1936, (17), 10 pp.).—[In German.] The characteristics of arc, resistance, combined arc and resistance, and induction furnaces are compared. The high-frequency furnace is then discussed from the point of view of its possibilities in the foundry. The electrical equipment and power factor correction, the construction of the furnace and crucible, and costs of operation are dealt with, recent German practice being described.—H. W. G. H.

The Application of Electric Heating Units to Soft Metal Melting. R. M. Cherry (*Gen. Elect. Rev.*, 1936, **39**, (7), 344–347).—A short article on the application of the plain sheath or cast in the Calrod type of immersion heater for the melting of soft metals such as lead, tin, type metal, &c. The construction of the heating units, methods of installation, and estimated energy consumption for typical applications are dealt with.—S. V. W.

Electric Furnaces with Metallic Resistances and Their Applications. M. Fourment (*Rev. Nickel*, 1936, 7, (3), 87–93).—A brief theoretical discussion is given of the use of electricity as a heating medium. The characteristics of the alloys normally used as resistors—nickel 80 and chromium 20%, and nickel 65, chromium 15, and iron 20%—are reviewed. Various types of furnaces—reheating, heat-treatment, salt-bath—are illustrated and described.—W. N.

Theoretical Basis of Electric Resistance Laboratory Furnaces. C. Rigollet (*J. Phys. Radium*, 1934, [vii], 5, 262–266).—The loss of heat from furnaces of the electric resistance type is studied, and Fourier's theory is applied to show the effect of heat losses on the thickness of furnace walls.—S. G.

Electric Melting of Aluminium. E. F. Russ (*Z. Metallkunde*, 1934, **26**, 285–287).—Induction furnaces for melting up to 200 kg. and a 250 kw. hearth furnace for melting up to 2500 kg. of aluminium are described.—S. G.

Induction Furnaces. P. Bunet (*Mém. Soc. Ing. civil France*, 1935, **87**, 902–924).—Describes the general principles.—S. G.

Application of Induction Heating in Automotive Production. E. L. Bailey (*S.A.E. Journal*, 1935, **37**, (5), 422–424; and *Automotive Eng.*, 1936, **26**, (342), 67–68).—S. G.

Frequency Changers for Induction Furnaces. Robert W. Wieseman (*Trans. Electrochem. Soc.*, 1936, **70**, 209–226; discussion, 226).—See *Met. Abs.*, this vol., p. 416.—S. G.

Electric Resistance Furnaces for the Heat-Treatment of Metals. R. Gröger (*Tech. Zentr. prakt. Metallbearbeitung*, 1935, **45**, (21/22), 550–556).—Descriptions of electrically heated ovens, principally to be used at high temperatures. Special features are: (1) in furnaces working at 1350° C. the heating elements consist of silicon carbide rods; adjustments are made for the variation of the resistance of the rods with temperature; (2) double-deck ovens are employed where the temperature has to be increased to 800°–900° C. slowly, and then quickly to 1350° C.; (3) arrangements are made for introducing special gaseous atmospheres.—W. A. C. N.

Batch-Type Electric Furnaces. G. J. Hales (*Indust. Heating*, 1936, **3**, (2), 97–100; (3), 166–168; (5), 243, 245–246).—A discussion of the inherent characteristics of such furnaces, including power rating, thermal load during charging and after the charge has attained the treatment temperature, and heat supply rate. The advantages of using good, fully refractory, lining bricks which will assist in maintaining the desired temperature, instead of permitting losses, are emphasized.—W. A. C. N.

Buys Electric Furnaces for Treating Airplane Parts. E. P. Dean (*Elect. World*, 1936, **106**, (39), 3015–3016).—The recently installed heat-treating plant of an aircraft factory is described, with approximate dimensions. The plant is used for both ferrous and non-ferrous parts.—P. M. C. R.

Electric Furnace Developments. H. A. Winne (*Heat-Treat. and Forging*, 1936, **22**, (1), 44–45).—American developments in annealing and copper brazing furnaces and arc and resistance welding equipment are briefly reviewed.
—J. C. C.

Industrial Electric Heating. E. M. Ackery (*Lincoln Eng. Soc. Ann. Rep. Proc.*, **1936**, 13–22).—The application of electric heating to industry in general is outlined and discussed.—I. J.

Bright-Annealing Processes. Louis Grangette (*Usine*, 1936, **45**, (3), 29–31).—Representative types of gas-heated furnaces for pot-annealing, of electrically heated bell furnaces, and of movable-base furnaces for box annealing are described, and shorter notes are appended on several forms of the " tunnel " furnace, with or without controlled atmosphere.—P. M. C. R.

Processes for the Bright-Annealing of Metals. P. Étienne (*Usine*, 1936, **45**, (21), 35).—E. comments on Grangette's advocacy of gas-heated furnaces for bright-annealing in reducing atmospheres (preceding abstract), and emphasizes the superior advantages of the electric furnace. G., in reply, criticizes É.'s conclusions regarding the maintenance of a reducing atmosphere, and refers to the high operating cost of electric furnaces.—P. M. C. R.

***Progress Report on Tests of Various Electric Heating Elements for Furnace Temperatures Between 1100° and 1500° C.—I.** M. G. Toole and R. E. Gould (*Trans. Electrochem. Soc.*, 1936, **70**, 89–109).—See *Met. Abs.*, this vol., p. 473.
—S. G.

Maximum Capacity of Heating Elements. K. Mertens (*Elektrowärme*, 1933, **3**, (12), 364–365; *Ceram. Abs.*, 1934, **13**, 127).—The calculation of dimensions of heating elements is explained. Charts are given for current, voltage, and diameter of elements as a function of the temperature, and calories required in the furnace.—S. G.

Furnace Charge Heat-Saturation Indicator. A. J. Bialous and J. T. M. Malpica (*Gen. Elect. Rev.*, 1936, **39**, (7), 348–350).—As an automatically-controlled furnace and its charge approach the desired temperature, the duration of successive " on " or " off " periods becomes more nearly constant. A device is described, and illustrated, which signals the establishment of this " heat-saturated " state by means of a rotary switch which automatically controls the movements of a reversible motor by means of moving contacts; the position of 2 discs driven by the motor actuates an alarm when 2 successive " off " periods are of equal duration.—P. M. C. R.

What the Electric Furnace Has Done for Civilization. P. H. Brace (*Trans. Electrochem. Soc.*, 1936, **70**, 33–47; discussion, 47–48; and (summary) *Heat-Treat. and Forging*, 1936, **22**, (10), 525–527).—See *Met. Abs.*, this vol., p. 473.—S. G.

†Colloidal Fuels. A. B. Manning and R. A. Acton Taylor (*Fuel Economist*, 1936, **11**, (126), 222–226).—Abstract of paper read before the Institution of Chemical Engineers, Feb., 1936. Factors involved in the preparation and use of coal-oil mixtures are discussed in considerable detail.—J. S. G. T.

***Variables in Coal Sampling.** J. B. Morrow and C. P. Proctor (*Trans. Amer. Inst. Min. Met. Eng.*, 1936, **119**, 227–269; discussion, 270–276).—S. G.

Tentative Specifications for Classification of Coals by Rank (D 388–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 520–526; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 812–818).—S. G.

XVI.—REFRACTORIES AND FURNACE MATERIALS

(Continued from pp. 582–583.)

Report of [A.S.T.M.] Committee C-8 on Refractories. R. A. Heindl, E. H. Van Schoick, and C. E. Bales (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 278–283).—Progress report.—S. G.

Tentative Definitions of Terms Relating to Refractories (C 71–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 459; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 787).—Defines the terms: insulating brick, insulating fire-brick, calcining, burning (firing), hard-burned refractory ware, light-burned refractory ware, and medium-burned refractory ware.—S. G.

Recent Developments in Refractories. Christopher E. Moore (*Proc. Staff. Iron Steel Inst.*, 1935–1936, **51**, 74–84; discussion, 84–90).—See *Met. Abs.*, this vol., p. 92.—S. G.

†Refractories in Metallurgical Industries. John D. Sullivan (*J. Amer. Ceram. Soc.*, 1936, **19**, (8), 213–233).—A general survey of refractory performance, requirements and life in the ferrous and non-ferrous industries. Furnace linings for copper, zinc, and lead, and the special requirements of arc and induction type furnaces are dealt with in detail. The effect of new refractory developments on the performance and life of furnaces is discussed. 33 *references* are given.—C. E. R.

Notes on Some Foundry Refractories. John D. Sullivan (*Trans. Amer. Found. Assoc.*, 1936, **44**, 254–280; discussion, 281–288).—See *Met. Abs.*, this vol., p. 582.—S. G.

***Acid Lining for Melting Non-Ferrous Metals in High-Frequency Furnaces.** J. A. Klyutscharev and S. A. Löwenstein (*Feuerfest*, 1933, **9**, (12), 157–159; *Ceram. Abs.*, 1934, **13**, 181).—Experiments on the manufacture of crucibles for melting non-ferrous metals are described. It was found that (1) Luga sand is a suitable material for the manufacture of acid lining; (2) the addition of coarse-grained ground quartz is necessary to increase the thermal resistance of the mix and its density when ramming; this factor is without effect on chemical resistance; (3) the addition of powdered glass is indispensable. The composition of the crucible mix is Chassov-Yar clay 12%, natural sand 30%, glass 15%, ground sand 33%, and ground quartz 10%. The results with crucibles of this composition were satisfactory.—S. G.

The Influence of Molten Aluminium on the Firebrick Lining of an Electric Furnace. A. N. Lysenko (*Legkie Metally* (*Light Metals*), 1935, 4, (5), 8–13; *C. Abs.*, 1936, **30**, 683).—[In Russian.] In remelting aluminium in an electric-resistance furnace with a firebrick lining, the aluminium penetrated into the porous brick, reduced the SiO_2 and Fe_2O_3, and made the brick a conductor of electricity. The slagging of the walls progressed upward from the level of the metal to the top of the furnace, where it short-circuited the nickel-chromium resistor units.—S. G.

Barium Aluminium Silicates as Refractories and Their Use for Different Technical Purposes. Felix Singer (*Trans. Ceram. Soc.*, 1936, **35**, (9), 389–396; discussion, 396–400).—Describes the use of barium anorthite as a basic refractory, possessing excellent mechanical and corrosion-resisting properties. The distectic point of 1780° C. is higher than that of either of the corresponding calcium or strontium minerals. Difficulty is experienced in its manufacture owing to its critical composition, the most suitable composition being BaO 40·8; Al_2O_3 27·1, and SiO_2 32·1%. One of the more important of its uses is in the melting of aluminium and its alloys.—I. J.

Determination of Thermal Conductivity of Refractories. Report for American Society For Testing Materials. Subcommittee C-8. P. Nicholls (*Bull. Amer. Ceram. Soc.*, 1936, **15**, (2), 37–51).—An attempt by the A.S.T.M. Subcommittee to recommend a specification for the determination of the thermal conductivity of refractories. The report discusses the results obtained from six different laboratories, of the thermal conductivity of two refractory materials, determined by various methods, which are described. The results differ materially, and, after suggesting the possible sources of error in each method of measurement, N. outlines a method of complete investigation, that would be a standard of reference and in which all sources of error could be determined and their limits reduced. Previous work has been seriously affected by lack of thoroughness because of lack of continuity in the investigations.—I. J.

*__Bonding Strength of Cold Setting Refractory Cements.__ R. A. Heindl and W. L. Pendergast (*Bull. Amer. Ceram. Soc.*, 1936, **15**, (5), 182–185).—The rate of absorption and transverse strength of five brands of fireclay and the water content, particle size, &c., of four cold-setting fireclay cements were studied. The unfired bonding strength of each combination of brick and cement was measured. The results indicate that the rate of absorption and transverse strength of a brick greatly influence the bonding strength of the cement.—I. J.

On the Modulus of Elasticity of Magnetite Refractories. I.—The Importance of the Modulus of Elasticity of Refractories and an Apparatus for Its Measurement. Seiji Konno and Hiroshi Yoshida (*Dainippon Yogyo Kyokwai Zasshi* (*J. Jap. Ceram. Soc.*), 1936, **44**, (525), 611–616).—[In Japanese.]—S. G.

Testing of Refractories Under Load. T. M. Firkin (*Commonwealth Eng.*, 1936, **24**, (5), 163–168).—A description is given of the cone melting-point test for refractories. The American, British, and German methods of testing under load are discussed, and the variation in the results obtained by the two latter methods is illustrated by comparative curves; other graphs compare the behaviour of different refractories under load. Characteristic types of failure are briefly described.—P. M. C. R.

Refractory Materials. J. H. Partridge (*J. Record Trans. Junior Inst. Eng.*, 1936, **46**, (7), 307–326; and (abstract) *Mech. World*, 1936, **99**, 82).—Deals in detail with the manufacture and testing of refractories.—S. G.

Heat Insulators in Industrial Use. Albert Aubert (*Usine*, 1936, **45**, (2), 31, 34).—Properties desirable in heat-insulators are summarized, and notes are given on 10 common insulating materials. The thermal conductivity at two or more temperatures in the normal working range and the density in different stages of compression are given in most cases. Schmidt's testing apparatus is described and criticized.—P. M. C. R.

Tentative Method of Panel Test for Resistance to Thermal and Structural Spalling of Super Duty Fireclay Brick (C 122-36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 457–458; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 785–786).—S. G.

***The Use of Penetrating Radiations in the Measurement of the Porosity of Refractory Brick.** J. B. Austin (*J. Amer. Ceram. Soc.*, 1936, **19**, (2), 29–36).—The possibility of using the absorption of X-rays or γ-rays in a refractory brick as a measure of porosity has been tested experimentally for both kinds of radiation. It is found that the method is entirely practical in either case, and should yield results better than those obtained by the usual displacement method. Gamma rays from radium appear to have some advantages over X-rays.—C. E. R.

XVII.—HEAT-TREATMENT

(Continued from pp. 583–585.)

***Thermal Treatment of Aluminium Castings for Pistons in Aeroplane Motors.** W. O. Kroenig and A. S. Ball (*Trudi Vsesoyuznogo Nauchno-Issledovatelskogo Instituta Aviatsionnykh Materialov* (*Trans. Research Inst. Aircraft Materials*), 1935, (28), 60 pp.; *C. Abs.*, 1936, **30**, 8113).—[In Russian.] An investigation of the physicochemical properties of aluminium alloys showed that the best alloys for pistons were: (I) copper 4·0, magnesium 1·5, nickel 2·0; (II) copper 4, magnesium 1·5, nickel 1; (III) copper 10, iron 1·5, magnesium 0·3, silicon 0·4; (IV) copper 12, nickel 1%. Of these, I and II have nearly the same mechanical properties at high temperatures. Optimum conditions of heat-treatment of these alloys are: for I and II, heating at 515° ± 5° C. for 3 hrs., quenching in boiling water and annealing at 250° C. for 3 hrs.; for III, heating at 515° ± 5° C. for 3 hrs., quenching in boiling (or 70°–80° C.) water and annealing at 250° C. for 2 hrs.; for IV, heating in oil at 250° C. for 2 hrs. The use of boiling water in quenching prevents the formation of cracks in the metal. 25 *references* are given.—S. G.

***Formation of Blisters in the Heat-Treatment of Aluminium Alloys.** W. Gatzek (*Luftfahrtforschung*, 1934, **11**, (3), 65–73; *J. Roy. Aeronaut. Soc.*, 1936, **60**, 38).—Specifications of 12 alloys are given. Systematic tests were carried out in a vacuum and in various gases, with heat-treatment in a salt bath and in the electric furnace. It appears that the formation of blisters is not an inherent property of the alloys, although the tendency to blister formation increases with magnesium content. The source of the trouble is the release of free hydrogen, which can be removed by previous heating in a vacuum. For this reason the presence of water vapour is to be avoided during melting. If preliminary removal of hydrogen is not possible, the electric furnace is preferable to the salt bath. Photographs are given of 47 test-pieces, showing the microstructure and blistering effects.—S. G.

Heat-Treatment of Aluminium.—I–II. R. S. Archer (*Indust. Heating*, 1936, **3**, (1), 16–18; (2), 90–94).—S. G.

[Heat-Treatment of] Aluminium Alloy Castings [in Electric Furnace]. H. J. Maybrey (*Wild-Barfield Heat-Treat. J.*, 1936, **1**, (8), 103–105).—S. G.

The Heat-Treatment of Light Metal Alloys in Electric Furnaces. — Knoops (*Machinery (Lond.)*, 1936, **49**, (1255), 134–137).—Translated from *Elektrowärme*, 1936, **6**, (1), 24–27; see *Met. Abs.*, this vol., p. 376.—J. C. C.

Bright-Annealing of Non-Ferrous Metals. H. A. Fells (*Gas World : Indust. Gas Suppt.*, 1936, **8**, (11), 9–11).—Copper, standard silver, and alloys not containing zinc can be bright-annealed without a muffle if combustion is so controlled that the furnace atmosphere contains a very slight excess of fuel gas. Alloys containing zinc require the usual acid-pickling to remove " bloom " after such treatment.—A. R. Pe.

Bright-Annealing Copper. E. K. Hansen (*Elect. J.*, 1936, **33**, (9), 395–398). —Typical pusher, continuous, and bell-type electric furnaces, together with their associated equipment for annealing copper in controlled atmospheres are illustrated and briefly described. Attention is directed to the importance of removing all entrapped air from the charge before it enters the furnace. In continuous furnaces this may be done by providing flushing chambers at the entrance of the heating zone.—J. C. C.

Application of Heat to Processing of Copper Alloys. R. S. Pratt (*Indust. Heating*, 1936, **3**, (1), 20–25).—Much of this article is a restatement of principles, but stress is laid on the importance of the mass of metal being heated in any process, a factor which is still mostly judged solely by experience. It is also shown that very small intervals of time in a continuous furnace may have greater effects on the results than many long periods in batch furnaces dealing with similar classes of material. The heat balance is changed as the mass changes and the temperature difference between furnace and charge has to be adjusted. The effects of various rates of loading on the metal temperatures in a continuous furnace are shown diagrammatically.—W. A. C. N.

***Effect of Iron Impurities on the Annealing of High Brass.** W. A. Gibson and J. H. Doss (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (II), 201–206; also *Indust. Heating*, 1936, **3**, (7), 443–446; *Met. Ind.* (*Lond.*), 1936, **49**, (3), 60–61, 71; and *Sheet Metal Ind.*, 1936, **10**, (111), 515–516).—See *Met. Abs.*, this vol., p. 274.—S. G.

The Heat-Treatment of Gold and Silver Alloys. W. A. C. Newman (*Sci. and Tech. Factors of Production of Gold and Silverwork* (*Worshipful Company of Goldsmiths*), **1935–1936**, 28–43; and (summary) *Jeweller and Metalworker*, 1936, **62**, (1495), 160–161).—A lecture. Methods of annealing silver alloys in open furnaces, muffles, salt-baths, and closed furnaces with a non-oxidizing atmosphere are described, especial stress being laid on the advantages of bright-annealing. Other subjects briefly discussed are stress-relief anneals, precipitation-hardening of standard silver, " fire " in silver, its removal and prevention. —A. R. P.

***Stress-Relief Annealing High-Strength Monel Metal Plate.** Peter R. Kosting (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (II), 222–230; discussion, 231–238; and *Indust. Heating*, 1936, **3**, (7), 439–442, 454).—See *Met. Abs.*, this vol., p. 274.—S. G.

Strain-Annealing of Non-Ferrous Metals. H. M. St. John (*Indust. Heating*, 1936, **3**, (2), 81–82, 84, 86, 88; and (summary) *Sheet Metal Ind.*, 1936, **10**, (109), 387–388).—S. G.

The Effect of Annealing on the Length of Cold-Drawn Rods. —— (*Metallurgist* (Suppt. to *Engineer*), 1936, **10**, 167).—A summary and critical discussion of a paper by K. Saito, *Sci. Rep. Tôhoku Imp. Univ.*, 1936, [i], **25**, 128–140; see *Met. Abs.*, this vol., pp. 55, 322.—R. G.

XVIII.—WORKING

(Continued from pp. 585–592.)

Present-Day Problems of the Rolling Mill Industry. Albert Nöll (*J. Iron Steel Inst.*, 1936, **134**, 135–164; discussion, 165–171).—Covers the development of the small-section and rod rolling mill, strip rolling mills, rolling mills for wide strip, improvement of the working of old sheet-rolling mills, the production of very wide and heavy sheet, and tube production, all from the point of view of the ferrous industry.—S. G.

The Roll Problem in Backed-Up Mills for Cold Reduction. Geo. A. V. Russell and S. S. Smith (*J. Iron Steel Inst.*, 1936, **134**, 47–72; discussion, 73–101; also (summaries) *Met. Ind.* (*Lond.*), 1936, **49**, (14), 335–340; (15), 362–368, 373; *Engineering*, 1937, **143**, (3715), 362–363; *Kalt-Walz-Welt*, **1937**, (1), 1–3).—See *Met. Abs.*, this vol., p. 417.—S. G.

The Importance of Friction in the Rolling Process and Its Influence on the Evolution of Sheet- and Strip-Rolling Machines. Th. Dahl (*Brit. Aluminium Co. Intelligence Memo.*, **1936**, 21 pp. (mimeographed)).—Translated from *Kalt-Walz-Welt*, **1936**, (5), 33–38; (6), 41–46; see *Met. Abs.*, this vol., p. 585.
—S. G.

Cold-Rolling and Cold-Pressing. J. W. Berry (*Proc. Staff. Iron Steel Inst.*, 1935–1936, **51**, 22–41; discussion, 42–50; and (summary) *Iron Coal Trades Rev.*, 1935, **131**, 759, 760).—The paper is of almost entirely ferrous interest.
—S. G.

Open Discussion on the Hot-Rolling of Sheets. —— (*Proc. Staff. Iron Steel Inst.*, 1935–1936, **51**, 51–57).—S. G.

On the Permissible Load-Limit for Sheet and Strip Rolling Mills. S. D. Brilkin (*Metallurg* (*Metallurgist*), **1936**, (7), 27–34).—[In Russian.]—N. A.

Measurement of the Power Required for Rolling by the Carbon-Plate Pressure Gauge Box. Werner Lueg (*Stahl u. Eisen*, 1936, **56**, (27), 766–768).
—W. A. C. N.

Flying Shears have Many Applications in Modern Mills. H. H. Talbot (*Steel*, 1936, **98**, (26), 57–58, 60).—The characteristics and applications of drum-type flying shears in strip-rolling mills are described.—P. M. C. R.

Working the Metals [Gold and Silver]. Rolling Sheet and Forming Articles Therefrom. R. S. Hutton (*Sci. and Tech. Factors of Production of Gold and Silverwork* (*Worshipful Company of Goldsmiths*), **1935–1936**, 15–27).—A lecture. The principles of rolling sheet, drawing wire, spinning, pressing, stamping, and testing of metal are explained briefly with especial reference to standard silver and carat golds.—A. R. P.

The Metallurgy of the Alloys of Gold and Silver. Donald McDonald (*Sci. and Tech. Factors of Production of Gold and Silverwork* (*Worshipful Company of Goldsmiths*), **1935–1936**, 1–14).—A lecture. Modern practice in casting and rolling standard silver and carat gold alloys is described, and some account is given of bright-annealing as applied to standard silver.—A. R. P.

The Working and Uses of Plated Sheet. B. Trautmann (*Apparatebau*, 1936, **48**, (18), 200–201; (19), 207–210).—See *Met. Abs.*, 1936, 3, (12), 587.—P. R.

Non-Ferrous Metal Tubes. W. L. Govier (*J. B'ham. Met. Soc.*, 1936, **16**, (4), 140–159; discussion, 159–169).—See *Met. Abs.*, this vol., p. 588.—S. G.

Electrolytic Zinc Tubing for Water and Gas Piping. L. Descroix (*Génie civil*, 1934, **105**, (17), 380–382).—The details of the drawing process employed in manufacturing tubing from high-purity (remelted electrolytic) zinc are described and illustrated. The advantages of tubing of this type include high corrosion-resistance, and a low coeff. of friction with water, which results in rapid flow and increased output.—P. M. C. R.

Study of Metal-Forming Operations Involving No Loss of Material. Georg Schlesinger (*Usine*, 1936, **45**, (1), 27–31).—Theoretical analyses of the nature and magnitude of the stresses involved in shearing, pressing, punching, and stamping are related to the nature, size, and thickness of the material. Shear resistance and tensile strength are tabulated for 9 non-ferrous metals and alloys and some ferrous materials, and the influence of these data on the choice and advantageous working of machinery is discussed.—P. M. C. R.

***Study of the Forgeability of Various Light and Ultra-Light Alloys.** Albert Portevin and Paul G. Bastien (*J. Inst. Metals*, 1936, **59**, 83–107; discussion, 107–110).—The authors have endeavoured to determine, by means of laboratory tests, the optimum conditions for hot-working light and ultra-light alloys. With this in view they have compared the results obtained from static bending and compression tests and dynamic bending and tensile tests. They have indicated the important part played by the rate of deformation, and have shown that the bending test appears to be the most convenient, speedy, and sensitive. The tests have been carried out on aluminium; on copper–aluminium alloys containing 6 and 12% of copper; on aluminium–magnesium alloys containing 5, 10, and 15% of magnesium; on magnesium; on magnesium–copper alloys containing 5, 10, and 15% of copper; and on magnesium–aluminium alloys containing 3, 6, and 9% of aluminium. The methods of testing employed have made it possible to define the capacity for hot-work of these various alloys.—A. P.

On the Movement of the Metal in the Manufacture of Cold-Drawn Hollow Bodies from Flat Plates.—II., III. Heinr. Meyer auf der Heyde (*Kalt-Walz-Welt*, **1936**, (7), 49–54; (9), 65–68; (10), 73–76).—Mathematical. Expressions are derived and graphs constructed for calculating the thickness and diameter of plates of metal required for deep-drawing articles of various shapes.—A. R. P.

The Handling and Forming of Light Metals. —— (*Apparatebau*, 1936, **48**, (20), 221–223).—Directions are given for the protection and handling of material during treatment. Various methods of cold- and hot-forming are enumerated, suitable light alloys being recommended in each case.—P. R.

Cost Savings Afforded by Alloy Anchorage of Punches and Dies [Cerromatrix]. —— (*Steel*, 1936, **98**, (13), 35–36).—Cerromatrix, a proprietary bismuth–tin–lead–antimony alloy, is recommended for attaching sets of punches to the punch plate for complicated work. The principal physical and mechanical properties of the alloy are indicated.—P. M. C. R.

The Diamond and Its Uses in Industry. E. L. C. Tappin (*J. Record Trans. Junior Inst. Eng.*, 1936, **46**, (12), 533–545; and (abstract) *Mech. World*, 1936, **99**, (2573), 416).—S. G.

Cooling and Lubrication During Metal Working. R. Plücker (*Allgem. Oel- u. Fett-Zeit.*, 1934, **31**; *Mineralöle*, **7**, 499–505).—Discusses requirements and selection of oils for metal working.—S. G.

Accident in the Working of Elektron. W. Bäck (*Oberflächentechnik*, 1936, **13**, (5), 55–56).—An explosion of Elektron dust from a grinding machine is attributed to faulty design of the extractor, the improved form of which is described and illustrated.—P. M. C. R.

Explosion Hazards of Sparking Tools. Jack Delmonte (*Safety Eng.*, 1936, **72**, (4), 184–185).—The production of sparks from working tools (see *U.S. Bur. Stand. J. Research*, 1933, **11**, 527) constitutes a source of danger in works where inflammable liquids, gases, or dusts are present. The use of 2–2·5% beryllium–copper is suggested; the mechanical properties of the alloy are summarized, with a note on its heat-treatment.—P. M. C. R.

XIX.—CLEANING AND FINISHING

(Continued from pp. 592–594.)

Sand- and Shot-Blasting. J. H. D. Bradshaw (*Proc. Inst. Brit. Found.*, 1935–1936, **29**, 565–584; discussion, 584–594).—See *Met. Abs.*, this vol., p. 593. —S. G.

Cleaning of Metallic Surfaces by Shot-Blasting. —— (*Rev. Fonderie moderne*, 1936, **30**, 253–257).—A comparison is made of mineral abrasives and shot, and a discussion is given of the theory and practice of shot-blasting, automatic machines, removal of dust, physiological precautions, and the technical and economic advantages of shot.—W. D. J.

Cleaning of Metallic Surfaces by Shot-Blasting. R. Eppenberger (*Rev. Fonderie moderne,* 1936, 30, 297).—The mechanical-projection shot-blasting machine is in considerable use, particularly in Germany and England, and offers much promise from many points of view.—W. D. J.

Electrolytic Cleaning and Pickling. Walter R. Meyer (*Monthly Rev. Amer. Electroplaters' Soc.*, 1934, **21**, (4), 37–41).—Discusses some conditions and actions that take place in cleaning and pickling.—S. G.

***Note on Pickling or Etching Baths for Duralumin.** H. Sutton and T. J. Peake (*J. Inst. Metals,* 1936, **59**, 59–64).—In view of the dangers involved in handling and transporting hydrofluoric acid, a search was made for pickling baths free from such objection. Various treatments were examined. Treatment in a bath prepared by adding 1% by weight of sodium fluoride to 10% (vol.) sulphuric acid followed by dipping in 50% nitric acid (pickling treatment D) gave satisfactory etching. The Wöhler fatigue range (10 million cycles) of Duralumin specimens was reduced from ± 10·85 to ± 10·1 tons/in.^{2}, a decrease of 6·9%, by the pickling treatment. The resulting decrease in fatigue range is nearly as small as that observed after pickling treatment C which gave the least that was observed in a previous investigation (*J. Inst. Metals,* 1934, **55**, 149), and less than any observed in the present investigation. From the points of view of absence of danger in the preparation of the bath and also of the quality of the etch the new treatment appears to be superior to any other yet investigated.—H. S.

***Anodic Treatment for the Production of Aluminium Reflectors.** N. D. Pullen (*J. Inst. Metals,* 1936, **59**, 151–158; discussion, 158).—A description is given of a dual anodic process designed for the treatment of aluminium surfaces in order to produce a high degree of reflectivity. The first bath in which the electrolytic brightening is produced is a mixture of sodium carbonate and sodium phosphate in the approximate proportions of 3 : 1 having a strongly alkaline reaction. The second bath in which a reinforcing film is produced consists preferably of a strong solution of acid sodium sulphate. Data are given showing the reflectivity of aluminium surfaces treated by this method compared with a standard silver mirror and other surfaces such as chromium plate, nickel plate, &c.—N. D. P.

The Patina of Copper and Its Alloys. A. Chaplet (*Cuivre et Laiton*, 1936, **9**, (182), 391–403).—A discussion of the formation, composition, and properties of various patinas produced on copper alloys by natural and artificial agencies. It is shown that the composition of the basic alloy affects materially the nature of any patina formed. Descriptions are given of methods for producing certain colorations—by oxides, sulphides, chlorides. The particulars are very comprehensive.—W. A. C. N.

Colouring of Copper Alloys with "Black Pickle." G. Gross (*Chem.-Zeit.*, 1935, **59**, 195–196).—S. G.

†Finishing of Die-Castings. J. C. Fox (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 193–203; also *Found. Trade J.*, 1936, **55**, (1040), 56–59; and *Aluminium and Non-Ferrous Rev.*, 1937, **2**, (4), 159–160, 162, 164; (6), 225–228).—See *Met. Abs.*, this vol., p. 324.—S. G.

Finishing Aluminium Hollow Ware. —— (*Steel,* 1936, **99**, (26), 32–35).—An illustrated description is given of the various processes used in a modern industrial plant in the U.S.A.—P. M. C. R.

The Surface Treatment of Light Metals. —— (*Apparatebau*, 1936, **48**, (16), 171–173).—Short accounts are given of the sand-blasting, brushing, grinding, polishing, pickling, plating, anodic oxidation, and painting of aluminium and light alloys.—P. M. C. R.

The Grinding and Polishing of Aluminium. H. Krause (*Tech. Zentr. prakt. Metallbearbeitung*, 1936, 46, (11/12), 384).—Detailed descriptions are given of specific polishing and grinding media and methods, having regard to the comparatively soft condition of aluminium and its alloys. For coarse grinding, carborundum wheels and, for later stages, fibre brushes are recommended. Steel wire wheels give a satin finish, especially if a fine pumice-powder dressing is employed. Pickling in 10–20% caustic soda solution saturated with salt may be necessary. Grease removal should be performed carefully in alkali solution as the metal is dissolved, and if alloys are in question such a procedure may cause brown discoloration. Pickling in dilute nitric or hydrofluoric acid is then adopted. Sand-blasting should be done with very fine sand at much lower pressures than with other industrial metals. The compositions of various polishing pastes for use on mops are given.—W. N.

Polishing [Gold and Silver]: Methods and Results of Finishing Processes. R. S. Hutton (*Sci. and Tech. Factors of Production of Gold and Silverwork* (*Worshipful Company of Goldsmiths*), **1935–1936**, 64–76; and *Jeweller and Metalworker*, 1936, 62, (1500), 404–406).—A lecture. Modern practice in polishing, burnishing, and buffing is described and some account is given of the nature of the process as revealed by electron diffraction methods.—A. R. P.

Polishing of Monel Metal in Manufactured State. R. Müller (*Tech. Zentr. prakt. Metallbearbeitung*, 1936, 46, (11/12), 383–384).—A series of suggested sequences of polishing media for Monel metal in the cast, rolled, welded, deep-drawn, and annealed states.—W. A. C. N.

Polishing Monel Metal and Pure Nickel. Henry R. Power (*Metal Cleaning and Finishing*, 1934, 6, (2), 76–77; *Ceram. Abs.*, 1934, 13, 107).—The artificial abrasive, electrically fused aluminium oxide, because of its property of fracturing when it becomes dull, thus presenting new sharp cutting edges at all times, possesses ideal characteristics for polishing and buffing Monel metal and nickel. Owing to the low thermal conductivity of these metals, a sharp, clean abrasive must be used which will cut with a minimum of pressure and prevent localized heating which would cause discoloration of the piece.—S. G.

Polishing Glues. R. Tiquet (*Galvano*, 1936, (47), 19–22).—Methods of testing and using glues for fixing the abrasive to polishing wheels and discs are described.—A. R. P.

Polishing—Abrasives. R. Tiquet (*Galvano*, 1936, (48), 17–19).—The properties and uses of silica, corundum, emery, and carborundum abrasives are briefly discussed.—A. R. P.

Grinding Wheels. A. S. Trollip (*Engineer of India*, 1936, [N.S.], 4, (6), 177–179).—The inspection, storage, selection, mounting, speed, and use of grinding wheels are considered from the point of view of safety.—P. M. C. R.

XX.—JOINING

(Continued from pp. 594–598.)

Methods of Jointing Copper Pipe. —— (*J. Roy. Inst. Brit. Arch.*, 1935, 42, 1149–1150; and *Copper Develop. Assoc. Publ.* No. 19, 1935, 7 pp.).—Screwed joints require the use of pipes thick enough to permit of cutting the threads: for light gauges a joint is used which does not diminish the thickness of the metal at any point in the tube. Compression joints are entirely mechanical and can be easily dismantled, but require somewhat expensive fittings. Welded and bronze-welded joints are rapidly made, require no special fittings, save space and weight, have neat appearance, and are as strong as the tube itself: they are coming into extensive use in sanitary work. Capillary or soldered joints are also increasing in popularity: they require special pre-fabricated fittings, the application of a blowlamp being sufficient to make the joint by melting the solder (applied from outside, or contained in the fitting) which is drawn into the space between tube and fitting by surface tension.—H. H.

***Fluxes for Use in Soft-Soldering.** J. W. Willstrop, A. J. Sidery, and H. Sutton (*J. Inst. Metals*, 1936, **59**, 53–58).—An examination was made of the soft-soldering of materials that are not very easily soldered with the aid of the usual fluxes, particular attention being devoted to the soldering of corrosion-resisting steel and to the corrosive effects of flux residues. The features of orthophosphoric acid as a flux and the properties of fluxes containing organic phosphates as the active agent were investigated. Fluxes based on organic phosphates permit easy soldering of many materials without residues of the fluxes causing corrosion. The fluxes may be used satisfactorily on corrosion-resisting steels and other materials not readily soldered with the use of fluxes containing zinc chloride as the active constituent.—J. W. W.

Soldering of Aluminium. E. Zurbrügg (*Alluminio*, 1935, **4**, (2), 106–108).—The various practical methods of soldering aluminium are described and divided into 3 groups: (*a*) high-temperature soldering (450°–600° C.) with aluminium-rich solders, (*b*) low-temperature soldering (200°–400° C.) with solders rich in heavy metals; (*c*) reaction soldering. (*a*) is characterized by its good corrosion-resistance while (*b*) should only be used where corrosion is unlikely to occur, or if the joint is covered with a lacquer or varnish. Low-temperature soldering can be done without flux, in which case the oxide film should be mechanically destroyed by filing, wire-brushing or with emery paper. A good solder of this type is pure zinc. (*c*) gives fairly good corrosion-resistance as the joint is made mostly of pure zinc. Detailed information is given for performing all three types of soldering. In all cases, the joint when completed, should be carefully washed with hot water and brushed, as any residual flux left on the joint will inevitably produce a corrosion zone.—J. K.

A New Process of Hard Soldering and Its Possible Connection with the Methods Used by the Ancient Greeks and Etruscans. H. A. P. Littledale (*Sci. and Tech. Factors of Production of Gold and Silverwork* (*Worshipful Company of Goldsmiths*), 1935–1936, 44–63; and (summary) *Jeweller and Metalworker*, 1936, **62**, (1501), 458, 460, 462, 464).—A lecture. Very close copies of ancient wire and granulated jewellery work have been made by using a copper hydroxide–glue paste for sticking the wires and granules in the correct position in the design and then slowly firing the article in a non-oxidizing atmosphere up to 900° C., whereby the copper oxide is reduced and the "nascent" copper instantly forms a layer of fusible gold or silver alloy which solders the wires or granules in their original position. The process is described in detail and many examples of beautiful and complicated articles made by it are illustrated. —A. R. P.

Soldering and Welding in the Bronze and Early Iron Ages. Herbert Maryon (*Tech. Studies Field Fine Arts*, 1936, **5**, (2), 76–108).—Examples of bronze and gold implements, jewellery and *objets d'art* made by ancient Sumerian, Egyptian, and Greek craftsmen are illustrated and the methods used by them in making them are discussed, with especial reference to the possible use of the copper oxide–glue process recently re-discovered by Littledale (see preceding abstract).—A.R.P.

Melting and Soldering Precious Metals. Hidetaro Kuroda (*J. Jap. Odontological Soc.*, 1935, **77**, (1), 71–80; and (abstract, in English and Japanese) *Japan Nickel Rev.*, 1936, **4**, (1), 196–198).—Full directions are given for the preparation and melting of small quantities of powdered platinum for casting purposes, and modifications of the method are suggested for comparatively large amounts of material, and for the preparation of alloys with iridium, rhodium, &c. The choice of fuels and fluxes for the soldering of platinum is discussed, and the compositions of 2 suitable solders are given.—P. M. C. R.

The Principal Methods of Riveting Light Alloys. —— (*Apparatebau*, 1936, **48**, (11), 115–117).—A review of methods, tools, and machinery for the riveting of light alloys, with notes on the heat-treatment of Bondur rivets, the use of Albondur, Bondurplat, and Allautal as rivet materials in situations where corrosion is probable, standard forms of rivet, strength of various rivet materials, and methods of assembly.—P. M. C. R.

***Report on the Welding of Light Alloys Containing Magnesium.** Fr. Eggelsmann (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **3**, 785–791 (in German), 792–798 (in English); also *Autogene Metallbearbeitung*, 1936, **29**, (22), 337–341; and *Met. Ind.* (*Lond.*), 1936, **48**, (26), 711–715).—The welding of an alloy containing silicon 0·9, manganese 0·5, magnesium 1·0%, remainder aluminium, was investigated. The leftward process was used, with a slight excess of acetylene in the flame. The welds had greater strength than the parent metal, but the elongation was seriously reduced. The latter property was improved by annealing at 530°–550° C. Both cold- and hot-hammering were found to be very harmful. A suitable flux is essential, and great care is necessary to remove all traces of it after welding.—H. W. G. H.

Contact Electric Welding of Duralumin. L. M. Manevich (*Sudostroenie* (*Shipbuilding*), **1936**, (9), 651–654).—[In Russian.] A description of the ATN-25 machine and alterations made therein at the Marty shipbuilding yard; and also of the results of tests of the machine in the welding of Duralumin.—N. A.

The Autogenous Welding of Light Metals. M. Maier (*Apparatebau*, 1935, **47**, (15), 147–151; (16), 159–162).—Suitable welding powder and rod are recommended for pure aluminium and several light alloys. Hydrogen, illuminating gas, or petrol may be used instead of acetylene. Instructions are given regarding the selection of burners and the preliminary setting of work, the correct handling of burner and rod, and the degree of heating required. The tensile strengths of 6 light alloys (fully annealed) are compared with those of the same alloys in the form of welded sheet of 4 thicknesses. A brief concluding note recommends appropriate heat-treatment of certain types of work.—P. R.

The Welding of Light Metals. —— (*Apparatebau*, 1936, **48**, (13), 140–143).—Detailed directions are given for the autogenous welding of aluminium and light alloy sheet, tubing, and wire. Hammer-welding and electric welding practice are briefly dealt with.—P. M. C. R.

Fundamental Questions for the Further Development of Aluminium Spot Welding. K. Ruppin (*Tech. Zentr. prakt. Metallbearbeitung*, 1935, **45**, (21/22), 571–574).—A description of the proper methods of application of spot welding to aluminium alloys and of the fundamental processes that are operative therein. R. mentions the Hobrock process, in which the union of thermally aged alloys is brought about at a temperature below the melting point; under definite conditions of temperature and pressure the recrystallization potential of the metal is utilized to bring about this effect.—W. A. C. N.

Resistance Welding of Light Metals. C. Haase and O. Plass (*Weld. Ind.*, 1936, **4**, (4), 140–144; (7), 258, 278).—Translated from *Aluminium*, 1935, **17**, 209–216; see *Met. Abs.*, 1935, **2**, 313.—S. G.

Electric Point Welding of VV Alloy. I. M. Brailovskiy (*Tehnika Vosdushnogo Flota* (*Tech. Air Fleet*), **1936**, (10), 107–110).—[In Russian.] The current density required is about 750 amp./mm.^{2}, time of application for two 1 mm. sheets is 0·2 second and for two 0·45 mm. sheets, 0·15 second, and welding pressure 2–4 kg./mm.^{2}. The tests were made with an automatic machine of Soviet manufacture (ATN-25). The strength of the weld exceeds that of joints riveted with Duralumin. The alloy used in the tests consisted of aluminium with copper 4·76, manganese 1·17, magnesium 0·8, iron 0·55, silicon 0·66, and titanium 0·17%.—N. A.

The Development of the Jointing of Light-Gauge Copper Tubes, Bronze-Welded Method, Employing the Oxy-Acetylene Blowpipe. W. L. Kilburn and H. J. Metcalf (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **5**, 1093–1104).—Hot and cold water heating and sanitary installations have been fabricated in metal piping for a considerable period. Some years ago, a solid drawn light-gauge copper pipe was produced, and the only method of jointing was a mechanical fitting, known as a compression joint. Practical opinion differed as to the efficiency, under all circumstances, of this method of jointing. It was suggested that if some other practical method of jointing could be found, the use of this piping would be increased. As a result of experiments, bronze welding was found to be a more simple and practical method of jointing, whereas the mechanical method of jointing was not always satisfactory. With the consequent increased use of bronze welding, further technical and practical knowledge was obtained, but it was felt that some improvement was necessary to enable bronze welded installations to become universally adopted, as the method had, up to then, only been used in connection with domestic hot and cold water installations. After experiments, a weldable copper fitting was evolved, which fulfilled the conditions required to make sanitary installations foolproof, from a welded point of view. During the progress of the development of the bronze welding method, it has been found that the oxy-acetylene blowpipe flame, under all working conditions, is the most practicable tool for the application of the necessary heat required for the jointing of light-gauge copper pipes, whatever the method of jointing, other than the mechanical compression fitting type.
—S. G.

The Sleeve Electrode for the Arc Welding of Copper. A. Matting and W. Lessel (*Weld. Ind.*, 1937, **5**, (2), 63–66).—See *Met. Abs.*, this vol., p. 479.
—H. W. G. H.

The Autogenous Welding of Copper and Its Alloys. —— (*Apparatebau*, 1935, **47**, (9), 89–94; (10), 99–104).—Necessary precautions in the welding of copper and its principal alloys (bronze, brass, nickel–brass, and Monel metal) are correlated with the structural and other peculiarities of the respective materials; suitable welding rods are indicated in each case, and the strengths of welded copper sheet of 4 thicknesses, of brass sheet of 3 thicknesses, and of Monel metal sheet of 2 thicknesses are tabulated, the method adopted being indicated in each case.—P. M. C. R.

Note on the Welding of Aluminium Bronzes. A. Boutté (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **4**, 831 (in French), 832 (in English); also *Met. Ind.* (*Lond.*), 1936, **48**, (24), 669–670; *Aluminium and Non-Ferrous Rev.*, 1936, **1**, (11), 521–522; *Rev. Soudure autogène*, 1936, **28**, (272), 7; *Mech. World*, 1936, **100**, (2585), 50; and *Sheet Metal Ind.*, 1936, **10**, (111), 563).—B. gives the causes which have hindered the development, on a commercial basis, of the oxy-acetylene welding of the aluminium bronzes. To eliminate these causes B. would use a flux having the property of acting energetically on the oxide which is formed, and having, on the other hand, no such action on the parent metal.—S. G.

The Repairing of Large Bronze Bells by Oxy-Acetylene Welding. Hans A. Horn (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **5**, 1263–1269 (in German), 1270–1275 (in English); and *Autogene Metallbearbeitung*, 1936, **29**, (24), 377–381).—The average life of a bronze bell is about 250 years, and failure usually results from the repeated hammering of the clapper, which causes severe cold-working and fatigue. Small cavities or inclusions often start the failure. The material contains about 75% copper, 20% tin and small quantities of phosphorus, iron, zinc, lead, arsenic, manganese, &c., and melts at about 850° C. For welding, an excess of acetylene is necessary in the flame, and small additions of phosphorus, manganese, or aluminium are made to the filler rod. The preparation of the crack for welding, and the preheating of the bell are extremely important. The latter should be very slow, 10–12 hrs. being necessary to heat the larger bells to 550° C., at which temperature welding can be begun. Welding always proceeds downwards, towards the mouth of the bell, but is carried out by "stepping backward." Once started, welding must be continued to completion, and cooling is retarded so as to take 2–6 days.—H. W. G. H.

Lead Welding (Lead Burning) and Welding of Low Melting Point Metals and Alloys by the Oxy-Acetylene Process. E. B. Partington (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **5**, 1086–1090). —The discovery of "leadburning," or, more correctly, the "autogenous welding" of lead, dates back several centuries. The methods adopted during the earlier years of its discovery consisted of pouring molten lead into a "V'd" joint previously prepared between two pieces of lead; the inside of the pipe, or the underside of the sheets, being packed with sand to prevent underflow and also to act as a base. Various other methods were subsequently evolved and, finally, oxy-acetylene leadburning, the latest process, has triumphed over the general anticipation that the phenomenally high temperature of the oxy-acetylene flame would be detrimental to its successful application, and is now in the full stride of commercial development.—S. G.

Modern Lead Welding Practice. Differences from Practice with Other Metals. F. E. Rogers and W. H. Carter (*Met. Ind.* (*Lond.*), 1936, **49**, (23), 560–562).—Based on an article in *Welding Eng.*, 1936, **21**, (8), 24; see *Met. Abs.*, this vol., p. 480.—L. A. O.

Causes of Bad Welding Properties in Nickel. A. Boutté (*Rev. Mét.*, 1935, **32**, (3), 114).—Summary of a paper read before the IXth International Acetylene Congress, 1935. Bad welding properties in nickel are attributed to the presence of over 0·02% sulphur and to the sulphur–magnesium ratio of the material.—P. M. C. R.

***Welding Tests on [Copper- and Nickel-] Plated Sheets.** —— Maier (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **6**, 1424–1430 (in German), 1461–1467 (in English)).—S. G.

The Welding and Soldering of Nickel, Copper–Nickel, and Chromium–Nickel Alloys. B. Trautmann (*Tech. Zentr. prakt. Metallbearbeitung*, 1936, **46**, (9/10), 353–354).—A review is given of welding these materials by one or more of the 10 methods commonly in use, and a discussion of the reasons why certain processes are inapplicable for certain of the alloys; at the same time the most appropriate processes for metals of particular composition and physical characteristics are enumerated. It is shown that under favourable conditions the welds may be as strong as, and of similar corrosion-resisting properties as, the original alloy. Suitable methods of preparation of parts for welding are described.—W. A. C. N.

Special Welding Technique Required in Process for Cladding Steel Rolls. —— (*Steel*, 1936, **99**, (19), 45–46).—Steel rolls coated with corrosion-resisting alloys are much used in manufacturing paper, glass, rubber, soap, &c. Monel metal is generally employed, but nickel, aluminium, or other materials may be used. The method of preparing and "cladding" the rolls is described. —P. M. C. R.

Hard-Facing With Stellite. A. B. Kinzel and C. W. Drury (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **5**, 1163–1169). —Hard-facing implies the deposition of a hard metal to the surface of a metal part subjected to abrasion or erosion. By eliminating or minimizing wear, hard-facing decreases operating costs, increases production, decreases shutdowns for repairs and generally increases operating efficiency. The process is applied to new parts and to the rebuilding of worn parts.—S. G.

A New Method for the Welding of Sheet Zinc. Hans A. Horn (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **4**, 834–837 (in German), 838–841 (in English); and *Autogene Metallbearbeitung*, 1936, **29**, (20), 305–308).—A flux consisting mainly of zinc and ammonium chlorides is used, being painted on the back of the seam. A neutral flame is preferred to excess of acetylene, and the sheets to be welded are butted close together. 50–60 litres per hour of acetylene are required per mm. sheet thickness. The inner cone of the flame should be held 1·5–2 mm. from the molten puddle and the flame should be inclined at an angle of 30°–45° to the seam. Photographs and photomicrographs of typical seams are given.
—H. W. G. H.

Oxy-Acetylene Welding for the Chemical Industry. H. W. G. Hignett (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **5**, 1081–1085; and *Met. Ind.* (*Lond.*), 1936, **48**, (25), 679–682, 697).—Attention is directed more particularly to the welding of corrosion-resistant materials. Since the oxy-acetylene process is not the only welding method employed in the fabrication of chemical plant, a brief review of its advantages and disadvantages in this branch of engineering is given.—S. G.

Various Types of Joint for Piping. K. Beyer (*Bull. tech. Bureau Veritas*, 1935, **17**, (10), 229–232).—From a report to the Committee on Thermal Questions of the Berlin Group of the Verein deutsche Ingenieure, 1935. The most usual forms of joint in piping conveying air, heated gases, hot or cold water, steam, oil, or sulphur dioxide are tabulated, with materials, pressure range, maximum working temperature and method of construction, the last-named by reference to a series of diagrams. Non-ferrous metals and alloys used include lead, copper, Monel metal, and aluminium.—P. M. C. R.

The Metallurgy, Properties, and Control of Welds. A. M. Portevin, with L. Bloch-Sée and D. Séférian (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **1**, 176–196 (in French), 197–216 (in English)). —Deals with welds in steel.—S. G.

Plastic-Elastic Equilibrium in Weld Seams. M. Cymboliste and H. Gerbeaux (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **2**, 343–386 (in French), 387–430 (in English)).—The usual tests on welded joints are of two kinds: either total destructive tests affording a measure of the load, dimensions, or stress at the moment of breakage, or else non-destructive tests giving a determination—if possible from point to point —of the elastic conditions prevailing in the more especially dangerous parts of the joint. It is of interest to follow the development of the stresses and strains in the joint from the moment when the elastic limit is reached up to the moment of breakage. This cannot be done with certainty by calculation, but it can readily be accomplished by observing the cracking which takes place in a special varnish covering the specimen under investigation. The method makes it possible to obtain indications of: (1) the points at which the plastic state first makes its appearance; (2) the extra margin of safety available to the joint in the semi-plastic period having regard to the horizontality of a portion of the stress–strain curve in constructional steels and in weld metal: this makes it possible to classify the different types of joint according to the way in which they are stressed; (3) the equilibrium conditions for heterogeneous joints, which are very difficult to examine analytically; and (4) the magnitude of, and part played by, latent stresses in the joints.—S. G.

Heat-Treatment of Fusion Welds. A. J. T. Eyles (*Wild-Barfield Heat-Treat. J.*, 1936, **2**, (1), 2–4; and *Heat-Treat. and Forging*, 1936, **22**, (8), 387–388).—The necessity for heat-treatment of fusion welds is discussed, and examples are quoted, including aluminium alloys, Duralumin, and brass.—W. N.

Arc Welding in Argon Gas. Gilbert E. Doan and William C. Schulte (*Elect. Eng.*, 1935, **54**, (11), 1144–1149).—A description of apparatus designed for experimental arc welding at atm. pressures in controlled atmospheres. Tests in argon reveal (*a*) the impossibility of maintaining a stable arc in highly purified argon under ordinary conditions; (*b*) the absence of all crater formation under pure iron; and (*c*) the absence of all observable "pinch effect" accompanying the detachment of the globules from the electrode wire.—S. W.

Residual Stresses in Arc-Welded Plates. N. S. Boulton and H. E. Lance Martin (*Proc. Inst. Mech. Eng.*, 1936, **133**, 295–339; discussion, 340–347).—The magnitude and distribution of the longitudinal residual stresses in a rectangular mild steel plate, after depositing a fillet weld along one or both of its longer edges, were determined by taking gauge readings before and after welding, and after milling off, first the deposited metal and then the plastically strained metal. An approximate theory is developed by which the residual stresses and strains may be calculated independently of the measured strains. This involves the mathematical analysis of the temperature distribution in a plate during welding, for which an equation is derived.—H. W. G. H.

Electric Arc Welding Machines. J. M. Willey (*Metropolitan-Vickers Gaz.*, 1936, **16**, (281), 209–214; (282), 233–240).—The static and arc characteristics for single-operator sets are discussed in relation to short-circuit current and reserve voltage. A method is given for calculating the approximate current requirements of multi-generator sets, and the relation between current and voltage is illustrated for level and rising characteristics. The operating costs of several types of set are estimated. A short account is given of single-operation machines for high-frequency a.c.—P. M. C. R.

The A.C. Arc Welder "Stabilarc." Takeshi Ogawa (*Hitachi-Hyōron* (*Hitachi Review*), 1935, **18**, (6), 355–360).—[In Japanese.] An English summary is given in *Jap. J. Eng. Abs.*, 1937, **15**, 125–126.—S. G.

A New Method for Testing Arc Welding Generators. T. Okamoto and K. Ando (*Denki Gakkwai Zasshi* (*J. Inst. Elect. Eng. Japan*), 1935, **55**, (569), 1032–1040).—[In Japanese.] A summary in English is given in the abstract section (English issue), 1935, **55**, (569), 131; and also an abstract in *Jap. J. Eng. Abs.*, 1937, **15**, 100–101.—S. G.

Progress of Electric Resistance Welding. J. E. Languepin (*Mém. Soc. Ing. civil France*, 1936, **89**, (5), 716–735).—Modern types of resistance welding machines for spot and seam welding iron and steel are illustrated and their construction, operation, and uses are described.—A. R. P.

Tools for Electric Spot-Welding. F. Hoch (*Z.V.d.I.*, 1936, **80**, (30), 911–912).—An illustrated description is given of spot-welding equipment, including spring-controlled assemblies and sets for light work.—P. M. C. R.

Alloying Elements in Welding Rods. A. B. Kinzel (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **3**, 781–784; discussion, 784; also *Met. Ind.* (*Lond.*), 1936, **48**, (24), 667–669; *J. Amer. Weld. Assoc.*, 1936, **15**, (11), 12–14; *Aluminium and Non-Ferrous Rev.*, 1936, **1**, (11), 522–524, **2**, (3), 132–133; *Sheet Metal Ind.*, 1936, **10**, (112), 638–640; and *Machines*, **1937**, (May), 14–18).—S. G.

Report of the Oxy-Acetylene Committee [of the International Acetylene Association] for 1935. E. V. David (*Internat. Acet. Assoc. Proc.*, 1935, **36**, 126–136; discussion, 136–138).—S. G.

Heat Effect of the Oxy-Acetylene Flame for Various Exit Velocities of the Gas Mixture. E. Streb and H. Kemper (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **4**, 814–816 (in German), 817–819 (in English)).—S. G.

***Electrostatic Charges in Flowing Gases.** W. Rimarski and —— Friedrich (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **4**, 893–911 (in German), 912–929 (in English); discussion, 931–932; also *Autogene Metallbearbeitung*, 1936, **29**, (15), 225–232; (16), 241–246).—S. G.

Suggestion in Regard to Minimizing the Risk of Explosion After Ignition of Dissolved Acetylene Cylinders. J. R. H. Goris (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **4**, 933–940 (in German), 941–948 (in English); discussion, 949–950).—S. G.

***The Effect of the Acetylene Pressure on the Security Against Flash-Back of Injector Welding Blowpipes.** —— Wolf (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **6**, 1449–1451 (in German), 1486–1488 (in English)).—S. G.

The Rate of Generation of Acetylene in the Acetylene Generator. Otto Mies (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **4**, 951–956 (in German), 957–962 (in English)).—S. G.

Acetylene Generators. Eduard Sauerbrei (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **1**, 218–239 (in German), 240–261 (in English)).—S. G.

Pressure Reducing Valves for Oxygen. —— Teich (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **6**, 1444–1448 (in German), 1481–1485 (in English)).—S. G.

Apparatus and Process for Extending the Field of Oxygen Cutting. R. Schneider (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **6**, 1436–1443 (in German), 1473–1480 (in English)).—S. G.

The Position of Oxy-Acetylene Welding, Cutting, and Surface-Hardening in Belgium. Ch. Dehasse (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **6**, 1504–1519 (in French), 1520–1535 (in English)).—S. G.

The Oxy-Acetylene Industry on the Golden Reef [South Africa]. O. Grafton and G. Maguire (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **6**, 1542–1546).—S. G.

A New Principle in the Practical Training of Oxy-Acetylene Welders. R. Granjon (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936*, **4**, 842–843 (in French), 844–845 (in English), discussion, 847; also *Weld. J.*, 1936, **33**, (393), 178–180; *Rev. Soudure autogène*, 1936, **28**, (273), 7–8; *Weld. Eng.*, 1936, **21**, (10), 42–43; *Sheet Metal Ind.*, 1936, **10**, (114), 795–796; and *Aluminium and Non-Ferrous Rev.*, 1936, **1**, (12), 565–566).—An account of a new training method adopted by the Office Centrale over a year ago, in which the novices are required to execute a given weld in a given minimum time, progress being achieved by improving the quality of the weld without exceeding the prescribed time. This method of training is claimed to be more rapid and effective than the more usual one of insisting on quality first and speed afterwards; it tends to make the welder avoid unnecessary movements of the blowpipe. The method is not recommended, however, for training welders in repair work.—H. W. G. H.

Note on a System of Simultaneous Training in Oxy-Acetylene and Electric Welding. R. Salelles (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **4**, 861–868 (in French), 869–876 (in English)).—S. G.

Coordination of Welding Methods and the Training of Welders. Hans Melhardt (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **1**, 148–161 (in German), 162–175 (in English)).—S. G.

Training and Control of Welders. W. Heigh and J. Orr (*Trans. Inst. Eng. Ship. Scotland*, 1935–6, **79**, 118–136; discussion, 137–155).—S. G.

Results of Psycho-Physiological Examinations for the Selection of Welders. L. Bloch-Sée (*XIIth Internat. Congr. Acet., Oxy-Acet. Weld. & Allied Ind., 1936, Proc.*, 1936, **4**, 848–853 (in French), 854–859 (in English)).—S. G.

XXI.—INDUSTRIAL USES AND APPLICATIONS

(Continued from pp. 598–607.)

Evolution of the Application of Aluminium During the Last Fifty Years (1886–1936). A. de Biran (*Rev. Aluminium*, 1936, 13, (84), 381–388).—The possibilities in the application of aluminium envisaged in 1886, the difficulties that had to be overcome, and the degree to which those possibilities have been realized are described.—J. H. W.

The Adaptation of Aluminium to Modern Applications and the Evolution of Light Alloys. —— (*Rev. Aluminium*, 1936, 13, (84), 374–377).—The trade names, compositions, and physical and mechanical properties of a number of aluminium casting and forging alloys are tabulated.—J. H. W.

Aluminium and its Alloys in Modern Practice. W. Machu (*Oesterr. Chem.-Zeit.*, 1935, 38, 13–17, 33–35).—A review.—S. G.

Correct and Faulty Treatment of Aluminium Plant. H. Röhrig (*Met. Ind.* (*Lond.*), 1936, 49, (1), 14–18; also *Aluminium and Non-Ferrous Rev.*, 1936, 1, (10), 474–475; (11), 519–520; and *Light Metals Rev.*, 1936, 3, (2), 28–30).—Read at the Chemical Engineering Congress of the World Power Conference, 1936. The physical and mechanical properties of aluminium and its alloys are reviewed, in relation to the suitability of these materials for use in large-scale plant and equipment. The impact strength, yield-point and elongation of soft and rolled aluminium and aluminium–manganese (1·5%) and of 3 other alloys are tabulated for 3 temperatures. Methods of assembling aluminium parts are considered, and precautions are indicated. The susceptibility of the metal and its alloys to attack by various corrosive agents is discussed, and a review of methods of cleaning and protection is given.
—P. M. C. R.

Aluminium Tanks for Brewery. J. Roux (*Brasserie et Malterie*, 1935, Nov. 5; *Light Metals Rev.*, 1936, 2, 249).—L. A. O.

Report of [A.S.T.M.] Committee B-7 on Light Metals and Alloys, Cast and Wrought. Sam Tour and J. A. Gann (*Proc. Amer. Soc. Test. Mat.*, 1936, 36, (I), 204–207).—New tentative specifications are submitted for magnesium-base alloy bars, rods, and shapes (*Met. Abs.*, this vol., p. 740). The activities of the various sub-committees, especially in considering specifications, are briefly reviewed.—S. G.

Proposed Revisions in [A.S.T.M.] Tentative Standards for Light Metals. —— (*Proc. Amer. Soc. Test. Mat.*, 1936, 36, (I), 208–211).—Appendix to Report of Committee B-7 (preceding abstract). Revisions are proposed to tentative specifications B80–34T—magnesium-base alloy sand-castings; B90–34T—magnesium-base alloy sheet; B91–34T—magnesium-base alloy forgings; B92–33T—magnesium ingot and stick for remelting; and B93–34T—magnesium-base alloy ingot for remelting.

Alloys of Aluminium and Their Uses. Paul V. Faragher (*Product Eng.*, 1936, 7, 62–66, 137–140; *C. Abs.*, 1936, 30, 7522).—A discussion of the heat-treatment, annealing and properties of the commonly used aluminium alloys, the forms in which they are available, and the proper alloy for each function. Tables of composition and mechanical properties are given, with photographs.
—S. G.

Structural Application of Aluminium Alloys. E. C. Hartmann (*Proc. Amer. Soc. Civil Eng.*, 1936, 62, (8), 1313–1328).—The characteristics of the Duralumin-type alloy "17 S–T" are detailed, recommendations being given for values of tension, compression, shear and bearing stresses suitable for use in designing; notes on its workshop fabrication are included. The economic application of this light-weight alloy for structural purposes is discussed.—J. C.

Complementary Notes on Telephonic Conductors in Aluminium. C. Pramaggiore (*Alluminio*, 1934, 4, (3), 156–162).—J. K.

Telephone Lines in Aldrey. G. Dassetto (*Alluminio*, 1935, 4, (3), 149–156).—Aldrey conductors can satisfactorily replace the usual materials for telephonic conductors, and it is necessary to study carefully its particular characteristics so as to use it in the most advantageous manner. Its mechanical resistance is only a little less than that of copper, and its weight very low. It can be loaded to a high value, since its elastic limit is only about 10% below the ultimate. It also possesses very good corrosion-resistance. The various methods of fastening the conductors to the insulators are carefully explained and illustrated.—J. K.

Metallurgical Problems of Aero Engine Manufacture. E. R. Gadd (*J. Roy. Aeronaut. Soc.*, 1936, 40, (308), 622–633).—Materials for pistons and cylinder heads are discussed fully, and the properties of the aluminium alloys R.R.59 and " Y " used for this purpose in high performance engines are described. The use of bronzes for valve seats and valve guides is mentioned briefly. A short section is devoted to crank-case materials and difficulties experienced. A comprehensive table giving the main physical properties of the materials used is appended.—H. S.

Aero Engines for Light Work. J. Bally (*Rev. Aluminium*, 1936, 13, (81), 191–206; and (summary) *Light Metals Rev.*, 1936, 3, (1), 19–20).—The future of private flying depends on the development of light machines at low cost. Substantial reductions in weight may be effected by the use of suitable light alloys in engine construction, and examples are discussed in connection with engines of French construction.—P. M. C. R.

Airscrew Development. H. C. Watts (*J. Roy. Aeronaut. Soc.*, 1936, 40, (307), 483–510; discussion, 510–523).—The main technical features of aluminium alloy airscrews and magnesium alloy airscrews in relation to these materials are mentioned.—H. S.

Manufacturing Phases of Metal-Aircraft Construction. Fred W. Herman (*S.A.E. Journal*, 1936, 39, (4), 394–399; and (summary) *Light Metals Rev.*, 1936, 3, (5), 97–99).—The ultimate tensile stress, yield-point, bearing power, and shear stress of alloys " 17S " and " 24S," which are widely used in stressed-skin structures, are tabulated for 3 types of treatment, and the relation of these properties to design is discussed, with special reference to lofting, tooling, fabrication, assembly, inspection, and methods of protection. The shear strengths of Duralumin and the new riveting alloy A 17 S.T. are compared. Protective methods include anodic oxidation (not applicable to Alclad) and a varnish applied by spraying or dipping.—P. M. C. R.

Stressed-Skin Structures for Aircraft. Don R. Berlin (*S.A.E. Journal*, 1936, 39, (5), 444–447, 458).—Method of forming and assembling light-alloy parts for all-metal stressed-skin aero structures are discussed. The attachment of the skin by riveting has been facilitated by the development of the alloy A 17 S, which can be used for riveting without special storage precautions when in the " semi-heat-treated " state. Stiffening members are of Duralumin: the bulb-angle form is recommended.—P. M. C. R.

The Technology of the Light Die-Casting Alloys; Their Uses in Automobile Construction. A. Dumas (*J. Soc. Ing. Automobile France*, 1935, 8, (4), 199–206; also (summaries) *Light Metals Rev.*, 1936, 2, (20), 351–353; and *Found. Trade J.*, 1936, 54, (1032), 420).—An illustrated review is given of the use of chill-cast and die-cast light alloys in automobile work. Special reference is made to the high-purity aluminium–copper–zinc alloys (zinc 12–14%), Magnalium, the " modified " alloys of the Alpax group, " AP 33 " (copper 4·5–5%, titanium 0·3%), " Y " alloy, Lo-Ex, and Central A (silicon 12, copper 2·5, nickel 2·5, manganese 1·25, titanium 0·2%). The use of light alloys in casings, cylinder heads, engine blocks, wheels, handles, brake drums, &c., is described.—P. M. C. R.

Light Alloys and the Ordinary Bicycle. J. Bally (*Rev. Aluminium*, 1935, **12**, (75), 3043–3054).—The introduction of light-alloy (Duralumin) frames, wheel rims, handle-bars, &c., has reduced the weight of the ordinary bicycle from 33 to 27·5 lb., and that of the racing machine from 22 to 16·5 lb. The production of Duralumin rims is described in detail.—P. M. C. R.

Aluminium in Rolling Stock Construction. Ernest V. Pannell (*Railway Gaz.*, 1936, **64**, (13), 613–614).—After reference to the economy of light-weight construction an account is given of light-alloy railway coach construction since 1910. Special features of design are noted, and P. emphasizes the possible advantages of material having a high elastic modulus in the event of collision.—P. M. C. R.

The Uses of Aluminium in Sewage Disposal Plants. R. C. Wilson (*Proc. 16th Texas Water Works Short School, Dallas, Texas*, **1934**, 99–102).—S. G.

Which Light Alloy Must I Use? —— (*Apparatebau*, 1936, **48**, (3), 26–28).—The uses of light alloys in relation to service conditions, especially in place of copper alloys, are reviewed and a table is given of the mechanical properties and principal applications of soft and heat-treated Bondur, Albondur, Bondurplat, Lautal, Pantal, K.S.–Seewasser, B.S.–Seewasser, Silumin, Mangal, and pure aluminium, with brief notes on the special characteristics of each.—P. R.

Aluminium Furniture—How It is Formed, Assembled, and Finished. Fred B. Jacobs (*Steel*, 1936, **99**, (19), 48, 50, 53, 88).—The successful manufacture of aluminium alloy furniture depends on welding technique and on the possibility of repetition work in forming operations. The forming, welding, polishing, heat-treatment, colouring, and finishing of the pieces are briefly described.—P. M. C. R.

History of Materials in Religious Art. J. Bally (*Rev. Aluminium*, 1935, **12**, (76), 3103–3114).—A brief historical survey is given of the developing use of metals in ecclesiastical architecture, decoration, and furnishing. Improvements in technique continue to extend the range of available media. Examples of the use of aluminium and light alloys are illustrated: they include domes, statuary, panelling, and furniture. Further possibilities are afforded by the anodic colouring processes.—P. M. C. R.

Aluminium Foil for the Wrapping of Butter. M. Saitner (*Milchwirtschaftl. Zeit.*, 1935, **40**, 741; *Light Metals Rev.*, 1936, **2**, 226).—L. A. O.

Aluminium Foil Substituted for Lead in Pipe Jointing. M. Meyeringhausen (*Gesundheits-Ing.*, **1935**, Sept. 14; *Eng. News-Record*, 1935, **115**, 877; *J. Amer. Water Works Assoc.*, 1936, **28**, 2021).—A report of an investigation carried out by the domestic engineering section of the Verein Deutsche Ingenieure of substitutes for lead, owing to the German Government's action in forbidding the use of lead in jointing cast-iron drain pipes in connection with the policy of reducing use of imported materials. Aluminium pipe joint now recommended by the section is made of aluminium foil 0·002–0·004 in. thick, which is creased, crumpled, and calked into space between bell and spigot. Calking is as simple as with lead and to a certain extent more convenient, owing to its weight being only one-quarter that of lead. Instead of 20 mm. usual with lead, the depth can be reduced to 10 mm., owing principally to the tensile strength being from 3 to 10 times greater. With good yarn packing, aluminium joints of this depth have been known to withstand pressures of about 150 lb./in.^{2} without leakage. The cost, for 2-in. to 6-in. pipe, is practically the same as for lead, or possibly 10% less. Molten aluminium cannot be used, owing to its high melting point and high heat of fusion.—S. G.

Tentative Specifications for Aluminium Sheet and Plate (B 25–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 257–261; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 685–689).—A minimum of 99% aluminium is required. A table gives the requirements as to tensile properties for various tempers and thicknesses.—S. G.

Tentative Specifications for Aluminium-Base Alloy Sand-Castings (B 26–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 246–251; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 674–679).—Cover aluminium-base sand-castings having a sp. gr. of 3 or less; 12 alloys are specified. A table sets forth the tensile properties of the alloys, either as cast or heat-treated. —S. G.

Tentative Specifications for Aluminium-Base Alloy Permanent Mould Castings (B 108–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 238–242; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 669–673).—Cover aluminium-base alloy permanent mould castings having a sp. gr. of 3 or less. Eleven types of alloy are specified, and the specifications refer to castings of two classes: (1) standard commercial quality for regular applications, and (2) class A alloys where the greatest freedom from impurities is required for special applications. Tables give the chemical compositions, tensile properties, sp. gr., and indications (fair, good, excellent) of the corrosion-resistance, casting properties, response to heat-treatment, principal uses, and machinability of the alloys.—S. G.

Tentative Specifications for Aluminium Alloy (Duralumin) Sheet and Plate (Aluminium–Copper–Magnesium–Manganese) (B 78–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 262–265; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 690–693).—Requirements as to chemical composition are: aluminium (min.) 92, copper 3·5–4·5, magnesium 0·2–0·75, and manganese 0·4–1·0%. The requirements for tensile properties for various tempers and thicknesses are tabulated.—S. G.

Tentative Specifications for Aluminium Alloy (Duralumin) Bars, Rods, and Shapes (Aluminium–Copper–Magnesium–Manganese) (B 89–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 252–256; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 680–684).—The composition of the alloy, as determined by chemical analysis, shall conform to: aluminium (min.) 92·0; copper 3·5–4·5, magnesium 0·2–0·75, and manganese 0·4–1·0%.—S. G.

Federal Specifications for Aluminium Alloy (Aluminium–Chromium–Magnesium–Silicon); Bars, Rods, Shapes, and Wire. —— (*Federal Standard Stock Catalog* (*U.S.A.*), 1936, **QQ–A–331**, 11 pp.).—S. G.

Tentative Specifications for Aluminium–Magnesium–Chromium Alloy Sheet and Plate (B 109–36T). —— (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 699–703).—The requirements as to chemical composition are: magnesium 2·2–2·8, chromium 0·15–0·35, iron + silicon (max.) 0·45, copper (max.) 0·10, manganese (max.) 0·10, other elements, each (max.) 0·03, total (max.) 0·10%, aluminium remainder. The requirements as to tensile properties are tabulated for various tempers and thicknesses.—S. G.

7 Per Cent. Magnesium–Aluminium Alloy Bars, Extruded Sections, and Forgings (Softened) [MG 7]. —— ((*Brit.*) *Air Min. Specification*, **D.T.D. 297**, 1936, 7 pp.).—Covers the alloy generally known as MG 7; sp. gr. ≯ 2·85. The chemical composition is to be: magnesium ≮ 6·5, ≯ 10·0; manganese ≯ 0·6; silicon ≯ 0·5; iron ≯ 0·75%; aluminium remainder. The requirements as to mechanical properties in the softened condition are: 0·1% proof stress, ≮ 8 tons/in.^{2}; ultimate tensile stress, ≮ 20 tons/in.^{2}; elongation ≮ 15%.—S. G.

Tentative Specifications for Aluminium–Manganese Alloy Sheet and Plate (B 79–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 266–270; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 694–698).—The requirements as to chemical composition are: aluminium (min.) 97·0, manganese 1·0–1·5, and copper (max.) 0·2%. A table gives the requirements for tensile properties for various tempers and thicknesses.—S. G.

Cadmium-Base Bearing Metals. —— (*Metallurgist* (Suppt. to *Engineer*), 1936, **10**, 124–125).—A brief review of some recent work on the development of cadmium-base alloys containing copper and silver or magnesium, bonded to steel by cadmium–zinc alloy, and of cadmium–nickel alloys. The increased use of such alloys has led to a shortage of cadmium and an increase in price which has been a serious embarrassment to the electroplating industry.—R. G.

Calcium, the Light Metal of the Future. P. Rakowicz (*Tech. Zentr. prakt. Metallbearbeitung*, 1935, **45**, (21/22), 559–561).—A summary of the technological uses of calcium as deoxidizer, refiner, and alloy metal. In amounts of from 2 to 20%, calcium enhances the mechanical properties of both aluminium and magnesium.—W. A. C. N.

The Uses and Occurrences of Chromium. G. H. Chambers (*Queensland Govt. Min. J.*, 1935, **36**, 382–383).—S. G.

Report of [A.S.T.M.] Committee B-5 on Copper and Copper Alloys, Cast and Wrought. C. H. Mathewson and D. K. Crampton (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 168–177).—New tentative specifications are presented for seamless copper–nickel alloy condenser tubes and ferrule stock (*Met. Abs.*, this vol., p. 736); for sheet and strip phosphor–bronze (*Met. Abs.*, this vol., p. 738); for bronze castings in the rough for wearing parts (*Met. Abs.*, this vol., p. 737); and for car and tender lined journal bearings (*Met. Abs.*, this vol., p. 737). New tentative specifications are submitted for bronze castings for turntables and movable bridges (*Met. Abs.*, this vol., p. 737) as a revision of the existing standard specification. Revisions of a number of specifications and the adoptions of previously published revisions of others are proposed. —S. G.

Copper Developments. A Review of Recent Work. —— (*Copper Develop. Assoc. Publ.* No. **20**, 1936, 15 pp.).—From *Metallurgia*, 1935, **13**, 46, 57–60; see *Met. Abs.*, this vol., p. 22.—S. G.

The Use of Copper Pipe Between Main and Consumers' Premises. J. Barker (*Gas J.*, 1936, **215**, 650–653; discussion, 653; and *Gas World*, 1936, **105**, 218–219).—Copper service pipes have advantages over those of iron or steel, notably in resisting internal corrosion whereby dust is formed and gas-flow retarded.—A. R. Pe.

Copper for Architecture in Sweden and Denmark. —— (*Copper Develop. Assoc. Publ.* No. **18**, 1935, 27 pp.).—Consists of extracts from a memorandum to a committee, compiled by two of the staff of the C.D.A., and illustrated by their own drawings and snapshots, after a short visit to Sweden and Denmark to study the architectural use of copper in those countries. The subjects briefly discussed include copper roofing, comparison of roofing costs (copper, steel, and tiles), patina, rain-water gutters and downpipes, and various other applications in exterior architecture.—S. G.

***Platinized Copper Gauze for Oxidation of Ammonia.** I. E. Adadurov and P. D. Didenko (*Ukrainskii Khimichnii Zhurnal* (*J. chim. Ukraine*, 1935, **10**, 271–276; *Brit. Chem. Abs.*, **1935**, [B], 946).—[In Ukrainian.] The maximum values for oxidation were 51 with copper, 34 with brass, and 74 with platinized copper or brass gauze; in all cases, the catalysts were unsuitable for further use after making contact for 18 hrs.—S. G.

Report of [A.S.T.M.] Committee B-1 on Copper and Copper Alloy Wires for Electrical Conductors. J. A. Capp and J. H. Foote (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 151–154).—New tentative standard specifications for hard-drawn copper alloy wires are proposed (*Met. Abs.*, this vol., p. 736). The Committee recommends the adoption as standard of tentative specifications for bronze trolley wire to replace the existing standard and also the adoption of a tentative revision in the standard specifications for copper trolley wire.—S. G.

Steel-Cored Copper Conductors. G. W. Preston (*Electrician*, 1935, **114**, (2960), 244–247; and *Copper Develop. Assoc. Publ.* No. **10** (revised edn.), 1936, 20 pp.).—Deals with stress distribution in composite conductors, factors of safety, virtual moduli and coeffs., characteristics, wind loads and conductor spacing, corona, erection, vibration, corrosion, and economic advantages.—S. G.

Tentative Specifications for Hard-Drawn Copper Alloy Wires for Electrical Conductors (B 105–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 339–343; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 760–764).—The wires may be made in any one of 10 distinct grades.—S. G.

Proposed Standard Specification for Aluminium Bronze (E 1714). —— (*Apparatebau*, 1935, **47**, (2), 16–17).—The portion of the German Standard Specification DIN 1705 relating to aluminium bronze is produced as a separate leaflet.—P. M. C. R.

Making Moulds for Plastics from Cast Beryllium Copper. —— (*Steel*, 1936, **98**, (10), 35, 38).—The hardness and good casting properties of 2·5% beryllium-copper render it a suitable material for moulds for producing small parts in synthetic plastics, either for intricate designs or for decorative work, where the requisite fine detail is not economically obtainable with steel. The limitations of the material are indicated, and its properties are compared with those of ordinary pack-hardened machine steel moulds.—P. M. C. R.

Cadmium–Copper Conductors. —— (*Copper Develop. Assoc. Publ.* No. **17**, 1935).—Consists of numerous sag and tension curves for standard sizes of conductor with alternative strandings.—S. G.

Cadmium–Copper. Its Importance as an Overhead Transmission Line Conductor Material. G. W. Preston (*Elect. Rev.*, 1935, **116**, (2990), 372–373; and *Copper Develop. Assoc. Publ.* No. **11**, 1936 (revised edn.), 19 pp.).—S. G.

Bearing Metals of Copper Alloys Containing Lead. H. Mann (*Tech. Zentr. prakt. Metallbearbeitung*, 1936, **46**, (17/18), 605–609).—Alloys containing lead 20–40%, the rest copper, excepting for small additions of tin or nickel as hardening elements, have a much more gradual decrease in hardness with increase in temperature than a high-tin white metal. Recently, it is stated, lead–bronze bearings have superseded the ordinary white metal in many types of Diesel and aero engines. The small additions of nickel or tin assist in keeping the lead in a finer state of division.—W. A. C. N.

Tentative Specifications for Seamless Copper–Nickel Alloy Condenser Tubes and Ferrule Stock (B 104–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 316–318; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 741–743).—Covers two grades, the requirements as to chemical composition of which are, respectively; nickel 29·0, 19·0; manganese (min.) 1·0, 1·0; tin (max.) 1·5, 1·0; zinc (max.) 1·0, 6·0; iron (max.) 0·5, 0·5; lead (max.) 0·05, 0·05%; copper remainder.—S. G.

Tentative Specifications for Copper–Silicon Alloy Plates and Sheets (B 96–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 319–321; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 744–746).—Cover rolled copper-silicon alloy plates for pressure vessels. Two types are specified.—S. G.

Tentative Specifications for Sheet Copper–Silicon Alloy (B 97–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 326–330; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 751–755).—Cover sheet copper–silicon alloy commonly used for drawing, forming, stamping, and bending. Three types are specified.—S. G.

Tentative Specifications for Copper–Silicon Alloy Rods, Bars, and Shapes (B 98–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 322–325; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 747–750).—Four types are specified.—S. G.

Tentative Specifications for Copper–Silicon Alloy Wire for General Purposes (B 99–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 331–334; and *Proc. Amer. Soc. Test. Mat.*, 1936. **36**, (I), 756–759).—Cover round copper–

silicon alloy wire for general structural purposes except for electrical transmission cable. Four types are specified.—S. G.

The Present State of Development of Bronze Bearings and Special Brasses. —— (*Tech. Zentr. prakt. Metallbearbeitung*, 1936, **46**, (15/16), 526–530).—The eutectoid bronze containing 30% zinc (really a brass) has characteristic properties of a cast bronze with good flowing properties, hard eutectoid grains being embedded in softer α-mixed crystals. Although more than 20% tin has been considered detrimental in copper–zinc alloys, recent investigations have shown this to be not universally true. Hansen recommends an alloy containing zinc 27–39, tin 0·4–8%. This alloy contains no β-crystals which would interfere with the bearing properties. It may also be used with up to 15% lead. The physical properties of this alloy are given. Copper–aluminium–silicon alloys have been developed. Alloys containing copper 65–80, silicon 2–6%, and the rest zinc; copper 76, zinc 20, silicon 3% are also described. Nickel–cadmium alloys containing small amounts of copper, magnesium, silver, and zinc have been suggested in America.—W. A. C. N.

Tentative Specifications for Bronze Castings for Turntables and Movable Bridges (B 22–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 275–278; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 724–727).—Covers 4 classes: *Class A*, for contact with hardened steel discs at low speeds under pressures not over 3000 lb./in.^{2}, *e.g.* disc bearing metals used in turntables and centre-bearing swing bridges; *Class B*, for contact with hardened steel discs at low speeds under pressures not over 2500 lb./in.^{2}, *e.g.* disc bearing metals used in turntables and centre-bearing swing bridges and for contact with steel (tensile strength 60,000 lb./in.^{2}, min.) at low speeds under pressures not over 1500 lb./in.^{2}, *e.g.* trunnions of movable bridges; *Class C*, for ordinary machinery bearings; *Class D*, for gears, worm wheels, nuts, and similar parts which are subjected to other than compressive stresses.—S. G.

Tentative Specifications for Bronze Castings in the Rough for Locomotive Wearing Parts (B 66–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 299–301; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 728–730).—Covers 4 compositions; the purposes for which they are ordinarily used are: phosphor–bronze—shoes and wedges, floating rod bushings, or other uses where a hard wearing surface is required; hard bronze—general purpose wearing metal may be cast in either sand or metal moulds, for rod bushings, shoes and wedges, cross-head gibs, engine truck and trailer brasses; medium bronze—may be cast in sand or metal moulds for driving box, engine and trailer truck brasses, hub liners, and bearings requiring lining metal for facing or lining; soft bronze—generally cast in metal moulds for driving boxes and special purposes where a soft metal is desired.—S. G.

Tentative Specifications for Car and Tender Journal Bearings, Lined (B 67–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 302–304; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 731–733).—Cover lined journal bearings for use on locomotive tenders, passenger and freight equipment cars. The requirements as to chemical composition are: *backing metal*, lead 15–22, tin 5–7, impurities (max.) including zinc 3, excluding zinc 1%, copper remainder; *lining metal*, tin as specified, antimony (min.) 8·0, tin and antimony 10–14, arsenic (max.) 0·2, copper (max.) 0·5, sum of tin, antimony, lead, and arsenic (min.) 99·25, other impurities (max.) 0·75%.—S. G.

Surface Hardening for Bearing Purposes. Christopher H. Bierbaum (*Machinery* (*N.Y.*), 1935, **42**, 204–206; *C. Abs.*, 1936, **30**, 63).—Pairs of bearing surfaces with desirable properties are made by mating a case-hardened steel surface with one of hard or chilled bronze. The best results are obtained when the hardness of the case gradually blends into that of the softer core. Sudden transitions of hardness, giving bearing surfaces susceptible to cracking and checking, should be avoided. Optimum conditions are given for the use of chromium plate and nitrided hard cases as bearing surfaces.—S. G.

Tentative Revision of Standard Specifications for Manganese–Bronze Ingots for Sand-Castings (B 7–27). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 1335; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 1197).—It is proposed to amend the table of chemical requirements in Section 3.—S. G.

Tentative Revision of Standard Specifications for Manganese–Bronze Sand-Castings (B 54–27). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 1335; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 1197).—It is proposed to amend the table of chemical requirements in Section 3.—S. G.

Tentative Specifications for Sheet and Strip Phosphor–Bronze (B 103–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 305–311; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 734–740).—Cover commercial sheet and slit-edged strip phosphor–bronze commonly used for drawing, forming, stamping, and bending, particularly in making spring devices for electrical apparatus. Four grades are specified.—S. G.

Requirements of Materials for Weaving Fourdrinier [Paper-Machine] Wires. H. E. Brown (*Paper Trade J.*, 1935, **100**, T.A.P.P.I. Sect., 39–42; *Brit. Chem. Abs.*, **1935**, [B], 272).—The properties of wire suitable for the manufacture of paper-machine wire are outlined, and recent methods of annealing are described, with photomicrographs of brass and phosphor-bronze wires.—S. G.

Strength of Hard Lead Pipe. H. Bablik and J. Krystof (*Gas u. Wasserfach*, 1935, **78**, 279–280; *C. Abs.*, 1935, **29**, 4714).—Calculations are given for the bursting strength of lead pipes in terms of the antimony content. For water pipes the optimum antimony content is apparently 0·36–0·72%.—S. G.

Boston's Lead Poison Problem. —— (*New England J. Med.*, 1933, **209**, 559–560; *J. Amer. Water Works Assoc.*, 1934, **26**, 1747).—Many house connections in Boston are made of lead. When the condition of a hospital patient led to suspicion of lead poisoning, examination was made of the water used at the patient's home and revealed a lead content above the danger line. The amount of lead found in the water from a number of houses showed lead contents ranging from 0·60 to 1·14 p.p.m. Chlorination has added to the danger from these lead pipes.—S. G.

Lead Work on Federal Court House, New York. —— (*Lead*, 1936, **6**, (6), 2–6; 1937, **7**, (1), 2–6).—A fully illustrated account, with diagrams of many structural details, of the use of lead in the foundation waterproofing, joint flashing, sanitary equipment, and roofing of the new Federal Court House, New York.—P. M. C. R.

Cast Lead Evaporator for Titanium Sulphate Foundation. —— (*Lead*, 1936, **6**, (4), 7).—A horizontal-tube evaporator for a mixture of titanium sulphate and sulphuric acid is made almost throughout of a 92 : 8 lead–antimony alloy.—P. M. C. R.

New Sulphite Pulp Plant Has Much Lead Equipment. —— (*Lead*, 1936, **6**, (5), 4–5).—Sheet and piping of 6% antimonial lead are used in a wood-pulp plant in Washington; tellurium–lead resists especially severe conditions of corrosion and heat.—P. M. C. R.

Problem of Flashing Stone Chimney Solved by Lead. —— (*Lead*, 1936, **6**, (4), 6–7).—Lead has been used to advantage in the waterproofing of a chimney built of rough slate. Diagrams show the method of installation.
—P. M. C. R.

Lead Loading-Coil Cases Advantageous in Telephone Work. —— (*Lead*, 1936, **6**, (5), 2).—The substitution of a lead–antimony alloy for steel in loading-coil cases has resulted in easier installation, improved resistance to corrosion, and reduced size per unit.—P. M. C. R.

Tin-Free Lead-Base Bearing Metals with Alkali and Alkaline Earth Additions (Bn-Metal). W. Brasch (*Tech. Zentr. prakt. Metallbearbeitung*, 1936, **46**, (13/14), 452–458).—Comparative figures for the physical properties of a good high-tin and Bn bearing metals are given which appear to be favourable to the latter. It is stated that the economy in tin which has resulted from the introduction of Bn metal is considerable. Various applications of this type of bearing material are described.—W. A. C. N.

Bearings of Calcium–Sodium Babbitt with Bronze Insertion. —— Dudkinskiy (*Uralskaja metallurgia* (*Metallurgy of Urals*), **1936**, (4), 45).—[In Russian.] A description of the pouring of calcium–sodium Babbitt with bronze insertion for increasing the wear-hardness of bearings.—N. A.

White Metals in Printing. A. Bargilliat (*Usine*, 1936, **45**, (6), 29).—From a paper to the Société de Chimie Industrielle. Average compositions are tabulated for foundry type, linotype, monotype, and stereotype: the mechanical properties and solidification range are related to the special purpose of each material.—P. M. C. R.

Tentative Specifications for Insulated Wire and Cable: Class AO, 30 Per Cent. Hevea Rubber Compound (D 27–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 1059–1085; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 1065–1091).—Cover the conductors, insulation, cable tape, cotton braid, and lead sheaths of class AO rubber insulated wire and cable. The conductor is to be of soft-annealed copper, properly tinned, and requirements as to physical properties are set forth in tables for various diameter wires. The lead sheaths are to consist of Grade II chemical lead or Grade III common lead not less than 99·85% pure as specified in Standard Specifications for Pig Lead.—S. G.

***Treating Water with the Aid of Magnesium Metal.** Hermann Bach (*Water Works and Sewerage*, 1934, **81**, (7), 241–243; *J. Amer. Water Works Assoc.*, 1936, **28**, 149).—Magnesium metal reacts with chlorine dissolved in water in two ways simultaneously: (1) $Mg + 2Cl = MgCl_2$; and (2) $Mg + 2Cl + 2H_2O = Mg(OCl)_2 + 2H_2$, forming magnesium hypochlorite (analogous to calcium hypochlorite). The hypochlorite chlorine is only loosely bound and upon slight acidification (CO_2 content of air) is set free: (3) $Mg(OCl)_2 + 2CO_2 = Mg(CO_3)_2 + 2Cl$. Fortunately, when period of contact is short, reaction (1), forming magnesium chloride, will predominate; but some hypochlorite will also be formed. By proper regulation of velocity of chlorinated water in a filter filled with turnings of chemically pure magnesium, free chlorine can be removed, leaving only a negligible trace of hypochlorite. In practice, magnesium alloys have to be dealt with; it is important to select material with which reaction (1) will predominate. Absolute freedom from carbide is essential, otherwise acetylene will be formed and impart a disagreeable odour to the water. Electrolytic magnesium sometimes contains carbide, derived from graphite electrodes. Chlorine–magnesium reaction products are highly soluble in water, so that the metal surface does not become obstructed. Hardness increase is negligible. Laboratory experiments are described in detail.—S. G.

Tentative Specifications for Magnesium-Base Alloy Sheet (B 90–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 287–290; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 712–715).—Cover commercial magnesium-base alloy sheet having a sp. gr. of 1·8 or less; two alloys are specified, designated Nos. 6 and 11. The requirements as to chemical composition are: No. 6: aluminium 3·3–4·7, manganese (min.) 0·20, copper (max.) 0·05, zinc (max.) 0·3, silicon (max.) 0·5, other impurities (max.) 0·3%, magnesium remainder; No. 11: manganese (min.) 1·20, copper (max.) 0·05, silicon (max.) 0·3, other impurities (max.) 0·3%, magnesium remainder.—S. G.

Tentative Specifications for Magnesium-Base Alloy Forgings (B 91–36T). —— (*Book of A.S.T.M. Tentative Standards*, **1936**, 275–278; and *Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 716–719).—Cover fully-worked commercial magnesium-base alloy forgings having a sp. gr. of 1·9 or less; 6 alloys are specified.—S. G.

Tentative Specifications for Magnesium Ingot and Stick for Remelting (B 92–36T). —— (*Book of A.S.T.M. Tentative Standards*, 1936, 279–280; and *Proc. Amer. Soc. Test. Mat.*, 1936, 36, (I), 704–705).—Cover one grade. The requirements as to chemical composition are: magnesium, by difference (min.) 99·80, total aluminium, copper, iron, manganese, nickel, silicon (max.) 0·20, and total copper and nickel (max.) 0·5%.—S. G.

Tentative Specifications for Magnesium-Base Alloy Ingot for Remelting (B 93–36T). —— (*Book of A.S.T.M. Tentative Standards*, 1936, 281–282; and *Proc. Amer. Soc. Test. Mat.*, 1936, 36, (I), 706–707).—Cover alloys having a sp. gr. of 1·9 or less; 11 alloys are specified.—S. G.

Tentative Specifications for Magnesium-Base Alloy Sand-Castings (B 80–36T). —— (*Book of A.S.T.M. Tentative Standards*, 1936, 283–286; and *Proc. Amer. Soc. Test. Mat.*, 1936, 36, (I), 708–711).—Cover commercial magnesium-base alloy sand-castings having a sp. gr. of 1·9 or less; 5 alloys are specified. The requirements as to tensile properties are tabulated for as cast and heat-treated conditions.—S. G.

Tentative Specifications for Magnesium-Base Alloy Bars, Rods, and Shapes (B 107–36T). —— (*Book of A.S.T.M. Tentative Standards*, 1936, 271–274; and *Proc. Amer. Soc. Test. Mat.*, 1936, 36, (I), 720–723).—Four alloys are specified.—S. G.

Nickel in Australian Industry. —— (*Commonwealth Eng.*, 1936, 24, (2), 71–74).—A review of the principal Australian applications of ferrous and non-ferrous materials containing nickel, with a short analysis of the world production of nickel, showing the proportions used for various purposes in the pure and alloyed conditions.—P. M. C. R.

Monel Metal for Roofing. —— (*Nickel Bull.*, 1936, 9, (7), 141–144).—The Monel metal roof of the Pennsylvania Railway Terminal at New York, erected in 1909, was examined in 1925. It was found that, despite the severe conditions, the gauge varied by only two-thousandths of an inch from its original thickness. The skylights, made from a different metal, corroded and gave constant trouble. Nearly 150 tons of 0·018 in. sheet were used on the roof. The method of fixing the sheets is illustrated.—S. G.

Monel Metal in Pulp and Paper Mills. —— (*Internat. Nickel Co. Bull.* C3, 1935, 20 pp.).—Describes the advantages of Monel metal and nickel in applications where they have found acceptance in the treatment of stock after pulping, in paper machines, caustic recovery, and pumps. Service records reported by a variety of mills are given. Data are included on the engineering properties of Monel metal, nickel, and nickel-clad steel. Properties of "K-," "H-," and "S-" Monel metals are given, as well as the corrosion-resistance of ordinary Monel metal.—S. G.

Nickel and Monel in the Chemical Industries. Kazuo Matsuura and Takashi Okamoto (*Japan Nickel Information Bureau, Tech. Information* B-16 (second edn., revised), 1936, 95 pp.).—[In English and Japanese.] A review (16 pp.) is given of the principal chemical industries of Japan, mentioning the important firms engaged and the applications and service experience of nickel and Monel metal. Problems of design are then discussed, suggested figures being given for working stresses in various types of pressure vessel. A detailed account is then given of the properties of the two materials, particularly their resistance to corrosion by various chemicals under different conditions of concentration and temperature. Two interesting tables show the uses of nickel and Monel metal which have been definitely established by practical experience. The first table is a list of process industries and the chemicals involved, with cross-references to the second table which tabulates the applications of nickel and Monel metal for each chemical.—H. W. G. H.

Stainless Steel, Nickel, and Nickel Alloys Solve Food Equipment Fabricator's Problems. George H. Tay (*Food Ind.*, 1936, 8, (2), 60–61).—Almost all food products can be manufactured or treated in vessels of stainless steel, nickel, or Monel metal. The two latter are recommended for brine products and Monel for fish, or in the chocolate industry. The principles of the design and construction of processing vessels are considered, with illustrations.—P. R.

Monel Metal and Nickel in the Manufacture of Pharmaceuticals, Fine Chemicals, and Proprietary Products. —— (*Internat. Nickel Co. Bull.* C–4, 1936, 16 pp.).—Discusses the advantages of Monel metal and nickel equipment and describes typical uses. Data on physical and mechanical properties are included, as well as a list of many pharmaceutical and fine chemical products regularly handled in Monel metal and nickel equipment.—S. G.

Report of [A.S.T.M.] Committee B-4 on Electrical-Heating, Electrical-Resistance, and Electric-Furnace Alloys. Dean Harvey and F. E. Bash (*Proc. Amer. Soc. Test. Mat.*, 1936, 36, (I), 157–161).—Proposes a new tentative method of test for the flexure-temperature characteristics of thermoflex (thermostatic metals) in the form of flat strips (*Met. Abs.*, this vol., p. 704). The adoption of various revisions to specifications is proposed. Information is given on proposed methods of bend test for wire, comprising 3 types of apparatus and procedures.—S. G.

How to Select Electric Heating Alloys. F. P. Peters (*Product Eng.*, 1936, 7, 19–21).—See *Met. Abs.*, this vol., p. 482.—S. G.

Nickel-Clad Steel. —— (*Nickel Bull.*, 1936, 9, (2), 25–28).—Discusses the manufacture and applications of nickel-clad steel plates, and the fabrication of plant in nickel-clad steel.—S. G.

Heat-Resisting Alloys for the Enamelling Industry. —— (*Nickel Bull.*, 1936, 9, (5), 101–104).—Discusses applications of nickel–chromium–iron alloys. —S. G.

***The Oligodynamic Action of Silver in the Treatment of Water.** J. Gibbard (*Canad. Public Health J.*, 1933, 24, 96–97).—Summarizes the results of experiments on the exposure of water containing *B. coli* to silvered porcelain rings. It is stated that the method cannot be recommended for practical use at the present time.—S. G.

Silvered Organic Materials and Shapes. Fritz Ohl (*Oberflächentechnik*, 1936, 13, (4), 39–40).—The direct deposition of thin films of silver or other ornamental metals on organic base materials may be effected by the vacuum process, in which the metal is derived from a metallic anode.—P. M. C. R.

***Silvering of Mirror Surfaces by Cathodic Sputtering.** M. Romanova, A. Rubzov, and G. Pokrowskii (*Physikal. Z. Sowjetunion*, 1934, 5, (5), 746–760).—[In German.] See *Met. Abs.*, 1934, 1, 328.—S. G.

***Tantalum Carbide: Its Relation to Other Hard Refractory Compounds.** Philip M. McKenna (*Indust. and Eng. Chem.*, 1936, 28, (7), 767–772).—The densities, crystalline form, and lattice dimensions of the carbides of tantalum and columbium were determined. The melting points of carbides of chromium, molybdenum, and tungsten are lower than those of carbon or the metal. Carbides of tantalum, columbium, zirconium, vanadium, hafnium, and titanium have melting points higher than those of the respective metals. Uses of hard carbides of tungsten and tantalum as constituents of tool materials are discussed. Compositions containing 80% tantalum carbide are little affected by acids such as sulphuric or hydrochloric; they are harder than steel, and can be used for cutting such materials as manganese steel, Stellite, Duralloy, Sillichrome, Ilium, &c.—F. J.

Manufacture of Crustless Cheese [Tin Foil and Aluminium Foil]. F. Kieferle (*Milchw. Zentr.*, 1935, 64, 19–23).—The relative merits of tin and aluminium foil for packing purposes are discussed, among other matters. —S. G.

Canned Beer. —— (*Information Circ. Internat. Tin Res. Develop. Council*, 1936, (1), 14 pp.).—The development and possibilities of canned beer are described. Compared with bottles containing equal quantities of beer, cans weigh less than half, occupy less than a third cubic capacity of storage space, cool more quickly in a refrigerator, are impervious to light, are not fragile, and the empty can is non-returnable. Brief details are given of canning methods. Compared with cans employed for foodstuffs, those intended for beer must be stronger and coated internally with different types of lacquer. Heavier gauges of tinplate and more thorough soldering of the seams must be adopted.—W. D. J.

***The Effect of Smena and Sormite Hard Facing on the Structure and Properties of the Base Metal.** Y. B. Biriukow (*Sobshenia Tsentralnogo Instituta Metallov Leningrad* (*Rep. Central Inst. Metals Leningrad*), 1935, (18), 114–130; *C. Abs.*, 1936, 30, 8114).—[In Russian.] Smena (tungsten 20·6, chromium 31·4, nickel 33·5, carbon, 4·2, manganese + silicon 1·6, iron 8·7%) and Sormite (chromium 30, silicon 4·5, manganese 1·1, carbon 3·2, nickel 5·3%, rest iron) were applied to steels containing 0·3–0·8% carbon. Application by the Bernardoss method gave high porosity, uneven surface, and slag inclusions. The oxy-acetylene method gave a dense and clean surface. It caused overheating, however. This can be avoided by using the Slavyanov method with 4–5 mm. rods covered with a special graphite mixture. To obtain good mechanical properties, the material should be quenched in oil and then in water.—S. G.

Modern Ultra-Hard Cutting Materials. H. W. Keeble (*Lincoln Eng. Soc. Ann. Rep. Proc.*, **1936**, 48–59).—Deals with the development, manufacture, and properties of metallic carbide products, and their use as cutting tools. Their influence on machine shop practice and tool design is described.—I. J.

***Zinc in Drinking Water.** A. G. Nolte and W. A. Kramer (*Amer. City*, 1934, **49**, (4), 63–64; *J. Amer. Water Works Assoc.*, 1934, **26**, 1749).—Older literature reveals conflicting opinions and experiences regarding the harmful effects of zinc in drinking water; recent investigations are more in agreement. Drinker and Fairhall suggest that if a limit on zinc is desirable, 30 p.p.m. would be appropriate. N. and K. conducted some experiments with strips of galvanized iron in tap-water, in water with p_H adjusted with lime to 10·5, and also with carbon dioxide, and tests were made of residual zinc in tap samples. The largest concentration of zinc found in water from any much-used tap was 5 p.p.m., which figure was not exceeded until galvanized pipe had stood in tap-water for over 24 hrs. Zinc was found to dissolve readily in strongly acid water and in caustic alkaline solutions; but in water only weakly acid or alkaline, such as drinking water, solution of zinc proceeded slowly. Excess zinc in water turns it opalescent and causes a greasy film on boiling, and hence is æsthetically objectionable. N. and K. conclude that zinc, in amounts as found in drinking water, has no harmful physiological effects, although its appearance is uninviting.—S. G.

Electrolytic Zinc Tubes for Piping Water and Gas. L. Descroix (*Génie civil*, 1934, **105**, 380–382; *C. Abs.*, 1935, **29**, 2896).—The zinc (99·95–99·99% pure) is drawn at 150°–200° C. Above 200° C. the zinc becomes crystalline; below 150° C. it is not sufficiently malleable. The pipes have a high polish, both inside and outside, and can be plated with nickel or copper. They combine the advantages of steel tubes and lead pipes, have unusual resistance to internal pressure, and empty faster than iron pipes. A description of the process at Viviez is given, with drawings and photographs.—S. G.

Anode Materials for High-Vacuum Tubes. E. E. Spitzer (*Elect. Eng.*, 1935, **54**, (11), 1246–1251).—Continued development of the high vacuum valve has played an extremely important part in the development of radio communication. Since the power output of a valve is proportional to the amount of heat that may be dissipated safely from its anode, the anode is one of the most vital parts of high-vacuum valves, especially those used for transmitting purposes. Several materials have been found suitable for the anodes of transmitting valves, depending on the requirements of specific applications and the type of cooling adopted; these materials and their characteristics are discussed.—S. G.

The Applications of Non-Ferrous Metals and Alloys. Clement Blazey (*Commonwealth Eng.*, 1936, **24**, (2), 51–56).—This review includes a short survey of the special brasses, and an enumeration of the alloys principally used in hot-pressing and forging, die-casting, sintering, extrusion, and the production of sheet; special summaries deal with recently developed bearing alloys, with light alloys, materials for use as electrical conductors or resistances, heat-resistant alloys, and with methods of increasing corrosion-resistance.—P. M. C. R.

Specifications for Die-Casting Alloys. —— (*Tech. Zentr. prakt. Metallbearbeitung*, 1935, **45**, (21/22), 561–565).—Tabular specifications for lead-base, light metal-base, and zinc-base die-casting alloys.—W. A. C. N.

Pump Cases, Worn by Silt, Relined with Lead. —— (*Eng. News-Record*, 1935, **115**, 198–199).—The water supply of Boulder City, Nevada, is derived from the Colorado River. Raw water, containing turbidity ranging up to 140,000 p.p.m. and averaging 30,000 p.p.m., is pumped into the settling basin and delivered against a head of 2300 ft. to a treatment plant on the edge of the town. Under these conditions the wear on the pumps, which are rated at 750 g.p.m. against a 115-ft. head when driven at 1760 r.p.m., is very great. The pumps are used until the cast-iron cases become so worn that delivery is only about 65% of the rated capacity, and they are then reconditioned. The original cast-iron case averages 450 hrs. of service, after which it is relined with bronze at a cost of approx. 95% of a new case. The bronze lining gives an average of 650 hrs. of service or 44% more than a cast-iron case. When the bronze lining is worn down to a thickness of about $\frac{1}{8}$ in., the pump is again taken out of service and the casing built up by wiping the worn places with lead. This lead lining costs about 20% as much as a new case and gives an average service of 410 hrs., or 91% of the average from the original case. In wiping the worn bronze casings, if spots are found where the bronze has worn through to cast iron, such places are built up with bronze before the lead wiping is put on. Soft bronze welding rod is used, and common wiping lead or solder for a soft metal finish. Relining with lead can be continued indefinitely.—S. G.

Water Service Materials. W. B. Rollins (*Rep. 8th Missouri Water and Sewerage Conference, Sedalia, Miss.*, **1932**, 40–42; *J. Amer. Water Works Assoc.*, 1935, **27**, 548).—Copper service pipe is flexible, resistant to corrosion, galvanic action, and frost, and costs less than any other complete service pipe except galvanized iron pipe with lead gooseneck, with which it is on about a par, and which it will outlast about three times.—S. G.

Tastes and Odours in Water Supply Caused by Electric Currents. M. W. Cowles (*Amer. City*, 1934, **49**, 59–60; *C. Abs.*, 1935, **29**, 262).—Service pipes of galvanized iron, brass, copper, or lead carrying a current impart flavours to water which are greater than would be expected from the small additional proportion of metal dissolved.—S. G.

Metals and Alloys in Chemical Plant Construction. James A. Lee (*Met. Ind.* (*Lond.*), 1936, **49**, (3), 55–59, 65; (4), 85–88, 95).—Read at the Chemical Engineering Congress of the World Power Conference, 1936. Non-ferrous materials much used in chemical plant include nickel (as structural material or coating), Monel metal and its derivatives, Hastelloy, copper, copper–chromium, red brass, the high copper–nickel alloys, the copper–silicon alloys containing manganese, tin, &c., copper–beryllium, lead, tellurium–lead, aluminium, silver, and precious metals of the platinum group. Applications, which are related to the physical, chemical, and mechanical properties of the respective materials, are enumerated in each case.—P. M. C. R.

†**Metals in the Chemical Industries.** Cecil H. Desch (*J. Soc. Chem. Ind.*, 1936, 55, (26), 169–174).—Jubilee Memorial Lecture. Modern uses for aluminium, tellurium–lead, antimonial lead, silver, and special steels in the chemical industries are described and the properties of the metals which render them useful for the particular purpose are discussed.—A. R. P.

Applications of Modern Metals and Alloys in the Chemical Industry. Paul Bastien (*Tech. moderne*, 1936, 28, (18), 633–637).—The extensive range of ferrous and non-ferrous materials now available for use in industrial chemistry is reviewed, with special emphasis on the increased resistance to corrosion conferred on cast iron and steel by additions of nickel, copper, chromium, molybdenum, and tungsten, on the applications of nickel, the nickel–chromium alloys, and Monel metal, and on the influence of tellurium and copper on the corrosion-resistance of lead.—P. M. C. R.

Materials of Construction for Chemical Engineering. J. McKillop (*Inst. Chem. Eng.*, 1935, 13, 63–76).—A review. Among other materials, lead, homogeneous lead-lined steel, aluminium, copper, nickel-clad steel, and various ferrous materials are dealt with.—S. G.

Constructional Materials [for Chemical Plant]. E. Rabald (*Chem. Fabrik*, 1935, 8, 25–31, 139–145, 155–159).—A review of recent literature. Tables are given of physical properties and corrosion-resistance of various metals and alloys.—S. G.

Metals in the Food Industry. N. D. Sylvester (*Chem. and Ind.*, 1935, 54, (13), 279–282; discussion, 282–283).—The choice of metals for use in food processing or storage is influenced by the effect of the metal on the food and the possible toxicity of any products, the effect of the food on the metal, and the action of cleansing materials on the metal. The importance of traces of certain metallic compounds in individual foods is considered. Conditions influencing the corrosion of ferrous alloys, tinplate, galvanized iron, plain, tinned, and plated copper, chromium plating, silver, nickel, Monel, and aluminium and its alloys are reviewed. In the *discussion* reference was made to the lacquering of nickel cans, the cleaning of aluminium, and the effect of sulphides on nickel.—P. M. C. R.

The Use of Anti-Corrosive Materials in the Construction of Brewery Plant. F. Mall (*Petit J. Brass.*, 1936, 44, 762–764; *J. Inst. Brewing*, 1936, 42, 472).—From *Industrie Cervecera*. From the earliest stages in the brewing process the plant is subject to corrosive action, principally owing to the natural acidity of steeping and germinating grain, of wort, and of beer. Corrosion is most prominent with iron, copper, and zinc; the metal least attacked is aluminium. In the interests of the flavour of the beer, which is readily spoilt by corrosion products, vessels should be lined with enamel, stone, slate, glass, wood, or aluminium. Vessels constructed of aluminium must be kept free from contact with concrete, cement, mortar, lime, copper, or bronze, and the directions of the manufacturers of the plant as to cleaning should be observed.—S. G.

Practical Applications of Oligodynamic Action. W. Raadsveld (*Chem. Week.*, 1934, 31, 505).—In brewing and paper making, copper pipes or treatment of water with copper filings would be advantageous for controlling algæ. The use of beads impregnated with active silver or other metals, Krause's Katadyn process and electro-Katadyn process (electric current between silver electrodes) for the continuous sterilization of water are described. Data are given on the use of the electro-Katadyn process at a small water supply at Heidelberg, at an ice factory, at a brewery, and at a Frankfurt swimming pool.—S. G.

Syrup Room Equipment. G. C. Calvert (*Nat. Bottlers' Gaz.*, 1935, **54**, (647), 78–79; *C. Abs.*, 1937, **31**, 1112).—Stainless steel and glass-lined processing equipment are nearly ideal. The weight of metal, interior finish, method of making the joints, and the construction of the bottom are vital points to both in resisting chemical action and in other performance.—S. G.

The Syrup Room—Construction, Design, Practice. J. H. Toulouse, J. M. Scharf, and Max Levin (*Nat. Bottlers' Gaz.*, 1936, **55**, (652), 42–58; *C. Abs.*, 1937, **31**, 1112).—A standard for construction, including location, floor and wall materials, equipment and layout. Stainless steel, glass enamel, nickel, nickel–chromium alloy, block tin, aluminium bronze, copper, and stoneware are classified as to their degree of suitability for use with hot-process and cold-process syrups with and without added acids, and for pipe-lines, valves, and fittings for syrups of these classes and for carbonated water.—S. G.

***Stainless Steel [and Other Metals] in the Textile Industry.** J. E. Goodavage (*Amer. Dyestuff Rep.*, 1935, **40**, 250–255; *Brit. Chem. Abs.*, **1935**, [B], 625).—A comparison is made of the behaviour of Monel metal and iron–chromium, iron–chromium–nickel and iron–chromium–nickel–molybdenum steels in various textile processing liquors, including liquors for dyeing wool with acid and chrome-mordant dyes, aqueous acetic acid (p_H 3·95), formic acid (2·85), sulphuric acid (2·02), a diazotizing liquor (hydrochloric acid plus sodium nitrite) as used for after-treating fabrics dyed with direct dyes, a bleach liquor (hydrogen peroxide + sodium silicate), a scouring liquor (2% sodium hydroxide + hydrogen peroxide + sodium silicate), and typical direct, sulphur, and vat dye liquors; detailed results are tabulated. Monel metal but not iron–chromium–molybdenum–nickel steel is corroded and coloured by the diazotizing liquor, and this steel is much better than Monel metal for the construction of wool dyeing machines, since it exerted no influence on the shades produced with the 60 chrome-mordant dyes tested. Iron–chromium–nickel–molybdenum steel is satisfactory when used for machines in which bleaching is effected intermittently with aqueous sodium hypochlorite (*d* 1·005–1·015), but it is attacked during prolonged storage of the latter. Monel metal is stained by vat dye liquors and aqueous sodium hypochlorite, but iron–chromium–nickel–molybdenum steel is quite resistant; the latter has a higher tensile strength and a harder surface than Monel metal.—S. G.

Are Metals Permeable by Oil? Augustus H. Gill (*Mech. Eng.*, 1935, **57**, (7), 413–414).—G. quotes the conclusions of Woodbury, Conradson, and Duguid, who extracted oil from used bearing metal by different methods, and describes the extraction of lubricating oil from leaded bronze by solvents.
—P. M. C. R.

Technical Basis of Bearing Construction. E. Falz (*Tech. Zentr. prakt. Metallbearbeitung*, 1936, **46**, (9/10), 326–334).—A study, illustrated by diagrams and curves, of the processes operative between journal and bearing and the intervening oily layer. The factors taken into consideration embrace: the play between shaft and bearing on which depends, in conjunction with the speed, the surge action which imparts circulatory motion to the oil; the parallelism of the moving and stationary portions in order to ensure uniform oiling; shaft bending, the effect of which diminishes as the bearing length decreases; the influence of the position at which the oil is introduced; good and bad arrangements of oil channels; materials for bearings. The article is very informative and well illustrated.—W. A. C. N.

The Bearing Problem in Aero-Engine Construction from the Point of View of Materials. H. Mann and H. Heyer (*Luftfahrtforschung*, 1935, **12**, (5), 168–175; *J. Roy. Aeronaut. Soc.*, 1936, **40**, 133).—Bearings have to be replaced because they wear or crack. Neither factor is amenable to mathematical treatment. Thus, the well-known PV factor only gives a measure of the heat generated in dry friction (brake), and the more recent V/P factor only registers minimum friction, without indicating the safety factor. On the other hand, it is difficult to reproduce working conditions in a testing machine. Recent improvement has been in the direction of materials and design. Bearing metals can be divided into 3 classes: soft, semi-soft, and hard. The soft bearing materials (tin and lead) are satisfactory, provided that no great shock loads have to be dealt with. The bearing metal is cast on to a medium-hard bronze sheet, and recent work has shown that it is an advantage to keep the soft casting as thin as possible (0·3 mm.). Medium hard bearing metals are of the soft bronze type (lead–copper), or have a cadmium-base. These are cast on steel sheets and the bearing usually exceeds 1·5 mm. in thickness. Such bearings withstand shock, but require glass-hard shafts, which add considerably to the expense. Hard bearing metals may consist either of hard bronzes (tin-base), light alloys, or cast-iron. Their use is generally restricted to special cases, *e.g.* pistons, valve guides, connecting-rod bearings, and auxiliary drives. 31 *references* are given.—S. G.

Metals and Modern Alloys in Aero Construction. Paul Bastien (*Tech. moderne*, 1936, **28**, (22), 794–796).—A review of metallic materials used in the construction of aero engines, propellers, bodies, and landing-gear. Light and ultra-light alloys are much used in crank and engine casings, forged structural members, landing wheels and floats, whilst nickel and copper alloys are employed in valve construction.—P. M. C. R.

The Use of Modern Metals and Alloys in the Motor Industry. Paul Bastien (*Tech. moderne*, 1936, **28**, (19), 683–686).—A review of the use of light and ultra-light metals and alloys and of zinc die-casting alloys in the engines, chassis, or body-work of modern commercial or passenger motor vehicles. —P. M. C. R.

Metallic Heat Insulation. J. T. Nichols (*Mech. Eng.*, 1935, **57**, (10), 621–624; discussion, 1936, **58**, (3), 190–192).—The reflectivity of metallic surfaces varies with the wave-length as well as with the nature of the material. Reflectivities at 300° F. (149° C.) are tabulated for various types of coated and uncoated steel sheet, aluminium (rolled and sand-blasted), and black and white paper. The cold-box method of insulation testing, and the integrating reflectometer employed, are described, as are tests on pipe coverings. In the discussion, *R. C. Parlett* emphasizes the superiority of the "guarded hot-plate" testing apparatus, criticizes the results of the pipe test, and refers to the possible loss of reflective power through corrosion or dust. *P. F. McDermott* and *C. E. Weinland* deprecate the use of Wien's equation for the intensity of monochromatic emission, and refer to certain discrepancies in calculating conductivities; they also discuss the possibility of condensation. —P. M. C. R.

Fire-Proofing of Wood and Cloth [by Metallization]. W. Faerman (*Métalliseur*, 1936, **1**, (2), 15–16).—An extract from *J. Marine Marchande.* A short description is given of tests on the fire-proofing value of impregnation by solutions and by coating surfaces with sprayed layers of zinc or nickel–brass. F. deals only with preliminary tests.—W. E. B.

Plating of Porcelain Insulators by the Schoop Method. K. M. Domnich (*Vestnick Elektropromishlennosti* (*Messenger Elect. Ind.*), **1936**, (9), 18–20).—[In Russian.] Preparation of the surface of porcelain insulators may be done either by sand-blasting or, in cases of zinc-spraying by Schoop's method, by coating the porcelain with joiner's glue. Sand-blasting adversely affects the mechanical strength of the insulator. For Schoop-spraying porcelain insulators, aluminium and copper may be used.—N. A.

Materials Used in Radio Manufacture. V. O. Stokes (*Marconi Rev.*, **1936**, (59), 7–18).—The uses and properties of some of the commoner metals, alloys, and non-metallic materials employed in radio manufacture are described. [*Note by abstractor :* The article contains a number of inaccurate statements.] —E. V. W.

New Types of Vacuum-Tight Joints Between Ceramic Materials and Metals. H. Handrek (*Z. tech. Physik*, 1936, 17, (11), 456–459).—Types of joints between glass and porcelain, glass and metal, some already known, some new, are described. The new process is one of shrinking the metal upon the ceramic material. The process is illustrated by the production of various kinds of joints between copper (coeff. of expansion, $\alpha = 165 \times 10^{-7}$) and Calit ($\alpha = 78 \times 10^{-7}$). The junction between metal and ceramic material is coated with a glass of appropriate coeff. of expansion ($\alpha = 63 \times 10^{-7}$).—J. S. G. T.

XXII.—MISCELLANEOUS

(Continued from pp. 607–610.)

N. N. Baraboshkin. Obituary. O. E. Zveginzev (*Izvestia Sektora Platini* (*Ann. Sect. Platine*), 1936, 13, 5–7).—[In Russian.] Obituary.—N. A.

†**The Scientific Organization of Works.** Pierre Chevenard (*J. Inst. Metals*, 1936, **59**, 19–51).—Autumn Lecture, 1936. The place of science in the organization of industrial works is discussed with special reference to what has been achieved in the works of the Société de Commentry, Fourchambault et Decazeville, in particular at the works at Imphy, which specialize in the manufacture of fine steels and precision alloys. The subject is discussed under the five heads of administration suggested by Fayol, *viz.* foresight, organization, direction, co-ordination, and control. The subject-matter makes very interesting and pleasant reading, touching all branches of work done at Imphy, and is interspersed with many suggestive quotations. Apparatus designed to effect control of certain operations, such as a high-sensitivity dilatometer for the control of Invar, apparatus for testing bi-metal strips, and a thermomagnetometer are described.—J. S. G. T.

Report of [A.S.T.M.] Committee B-2 on Non-Ferrous Metals and Alloys. R. F. Mehl and E. E. Thum (*Proc. Amer. Soc. Test. Mat.*, 1936, **36**, (I), 155–156).—A brief report, in which a general reorganization of the Committee is announced.—S. G.

Development and Status of Non-Ferrous Alloys in Germany Since 1933. Willi Claus (*Internat. Giessereikongress, Düsseldorf, 1936, Tech.-wiss. Vorträge*, **1936**, (18), 8 pp.).—[In German.] Commercial and economic necessity is responsible for the trend of research and development work in the German non-ferrous foundry industry. Examples are provided by the light alloys, Silumin–Gamma and Hydronalium, the aluminium-base bearing metals, and the zinc-base alloys. The importance of economy in copper and tin is stressed and the properties of many alloys, developed with this in view, are tabulated. —H. W. G. H.

Non-Ferrous Metallurgy in 1935. A. I. Boot (*Zvetnye Metally* (*Non-Ferrous Metals*), **1936**, (3), 3–15).—[In Russian.]—S. G.

Scientific Bases of Smelting and Metallurgy. Georg Masing (*Metall u. Erz*, 1936, 33, (16), 432–434).—A lecture stressing the importance of a knowledge of the fundamentals of physical metallurgy to the smelter and metal worker. —A. R. P.

Problems on the Borderline Between Smelting Technique and Metal Technique. P. Röntgen (*Metall u. Erz*, 1936, 33, (17), 461–466).—The use of segregation phenomena and parting processes depending on " resistance limits " (Tammann) in refining processes is discussed with reference to recent work.—A. R. P.

Man and Machine in German Foundries. Karl Arnhold (*Internat. Giesserei-kongress, Düsseldorf, 1936, Tech.-wiss. Vorträge,* **1936,** (33), 8 pp.).—[In German.] Rhetoric.—H. W. G. H.

The Functions of a Technical Information Bureau. Ernest S. Hedges and C. E. Homer (*Assoc. Special Libraries Information Bureau Rep. Proc.,* **1935,** 30–37; and *Misc. Publ. Internat. Tin Res. Develop. Council,* 1935, (3), 8 pp.). —S. G.

Recent Advances in the Aluminium Industry. Francis C. Frary (*Trans. Electrochem. Soc.,* 1936, **70,** 131–141).—See *Met. Abs.,* this vol., p. 483.—S. G.

Chemical Fire Extinguishment [Danger of Aluminium Powder]. C. B. White (*Safety Eng.,* 1936, **71,** (1), 31).—The dangerous possibilities of aluminium powder are emphasized in the concluding paragraph; most modern extinction agents intensify the combustion of this material.—P. M. C. R.

***The " Casting-On " of a Sword Hilt in the Bronze Age.** Herbert Maryon (with A. J. Smythe) (*Proc. Soc. Antiquaries Newcastle-upon-Tyne,* 1935, [iv], **7,** (1), 41–42).—Briefly describes a bronze sword found in the Tyne. A drawing shows the hilt only. In ancient times the blade was broken from the hilt, and was subsequently provided with a new hilt. The failure occurred at a weak spot between the rivet holes. *A. J. Smythe,* who made a metallographic examination, states that the blade is of cast bronze with an estimated tin content of 7%. The handle is also of cast bronze, richer in tin than the blade, the estimated tin content being 10–12%. The metal contains numerous blowholes and the structure shows evidence of more rapid cooling than the blade. The joint between the blade and handle has numerous non-metallic inclusions. The structure is indeterminate, but passes in a very short distance into those which characterize the blade and handle. From S.'s report it appears that at the time of casting of the hilt it was fused on to the blade; there is no sign of any separate soldering or brazing. An examination of the drawing shows what was probably the jet or gate by which the molten metal entered the mould.—S. G.

Mercury in U.S.A. I. M. Krasnopolski (*Redkie Metalli* (*Rare Metals*), 1936, **5,** (6), 36–72).—[In Russian.] A description of the production of mercury at certain works in U.S.A.—D. N. S.

Development of the Tin Industry in the U.S.S.R. N. N. Muratch (*Zvetnye Metally* (*Non-Ferrous Metals*), **1936,** (3), 16–26).—[In Russian.]—S. G.

Note on a Seventeenth-Century Discourse on Tin as a National Asset. S. W. Smith (*Trans. Inst. Min. Met.,* 1936, **45,** 503–505).—See *Met. Abs.,* this vol., p. 604.—S. G.

Rare Metals in Industry. E. P. Libman (*Redkie Metalli* (*Rare Metals*), 1936, **5,** (6), 32–35).—[In Russian.] A review.—D. N. S.

Procedure for Proper Maintenance of Industrial Dust Control Systems. C. A. Snyder (*Steel,* 1936, **99,** (5), 58).—Maintenance and inspection methods for dust control systems are summarized, and the air speeds required to convey various types of metallic and other dusts through extraction ducts are tabulated.—P. M. C. R.

Handling Acids Safely. R. W. Parks (*Safety Eng.,* 1936, **71,** (6), 245–248; **72,** (7), 29–30, 32).—An illustrated review of precautions and safety equipment recommended in the handling, transport, and storage of acids and for the protection of workmen.—P. M. C. R.

The Engineering Control of Occupational Disease Hazards. Warren A. Cook (*Safety Eng.,* 1936, **71,** (1), 39–40, 44; (2), 85–88).—This review includes a description of tests of the lead content of air in type-setting rooms; lead concentrations at various temperatures are tabulated, and methods of control are discussed. Important features of equipment for the protection of sand-blasters are described. A table summarizes the legal position regarding compensation for 63 types of occupational risk, including several forms of metal poisoning, in the U.S.A., Canada, and Great Britain.—P. M. C. R.

Report of [A.S.T.M.] Committee E-9 on Research. P. H. Bates and C. L. Warwick (*Proc. Amer. Soc. Test. Mat.*, 1936, 36, (I), 545–549).—Contains a brief summary of the research activities and the work of the research committees of the Society.—S. G.

More Research. Willis R. Whitney (*Trans. Electrochem. Soc.*, 1936, 70, 4–11).—An address.—S. G.

Leadership—or Scientific Research? Clement J. Freund (*Mech. Eng.*, 1936, 58, (4), 230–232).—S. G.

The Institute of General and Inorganic Chemistry of the Academy of Sciences. N. S. Kurnakow (*Uspehi Khimii* (*Progress of Chemistry*), 1936, 5, (7/8), 957–971).—[In Russian.] Among those of various other departments, the investigations of the department of metallic equilibria are examined, dealing with platinum, iron, and other metals. Investigations on the formation of chemical compounds and phases of variable composition are specially noted.—N.A.

Investigations of the Institute of General and Inorganic Chemistry in the Field of Metallic Equilibria. G. G. Urasov (*Uspehi Khimii* (*Progress of Chemistry*), 1936, 5, (7/8), 1083–1107).—[In Russian.] A survey of papers on light alloys. In the aluminium–magnesium–silicon system the maximum mechanical properties produced by ageing occur with alloys on either side of the quasi-binary section Al–Mg_2Si, which have a composition which falls on lines representing the simultaneous saturation of the ternary solid solution by two phases.—N. A.

Statistics in the Service of Engineering. Dudley L. Walton (*Trans. Liverpool Eng. Soc.*, 1936, 57, 207–225; discussion, 226–232).—S. G.

XXIV.—BOOK REVIEWS

(Continued from pp. 618–627.)

Printing Metals. Cr. 8vo. Pp. vii + 92, with 15 plates and 9 illustrations in the text. 1936. London: Fry's Metal Foundries, Ltd., Tandem Works, S.W.19. (Limited free circulation.)

That such a large amount of information should have been collected in so small a space without detriment to the style or quality is greatly to the credit of the writers. Some sixteen pages are employed to describe simply and clearly the principles of equilibrium diagrams, and this is then followed by a short account of the tin–lead–antimony alloys based principally upon the researches of Dr. Frances D. Weaver (*J. Inst. Metals*, 1935, 56, 209). A series of 15 particularly fine photomicrographs by Dr. Weaver are used to illustrate the structures of a complete range of type metals.

Under the headings of Linotype, Intertype, Typograph, Monotype, Type-casting, Stereotype, and Electro backing metals are then discussed the most suitable alloys for these processes, their physical properties, and the specific casting conditions and peculiarities. Subsequent sections deal with the effects of impurities, melting losses, fluxes, depreciation, remelting of type and slugs, temperature control, automatic ingot feeders for slug-casting machines, and dross containers.

One cannot but be impressed that the writers are acquainted not only with the metallurgy of these alloys but are completely conversant with the details connected with their use. The information recorded is modern and accurately quoted, and the style is particularly pleasant.
—W. D. Jones.

Berufskunde für Former. Von Heinrich Giljohann. 15 × 21 cm. Pp. 104, with 116 illustrations. 1935. Berlin u. Leipzig: Julius Beltz. (R.M. 3.50.)

The five sections of this small book deal respectively with moulding materials (sand, loam, &c.); moulders' tools; moulding boxes and accessories; drying apparatus for moulds and cores; and moulding methods. In the last section, sand moulding by hand and machine, and loam moulds are considered in some detail, whilst permanent moulds and die-casting are more briefly discussed. Attention is concentrated on iron and steel, but much of the information given is applicable to non-ferrous work. The book is intended for foundry apprentices, to whom it can be recommended as sound, concise, and clearly written.—H. W. G. Hignett.

Handcraft in Wood and Metal. A Handbook of Training in Their Practical Working for Teachers, Students, and Craftsmen. By John Hooper and Alfred J. Shirley. Fifth Edition, Revised and Enlarged. Med. 8vo. Pp. viii + 332, with numerous illustrations. 1936. London: B. T. Batsford, Ltd. (10*s.* 6*d.*)

That this is its fifth edition is sufficient evidence of the popularity of this book, which describes models for three-year courses in wood- and metal-working. For its instruction in craftsmanship, one must express admiration for this excellently published work; but one could wish that the authors had avoided giving metallurgical information which is often misleading and sometimes inaccurate. The table on p. 149 is, for example, of little value; although it is true that aluminium " can be cleaned by immersion in caustic potash and soda," the process has certain disadvantages; and there is a most curious definition on p. 312—" Alloy steels—steels containing other elements with and without carbon or iron." The printing and illustrations are excellent, and, considered in relation to the price of the book, provide an example of which many publishers of metallurgical works might well take notice.—H. W. G. Hignett.