I.—PROPERTIES OF METALS

(Continued from pp. 337–343.)

On the Alleged Allotropy of Antimony. A. Schulze and L. Graf (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1933, **16**, (2), 459–462).—Reprint from *Metallwirtschaft*, 1933, **12**, 19–21; see *J.*, this volume, p. 177.—M. H.

Measurements Employing Liquid Helium. XV.—Resistance of Barium, Indium, Thallium, Graphite, and Titanium at Low Temperatures. W. Meissner, H. Franz, and H. Westerhoff (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1932, **16**, 107–115).—Reprint from *Ann. Physik*, 1932, [v], **13**, 555–563; see this *J.*, 1932, **50**, 593.—M. H.

The Exact Measurement of the Specific Heats of Solid Substances at High Temperatures. XI.—On the Remarkable Behaviour of Beryllium after Preliminary Heating above 420° C. F. M. Jaeger and E. Rosenbohm (*Proc. K. Akad. Wet. Amsterdam*, 1932, **35**, 1055–1061).—[In English.] Ordinary beryllium, heated at 100° C. and dropped into the calorimeter, behaves normally; but, if the metal has been heated previously at a temperature above 420° C., its rate of loss of heat when cooled from 100° C. is extended over a very long time interval. When beryllium is heated at 900° C., dropped into solid carbon dioxide, and then placed in liquid air, heat is developed for a period of 40–90 minutes. The metal reverts to its normal behaviour when kept for some months. There is no additional heat effect superimposed on the heat given up by the heated metal. No explanation of this thermal hysteresis is offered, but it is shown that allotropy or changes in thermal conductivity cannot account for it. No difference could be detected in the physical properties in the two states, other than in the transfer of heat.

—E. S. H.

On the Question of the " Transformation Points " of Bismuth and Copper. J. Arvid Hedvall, R. Hedin, and E. Andersson (*Z. anorg. Chem.*, 1933, **212**, 84–90).—Dilatometric measurements have confirmed the work of Cohen (1913–1915) that transformations occur in bismuth and copper at 74·5°–75·1° C. and 68·2°–71·0° C., respectively. The " transformation " is not a polymorphic change, but seems to be due to alterations in the secondary (so-called " mosaic ") structure of the crystals (see A. Goetz, this *J.*, 1930, **43**, 521). These changes are occasioned by periodic fluctuations (contractions) of the lattice parameter; they can also be detected chemically, since the reactivity (determined by dissolution experiments in 1·84*N*-nitric acid and 0·13*N*-iodine for bismuth, and in 0·44*N*-nitric acid for copper) reaches a maximum during the transformation process.—M. H.

$\alpha \rightleftharpoons \beta$-**Transformation of Calcium.** Fritz Ebert, Hellmuth Hartmann, and Hans Peisker (*Z. anorg. Chem.*, 1933, **213**, 126–128).—The polymorphic transformation of calcium at about 450° C. found by Rinck (cf. *J.*, 1932, **50**, 601) has been confirmed by X-ray analysis; β-calcium is stable above 450° C., has a hexagonal close-packed lattice : $a = 3·98$ A., $c = 6·52$ A., $c/a = 1·639$, elementary volume $= 89·4$ A.^{3} with two atoms in the elementary cell, $d_{calc.} = 1·48$ at 450° C. (compared with $d_{calc.} = 1·55$ for α-calcium at 18° C.).—M. H.

On the Hydrogen Content and the Hardness of Electrolytic Chromium. —— Guichard, —— Claussmann, —— Billon and —— Lanthony (*Compt. rend.*, 1933, **196**, 1660–1663).—Chromium was deposited on the single face of a copper cathode from a solution of chromic acid and violet chromium sulphate,

using a lead anode and a current of 26 amp./dm.^{2} at 4·8 v. The resultant deposit contained 99·5% chromium and had a Brinell hardness of 463 in one case and more than 500 in another. Hydrogen was fractionally extracted in a dry vacuum as previously described, and so extracted was very pure, but the process is very slow, requiring several days' heating at each temperature. The evolution of hydrogen is high at low temperatures and then slows down considerably, being nearly complete at about 500° C. In the first case, the hardness did not diminish until above about 380° C., at which temperature 96% of the total hydrogen had been evolved. In the second case, the hardness began to decrease a little below 300° C., but was still 463 at 320° C., 95% of the hydrogen having been eliminated. Above 485° C., no more hydrogen was evolved, but the hardness continued to fall with increasing temperature to 168. Thus, as in the case of iron, nickel, and cobalt, it is concluded that the high Brinell hardness of electrolytic metals is independent of their hydrogen content.—J. H. W.

The Solubility of Oxygen in Gold and in Certain Silver–Gold Alloys. F. J. Toole and F. M. G. Johnson (*J. Physical Chem.*, 1933, 47, 331–346).—The solubility of oxygen in gold has been measured over the temperature range 300°–900° C. at pressures between 11·9 and 70·0 cm. of mercury, and found to be of the order 0·010 vol. per vol. of metal at the highest temperature and pressure used. The solubility of oxygen in three silver–gold alloys containing 5, 10, and 20% of gold has been measured between 200° C. and 850° C. and under pressures of from 5 to 80 cm. of mercury. Above a certain "critical" temperature, the solubility Q at $t°$ C. is given by $1/Q = K_1(A-t)$. A denoting the m.p. of the alloy; the solubility is a function of the percentage concentration, C, of gold in the alloy and is given by $1/Q = K_2(C+5·7)$. Below the "critical" temperature, the apparent solubility is related to the pressure, P, by the equation $Q = aP^K$, in which K diminishes with decreasing temperature; the relation between solubility and temperature and that solubility and concentration are complicated by the appearance of minima in the curves. Solubility phenomena below the "critical" temperature are explained in terms of surface effects. Nitrogen is insoluble in gold and in the alloys studied.—J. S. G. T.

Measurements Employing Liquid Helium. XVII.—Resistance of Lead in a Magnetic Field at Temperatures Below the Superconductivity Point. W. Meissner (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1932, 16, 127–134).—Reprint from *Ann. Physik*, 1932, [v], 13, 641–648; see this *J.*, 1932, 50, 594.—M. H.

The Isotopic Constitution and Atomic Weight of Lead from Different Sources. F. W. Aston (*Proc. Roy. Soc.*, 1933, [A], 140, 535–543).—Ordinary lead and a number of radiogenic leads have been analyzed with the mass-spectrograph by means of their volatile methyls and the abundance of their isotopes has been estimated. The mass numbers and relative abundances of the isotopes present in ordinary lead are: 203, 0·04; 204, 1·50; 205, 0·03; 206, 27·75; 207, 20·20; 208, 49·55; 209, 0·85; 201, 0·08, corresponding with a mean mass number 207·190. The present accepted international atomic weight of lead is 207·22. The mean mass numbers of samples of radiogenic leads containing only isotopes 206, 207, and 208 ranged from 206·067 to 207·895.—J. S. G. T.

Revision of the Atomic Weight of Selenium. Synthesis of Silver Selenide. O. Hönigschmid and W. Kappenberger (*Z. anorg. Chem.*, 1933, 212, 198–208).—Analysis of silver selenide gave an atomic weight of 78·962 for selenium.
—M. H.

Limitation of Our Fundamental Knowledge of the Properties of Metals. F. O. Clements (*Met. Ind. (Lond.)*, 1932, 40, 323–324, 353–354).—Abstract of a paper read before a joint meeting of the New York Metals District of the American Society for Testing Materials, and the Iron and Steel Division of the

Institute of Metals Division of the New York Section of the American Institute of Mining and Metallurgical Engineers with the co-operation of the New York Section, American Welding Society. The following points are discussed: The fundamental properties of metals and the possibilities of various alloy combinations, stress being laid on their infinite variety; the limited state of our knowledge of the properties and possibilities of alloys, in spite of the vast amount of research that is being conducted on them annually; " Automobileium," the ideal alloy; the necessity for further knowledge of the atomic arrangement of the alloy molecule and its application to the interpretation of test results; problems awaiting solution.—J. H. W.

II.—PROPERTIES OF ALLOYS

(Continued from pp. 343–350.)

Measurement of Viscosity of Molten Light Alloys, Copper Alloys, and Cast Irons at High Temperatures by the Rotating Cylinder Method. Daikichi Saito and Tatsuo Matsukawa (*Mem. Coll. Eng. Kyoto Imp. Univ.*, 1932, **7**, 49–114).— [In English.] The rotating cylinder method has been adapted to the measurement of the viscosity of molten metals and alloys. Data are given, representing the experimental results for aluminium and the alloys aluminium–copper, aluminium–zinc, aluminium–copper–zinc, aluminium–silicon, aluminium–copper–nickel, aluminium–copper–nickel–magnesium, Silumin, aluminium–bronze, bronze, phosphor-bronze, brass, gun-metal, and manganese–brass. Two change points were observed in aluminium and the light alloys at 765° and 855° C., respectively, and their existence was confirmed by thermal analysis and measurements of electrical resistance. The modification of Silumin appears to be connected with the change at 765° C.; by modification the change point is moved to a lower temperature.—E. S. H.

Research on the Preparation of Aluminium–Barium Alloys. E. Alberti (*Metall u. Erz*, 1933, **30**, 231–233).—Alloys with up to 7% barium can be prepared by addition of metallic barium to molten aluminium at 900° C. under a layer of barium–potassium chloride flux. A Thermit reaction with a 3 : 1 mixture of barium peroxide and aluminium powder yielded an alloy with 46·5% barium; with a 2 : 1 mixture the alloy contained 47% barium, and with a 6 : 2 : 3 mixture of barium peroxide, baryta, and aluminium a 54%-barium alloy was obtained. Small amounts of barium can be introduced into aluminium by stirring the metal at 1000°–1100° C. under a eutectic flux of barium chloride and fluoride (83 : 17) and adding baryta.—A. R. P.

Occurrence of CuAl₂ in Duralumin. L. W. Kempf (*Phys. Rev.*, 1933, [ii], **43**, 942–943).—A note. The conclusions of Clark and Smith (*J.*, this volume, p. 294) concerning the presence of $CuAl_2$ in an old Duralumin aeroplane propeller blade are criticized. Commercial heat-treated forgings of the 25ST alloy usually contain excess undissolved $CuAl_2$, and K. considers that further evidence is necessary before it can be concluded that $CuAl_2$ can be precipitated by stress alone.—W. H.-R.

Research on the Electrochemical Potential of Duralumin in Relation to the Heat-Treatment and Ageing. Hiroshi Imai and Masami Hagiya (*Ryojun Coll. Eng. Publ.* No. 36, 1933, 1–9).—[In German.] On quenching Duralumin from 510° C. the potential becomes electronegative and remains unchanged for 10 days at room temperature. On ageing the alloy at 100° C., the potential becomes electropositive, and after annealing the alloy at 200° C., the potential reaches its original value. No indication of the separation of an intermetallic compound or of any change in the solid solution was obtained after ageing for 10 days at 20° C.—A. R. P.

Beryllium. Developing Its Use in Industry. W. H. Bassett (*Min. and Met.*, 1933, **14**, 227–228).—The properties of copper alloys with 2·5–2·75% beryllium are described.—A. R. P.

Hard Metals, Their Development and Importance. F. Polzguter (*Schweiz. Verband für die Materialprüfungen der Technik, Diskussionsber.*, No. 24, 1932, 23–32).—The preparation, properties, and uses of alloys of the Stellite type and of sintered carbide alloys of the Widia type are described.—A. R. P.

Structural Transformations in the Binary System Iron–Cobalt. A. Kussmann, B. Scharnow, and A. Schulze (*Z. Metallkunde*, 1933, **25**, 145–146).—Report of a paper published in *Z. tech. Physik*, 1932, **13**, 449–460. See *J.*, this volume, p. 182.—M. H.

Physical Properties and Structure of the Binary System Iron–Cobalt. A. Kussmann, B. Scharnow, and A. Schulze (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1933, **16**, (2), 437–448).—Reprint from *Z. tech. Physik*, 1932, **13**, 449–460. See *J.*, this volume, p. 182.—M. H.

On the Thermal Expansion of Manganin. A. Schulze (*Wiss. Abhandl. Physikal.-Tech. Reichsanst.*, 1933, **16**, (2), 467).—Reprint from *Z. tech. Physik*, 1933, **14**, 89–90. See *J.*, this volume, p. 234.—M. H.

On the Nature of the β-Transformation in Copper–Tin Alloys.—II. Hiroshi Imai and Masami Hagiya (*Mem. Ryojun Coll. Eng.*, 1932, **5**, 77–89).—[In German.] Dilatometric investigation of the kinetics of the eutectoidal decomposition of β-bronze has confirmed the results obtained by electrical resistance methods (see *J.*, 1932, **50**, 224), but the curves obtained are more complex. On annealing quenched β-bronze at 250°–350° C., the resistance falls sharply to 60% of its original value, and at the same time the etching characteristics of the alloy undergo a sharp change, in that the individual crystals develop a striped appearance, probably due to the presence of layers in different stages of the transformation; on further annealing, the striped crystals are replaced by new small crystals. From these results it is suggested that the decomposition of β proceeds in three stages, as follows : $\beta \rightleftharpoons \beta' \rightleftharpoons \beta'' \rightleftharpoons \alpha + \delta$. The martensitic needle-like structure obtained by quenching β bronze with a low tin content disappears on annealing at 450°–500° C. and is therefore not α, but probably β′; this decomposition takes place very slowly, but at the same rate as the fall in electrical resistance. The unstable structure frequently observed in quenched α + β bronzes is explained on the assumption of a stepped decomposition of the β-phase.—A. R. P.

Enquiry into the Manufacture of Gold-Filled Spectacles. Anon. (*Joint Council of Qualified Opticians*, 1932, Nov., 1–34).—From a complete study of the processes used in the manufacture of gold-filled spectacle frames supported by photomicrographic examination of the products, the following conclusions are reached : The best gold coating, from the point of view of hardness, colour, and resistance to acid, is 12 carat; gold solder, and not silver solder, should be used in all joints, which should be electrically soldered in preference to any form of gas soldering, and should be so made that the outer gold coating covers any exposed base metal to avoid corrosion; the internal core wire should be of non-corrosive material, and should be properly protected by internal and external wrappings of gold-filled wire, which should be consolidated by efficient mechanical treatment; the parts of the frame in contact with the skin should be made of better quality metal with a thicker gold covering; tumbling (barrel polishing) should be used for the final polishing, to avoid damage to the outer surface; testing of finished frames should be made by photomicrography as well as by chemical methods, and all soldered parts should be excluded in making an assay.—A. R. P.

Preparation of White Gold. Anon. (*Metallurgia*, 1933, **8**, 56).—An alloy is discussed which, in regard to physical properties, resembles platinum and has the advantage of a lower cost. It is manufactured by melting together 25% of a primary alloy and 75% of bright gold. Special care is required in the manufacture of the primary alloy, which consists of gold, nickel, zinc, copper, and manganese, the proportions of which vary according as a soft or hard 18-carat white gold is desired. The procedure adopted in preparing

the primary alloy is briefly considered, and the influence of the various constituent metals on the physical properties referred to. The alloy also possesses all the physical properties which permit of it being readily worked or machined either in the hot or cold conditions.—J. W. D.

Dissolution Experiments with Single Crystals of Gold–Silver Alloys. E. Schiedt (*Z. anorg. Chem.*, 1933, **212**, 415–419).—No differences are observable in the rate of dissolution in 33 or 65% nitric acid at 25° C. of single-crystal and polycrystalline gold–silver alloys containing 37–44·6 atomic-% gold. The rate of dissolution of single crystals with 38 ± 5 atomic-% gold in 33% nitric acid at 25° C. is practically independent of the orientation.—M. H.

Tellurium Lead. Anon. (*Indust. Chemist*, 1933, **9**, 159–160).—A review of published work.—E. S. H.

On Lithium Alloys. I—Thermal and X-Ray Analysis of the System **Lithium–Tin.** A. Baroni (*Atti R. Accad. Lincei Rend.*, 1932, [vi], **16**, 153–158; *Chem. Zentr.*, 1933, **104**, I, 1002).—The system contains three compounds, Li_4Sn (m.p. 684° C.), Li_3Sn_2 (m.p. 483° C.), and $LiSn_4$. Eutectics occur at 458° C. and 35 atomic-% tin, at 320° C. and 58 atomic-% tin, and at 214° C. and 94 atomic-% tin. X-ray analysis confirms the existence of Li_4Sn and Li_3Sn_2, but not that of $LiSn_4$.—A. R. P.

Contribution to the Study of the Constitution of Ternary Alloys of Magnesium, Copper, and Silicon. Albert Portevin and Maurice Bonnot (*Compt. rend.*, 1933, **196**, 1603–1605).—An investigation of the ternary system magnesium–copper–silicon was made by studying the alloys corresponding with the intersections of lines joining the known compounds, Mg_2Cu, $MgCu_2$, Mg_2Si, and Cu_3Si, on the ternary diagram. A compound Mg_2Cu_3Si, melting at 927° C., was established, and the quadrilateral, $Mg–Mg_2Cu–Mg_2Cu_3Si–Mg_2Si$, was more particularly studied by thermal analysis and microscopically. In this region there are 2 quasi-binary systems, the one having a eutectic of Mg_2Cu_3Si–Mg_2Cu with a composition closely approaching Mg_2Cu and melting at 565° C., and the other a eutectic of Mg_2Cu_3Si–Mg_2Si containing 16% of Mg_2Si and melting at 857° C. The 2 sections formed by the diagonals of the quadrilateral have the one a peritectic at 508° C., and the other a ternary eutectic of $Mg–Mg_2Cu–Mg_2Si$ containing copper 32·5% and silicon 0·4%, and melting at 479° C. The peritectic reaction is always incomplete.—J. H. W.

New Nickel–Chromium Alloy [Inconel]. Anon. (*Found. Trade J.*, 1933, **48**, 410).—Inconel is a nickel alloy containing 12–14% of chromium and about 6% iron. It is said to have about the same working qualities as fine nickel, to be easily soldered and brazed, to be stainless, and highly resistant to corrosion.—J. H. W.

An Investigation of Methods of Decarburizing Iron–Nickel–Chromium Alloys. Russell Wendt Dayton (*Rensselaer Polytech. Inst. Eng. Sci. Ser. Bull.* No. 41, 1933, 1–28).—Decarburizing experiments on (A) Nichrome containing carbon 1·09, silicon 0·62, manganese 0·57, chromium 9·65, and nickel 60·50%, balance iron, and (B) KA2 steel containing the same elements in the following proportions 1·21, 0·22, 0·08, 16·88, and 10·22%, have been made in magnesia-lined graphite crucibles heated in an Ajax–Wyatt high-frequency induction furnace. The Nichrome was most effectively decarburized with ferrous oxide, whereas chromium sesquioxide is the most effective slag for KA2 steel. After removal of the carbon, deoxidation with aluminium or magnesium is necessary to obtain a workable alloy. The equilibrium constant for the removal of carbon by ferrous oxide from metal containing 0·038–0·375% carbon and 0·014–0·053% oxygen is 66×10^{-6} at 1500° C. In the Nichrome alloy the minimum carbon content attainable under a 100% ferrous oxide slag is 0·056% at 1400° C. and 0·032% at 1600° C. The use of oxide slags as decarburizers is preferable to blowing with oxygen, since the former method results in a much smaller loss of chromium by the metal.—A. R. P.

Characteristics of Monel Metal. Anon. (*Machinist (Eur. Edn.)*, 1933,

77, 309–310).—Tables give the mechanical property ranges, minimum mechanical properties, the physical properties, and the results of mechanical tests of standard products.—J. H. W.

Some Nickel–Bronze Alloys. Anon. (*Nickel Bulletin*, 1933, **6**, 83).—A few notes on the use of nickel in copper–tin alloys.—J. H. W.

The Structure of the Iron–Nickel Alloys. W. Broniewski and J. Smolinski (*Compt. rend.*, 1933, **196**, 1793–1796).—Continuing previous experiments (cf. this *J.*, 1932, **50**, 351, 474 *et ante*), the following properties of the iron–nickel alloys from 0–100% nickel have been investigated : electrical conductivity; temperature coeff. of electrical resistance from 0° to 100° C.; e.m.f. at 0° C. compared with lead, and its variation between − 80° C. and + 100° C.; coeff. of expansion at 0° C., and its variation between 17° and 444° C.; loss in ergs/grm. for a cycle of hysteresis in a field of 150 gauss, and the coeff. of specific magnetism in fields of 5 and 800 gauss. Specimens, after melting *in vacuo*, were annealed for 100 hrs. at 950° C. *in vacuo* and slowly cooled. The most important single points occurred between 25% and 35% of nickel, and did not correspond with any compound. The compound $FeNi_3$ was confirmed. Up to 28% nickel, there is a solid solution of $FeNi_3$ in iron; from 28% to 32% nickel, a mixture of 2 solid solutions; from 32% to 67·8%, a solid solution of iron in $FeNi_3$, and above 67·8% a solid solution of nickel and $FeNi_3$.—J. H. W.

Equilibrium Diagram of the Iron–Nickel–Tungsten System. Kazimir Winkler and Rudolf Vogel (*Arch. Eisenhüttenwesen*, 1932, **6**, 165–172; *Chem. Zentr.*, 1933, **104**, I, 1993).—After briefly describing earlier work, a theoretical review of the system is given in which are discussed the primary crystallization, the equilibria in the secondary crystallization, and the transformations in the solid state. Finally, the equilibrium diagram has been investigated by thermal, magnetic, and micrographic methods. The four primary saturation surfaces, on which with falling temperature ternary α, ternary γ, Fe_3W_2, and a ternary solid solution (S) very rich in tungsten separate successively, have been determined. Two 4-phase equilibria occur, *viz.*, (1) liquid + $\alpha \rightleftharpoons \gamma + Fe_3W_2$ at 1465° C. and (2) liquid + $Fe_3W_2 \rightleftharpoons \gamma + S$ at 1455° C. The secondary saturation surface of S and of Fe_3W_2 as well as the $\alpha \rightleftharpoons \gamma$ transformation points in the solid state have been ascertained by examination of the structure of specimens annealed and quenched at various temperatures. and the magnetic transformation points of various ternary alloys have been determined by magnetometric measurements.—A. R. P.

Alloys of Praseodymium and Magnesium. G. Canneri (*Metallurgia italiana*, 1933, **25**, 250-252).—The system has been studied by thermal and micrographic methods. Two well-defined compounds exist : PrMg melting at 767° C. and $PrMg_2$ melting at 798° C., which form a continuous series of solid solutions; the existence of a third compound Pr_3Mg, stable only between 528° C. and 752° C., is determined from the behaviour of alloys containing up to 40 atomic-% magnesium. The physical and chemical properties of these alloys are similar to those of magnesium and lanthanum.—G. G.

Testing of [Dental] Amalgams. H. Sieglerschmidt and H. Arndt (*Deut. Zahnärztl. Woch.*, 1931, **34**, (23); *Mitt. Material.*, 1932, 200–202; *C. Abs.*, 1933, **27**, 2536).—Compression, flow, and cutting tests and determinations of the change in length on ageing of silver–tin amalgams containing 68% silver indicate that these properties are subject to considerable variation according to the treatment used in grinding and mixing the constituents and in preparing the test-piece. By the use of sufficient pressure in forming the specimen, the expansion which occurs on hardening may be completely suppressed, and with very heavy pressures a contraction may occur. Maximum strength is obtained after grinding for 6 minutes. With a high forming pressure, higher strength and a smaller flow under constant pressure are obtained. Expansion tests beginning 15 minutes after amalgamation show that at first the amalgam

contracts, generally for 30–60 minutes, and then expands during the following 24 hrs.; occasionally a small contraction takes place afterwards.—S. G.

Coefficients of Linear Expansion of Antifriction Metals. A. A. Botchvar and A. A. Maurakh (*Zvetnye Metally* (*The Non-Ferrous Metals*), 1930, 504–507; *C. Abs.*, 1933, 27, 689).—[In Russian.] Samples of antifriction metals were prepared in a hydrogen atmosphere and tested for their coeff. of expansion from 20° to 200° C. Sample No. 0 contained 100% tin and had α (linear coeff. $\times 10^{-6}$) = 23·50; No. 1, tin 83, antimony 12%, α = 24·20; No. 2, tin 16, antimony 16, lead 65, copper 3%, α = 26·50; No. 3, tin 16, antimony 15, lead 70, copper 3%, α = 27·40; No. 4, tin 5, antimony 15, lead 77, copper 3%, α = 28·40; No. 5, antimony 17, lead 81·5, copper 1·5%, α = 26·5; No. 6, lead 98·9, calcium 0·6, sodium 0·5%, α = 36·3. The lowest critical points of these alloys are, in the order given above, 232, 235, 243, 243, 243, 243, and 325.—S. G.

Carbides in Carbon Containing Alloys of Tungsten and Molybdenum with Chromium, Manganese, Iron, Cobalt, and Nickel. V. Adelsköld, A. Sundelin, and A. Westgren (*Z. anorg. Chem.*, 1933, 212, 401–409).—X-ray analysis of carburized alloys of tungsten with chromium, manganese, cobalt, and nickel and of molybdenum with iron, cobalt, and nickel has shown that double carbides of the type found in iron–tungsten–carbon alloys (Fe_3W_3C) also occur in the cobalt–tungsten–carbon, nickel–tungsten–carbon, and iron–molybdenum–carbon systems. No such carbide could be detected in the systems cobalt–molybdenum–carbon and nickel–molybdenum–carbon. On annealing at high temperatures the double carbides with tungsten decompose with separation of tungsten carbide, WC, whereas Mo_2C separates from the carbide Fe_3Mo_3C. In chromium–tungsten–carbon alloys a phase $(CrW)_4C$ having the cubic crystal structure of chromium carbide Cr_4C has been detected.—M. H.

On the Mutual Solubility of Molten Zinc in Molten Lead and Molten Bismuth. Karl Hass and Karl Jellinek (*Z. anorg. Chem.*, 1933, 212, 356–361).—For the determination of the composition of the conjugate layers in a metal system an apparatus has been developed by means of which an exact separation can be made of the two liquid layers in equilibrium at a given temperature. The apparatus has been used in the study of the lead–zinc system at 420°–770° C. and of the bismuth–zinc system at 460°–735° C.; the percentage of zinc in the upper and lower layers in the first case is 98·7 and 2·0 at 420°, 94·0 and 5·0 at 575°, 89·5 and 7·5 at 675°, 83·2 and 11·5 at 750°, and 81·8 and 13·1 at 770° C., and in the second case: 95·5 and 16·8 at 460°, 93·4 and 21·2 at 545°, 90·0 and 24·0 at 620°, and 77·5 and 32·0 at 735° C. The critical points of the solubility curves lie at about 945° C., 47% zinc for the lead, and at about 820° C., 56% zinc for the bismuth system.—M. H.

The Age-Hardening of Alloys as a Dispersoid-Chemical Problem. K. Trettin (*Kolloid-Z.*, 1932, 60, 101–110, 356–360; *Chem. Zentr.*, 1933, 104, I, 1002–1003).—The mechanism of precipitation-hardening by heat-treatment of copper, iron, and other heavy metal alloys and of aluminium alloys is critically discussed with special reference to the decomposition of the compound Al_2Zn_3, the rate of which depends on the rapidity of nuclei formation. Recent work on the detection by X-rays of the structural changes which occur in age-hardening is also discussed with special reference to the bearing of the results on the precipitation theory.—A. R. P.

On the Detection of Small Quantities of Eutectic in Metals by Determination of the Tensile Strength as a Function of the Temperature. G. Tammann and H. J. Rocha (*Z. Metallkunde*, 1933, 25, 133–134).—In the tensile strength–temperature curve of metals containing small amounts of a more easily fusible constituent the melting point of the latter is clearly indicated by an abrupt decrease in the tensile strength. This is shown by experiments with coarse-grained samples (cast or recrystallized) of zinc with 0·1% tin (representing 0·037% of eutectic), of cadmium with 0·1 and 0·05% bismuth, and of iron

containing 0·5% iron sulphide. The curves for silver with 5% and 9% copper show distinct breaks at 860° C. (solidus temperature of the solid solution) and 780° C. (eutectic temperature), respectively. By this method it is possible to detect a smaller quantity of eutectic than can be detected microscopically.
—M. H.

The Influence of Surface Energy in Disperse Systems. Chu-Phay Yap (*Phil. Mag.*, 1933, [vii], **16**, 80–95).—The extension of Gibb's phase rule to take into account the influence of surface is discussed. A system in which one of the phases is in a state of sub-division (particle-size not being constant, however) has an additional degree of freedom, and for such a system, with the usual notation $f = n - p + 3$. The phenomenon of under-cooling is discussed from the point of view of equilibrium particle size and its change with temperature. The stability of disperse states is discussed, and the application of the theory to metallic systems, *e.g.*, hardening and the determination of solid solubility curves, is briefly referred to.—J. S. G. T.

Some Errors Inherent in the Usual Determination of the Binary Freezing-Point Diagram. Evald L. Skau and Blair Saxton (*J. Physical Chem.*, 1933, **37**, 183–196).—The freezing-point (T)–composition (N) diagram for the system β-chlorocrotonic acid–β-chloroisocrotonic acid has been constructed by a method in which no correction is made for the amount of solid crystallizing, and curves derived from these data are compared with those obtained using accurate data. The errors involved cause a shift of the observed eutectic along both axes. False indications of compound formation are possible by use of the first method. The relation between the entropy of fusion and the shape of the T–N diagram of an ideal binary mixture is discussed.—J. S. G. T.

Propagation of Large Barkhausen Discontinuities. IV.—Regions of Reversed Magnetization. L. Tonks and K. J. Sixtus (*Phys. Rev.*, 1933, [ii], **43**, 931–940).—Describes experiments in which large Barkhausen discontinuities were made to travel in a stretched nickel–iron alloy wire by applying a small local field in addition to the main field, and were then stopped by the application of a local opposing field. The minimum reversed (stopping) field required to stop the propagation of the travelling discontinuity was determined in different main fields, and the flux and pole distribution in the stopped boundary were examined. The results confirm the view that reversal in the wire proceeds only when the total field exceeds the critical field. The details of the boundary surfaces are discussed, and experiments described in which the regions of reversed magnetization were made to vary in shape, by altering the exact conditions under which propagation was stopped.
—W. H.-R.

III.—STRUCTURE
(Metallography ; Macrography ; Crystal Structure.)

(Continued from pp. 350–354.)

Report of Committee E–4 [of A.S.T.M.] on Metallography. C. H. Davis and O. E. Harder (*Amer. Soc. Test. Mat. Preprint*, 1933, 1–3).—A progress report of the activities of certain Sub-Committees. A standard grain-size chart having, however, special reference to steels is proposed.—W. A. C. N.

Crystal Structure and Morphology of Gallium. F. Laves (*Z. Krist.*, 1933, **84**, 256–298).—Gallium forms rhombic, pseudotetragonal crystals, having $a = b = 4·506$, $c = 7·642$; $c/a = 1·697$. The elementary cell contains 8 atoms.—E. S. H.

Fine Structure of Electron Diffraction Beams from a Gold Crystal and from a Silver Film on a Gold Crystal. H. E. Farnsworth (*Phys. Rev.*, 1933, **43**, 900–906).—The diffraction of low-speed electrons from a gold crystal has been studied by the method previously used for silver (Farnsworth, *ibid.*, 1932, **40**, 684). Additional maxima which could be grouped as components

of fine structure of the main diffraction beams were again observed, but many details of position, structure, and intensity were different for the two metals, although the lattice constants are nearly identical. A very thin film of silver, deposited by evaporation on the gold crystal, gave results closely agreeing with those obtained for massive silver. F. concludes that the details of the fine structure are determined at least to some extend by the nature of the atoms, and not by the size of the lattice or by surface irregularities.—W. H.-R.

Crystal Structure of Indium. Francis P. J. Dwyer and David P. Mellor (*J. Proc. Roy. Soc. New South Wales*, 1932, **66**, 234–239).—Indium has a face-centred tetragonal lattice, $a = 4.588$, $c = 4.946$ A., $c/a = 1.078$, the unit cell contains 4 atoms and $d = 7.28$ (calculated), 7.27 (actual). The distances between the atomic centres of the atoms at the centre and corners of the faces are 3.28 A. for the (001) face and 3.89 A. for the (010) face. The symmetry of the lattice indicates that it is made up of close-packed prolate spheroids with an axial ratio of $1 : 1.078$.—A. R. P.

Magnetic Dipole Fields in Unstrained Cubic Crystals. L. W. McKeehan (*Phys. Rev.*, 1933, [ii], **43**, 913–923).—Theoretical. Calculations are made, by two different methods, of the magnetic field components at selected points due to infinite cubic arrays of equal parallel dipoles. Detailed tables of results are given for the simple cubic, face-centred cubic, body-centred cubic, and diamond types of lattices. The observed directions of easy magnetization cannot be predicted from these results, which may, however, be of use in theories of ferromagnetism Previous calculations by Boumann (*Arch. Néer.*, 1931, [3.A.], **13**, 1) are carried out more accurately, and the general qualitative conclusions are confirmed.—W. H.-R.

Magnetic Dipole Fields in Dislocated Cubic Crystals. L. W. McKeehan (*Phys. Rev.*, 1933, [ii], **43**, 924–930).—Cf. preceding abstract. Theoretical. Calculations are made to see whether magnetic stability can be predicted in cubic arrays of parallel dipoles subjected to dislocations of two sorts. (1) The dipoles are supposed to depart from a strictly cubic arrangement, and to acquire a lower symmetry in which the dislocation is homogeneous through-out. (2) Parts of the crystal are supposed to slip relatively to one another, so that each individual part retains cubic symmetry, and the dislocation is sharply localized. The results of the calculations do not account for the observed directions of easy magnetization in crystals of nickel and iron, and the methods fail to explain magnetic stability in nearly perfect crystals as the result of the above types of dislocation, although type (2) may account partly for the effects of cold-work on magnetic properties.—W. H.-R.

Magnetic Dipole Energy in Homogeneously Strained Cubic Crystals. L. W. McKeehan (*Phys. Rev.*, 1933, [ii], **43**, 1022–1024).—Theoretical. The magnetic potential energy per dipole in homogeneously strained, originally perfect, cubic arrays of parallel equal dipoles is calculated in two ways which are essentially modifications of methods used by Becker (*Z. Physik*, 1930, **62**, 253) and by Akulov (*ibid.*, 1928, **52**, 389), and discussed by Powell (*Proc. Camb. Phil. Soc.*, 1931, **27**, 561).—W. H.-R.

Magnetic Dipole Energy in Hexagonal Crystals. L. W. McKeehan (*Phys. Rev.*, 1933, [ii], **43**, 1025–1029).—Theoretical. Calculations previously made (McKeehan, cf. preceding abstracts) for cubic arrays of parallel dipoles are extended to simple hexonal and close-packed hexagonal arrays with the axial ratio 1.633 required by close-packed spheres. The results are also applicable in cases where the axial ratio is slightly different. The calculations indicate that the hexagonal close-packed arrangement is magnetically stable by a very small margin, when magnetization is along the hexagonal axis, but the fluctuations to be expected in a real crystal would completely mask so small a stabilizing field. The simple hexagonal arrangement is, however, highly unstable for magnetization in this direction.—W. H.-R.

IV.—CORROSION

Lead Alloys Resistant to Sulphuric Acid. B. Garre and H. F. Mikulla (*Z. anorg. Chem.*, 1933, **212**, 326–328).—Determinations of the loss in weight in concentrated sulphuric acid at 15°, 100°, and 200° C. and in 10% sulphuric acid of sheets of lead (99·90%) and quenched lead alloys containing 0·1–2·0% $AgCd_4$ (see Garre and Vollmert, *J.*, this volume, p. 124) have shown the high superiority of the alloys. It is suggested that the cadmium passes into solution leaving a protective coating of silver on the surface. Quenched lead alloys with 0·5–5% $AgCd_4$ age-harden at room temperature.—M. H.

Corrosion of Magnesium Alloys. W. Kroenig and G. Kostylev (*Z. Metallkunde*, 1933, **25**, 144–145).—Cf. *J.*, this volume, p. 195. Magnesium corrodes in a 3% sodium chloride solution with evolution of hydrogen which is accelerated by contact with other metals. The evolution of hydrogen at the cathode (foreign metal) and anode (magnesium) depends on the nature of the foreign metal, and increases with a decreasing hydrogen overvoltage at the cathode. A study of the corrosion of a large number of magnesium alloys in solutions of salts, tap-water, and distilled water has shown that the pure metal is more severely attacked than its alloys except those containing 2% copper, 5% nickel, or 1–3% lead. The corrosion resistance of magnesium is considerably increased by addition of manganese, and still further by aluminium and zinc. The best results have been obtained with an alloy containing 6–8% aluminium, 1–1·5% zinc, and 0·3–0·4% manganese, and magnesium–cadmium alloys show severe intercrystalline corrosion. Heat-treatment does not result in an increase of the corrosion resistance. A detailed report will be published elsewhere.

—M. H.

Corrosion Phenomena in the Interior of [Domestic] Hot Water Boilers and Pipes. P. Schläpfer (*Elektrizitäts-Verwertung, Sonderheft* **4–5**, 1932, Reprint, 1–8).—[In German, with lengthy French summary.] The causes and prevention of corrosion in galvanized domestic boilers and hot water systems are discussed. Corrosion is favoured by the slow speed of circulation of the hot water, the high oxygen content of the usual feed water, and the use of soft iron, which takes only a thin zinc coating, for the construction of the apparatus. Soft water is usually more corrosive than hard, since the aggressive action of the dissolved carbon dioxide is increased by removal of the alkaline-earth bicarbonates in the water. Small quantities of chlorides in the water augment the corrosive action, whilst adherent carbonate–sulphate films on the metal surface tend to retard it.—A. R. P.

On the Importance of Chemical Reactions in the Corrosion of Metals. Gerhard Schikorr (*Korrosion II. (Bericht über die Korrosionstagung,* 1932), 1933, 1–5; discussion 5–6).—A review of recent work on the chemical reactions which occur during the corrosion of metals in acid, alkaline, and neutral salt solutions.—A. R. P.

The Theory of Metallic Corrosion in the Light of Quantitative Measurements. VI.—The Distribution of Corrosion. G. D. Bengough and F. Wormwell (*Proc. Roy. Soc.*, 1933, [A], **140**, 399–425).—Experiments show that there is no close correlation between the rate of oxygen supply to a given area of a metal subject to corrosion and the intensity of corrosion at that area; intensity of corrosion is actually controlled by the distribution of protective films which are not necessarily confined to highly aerated regions nor absent from less aerated regions. The spread of alkali, the presence of reactive areas in the metal, gravity, and other factors affect film distribution, which often undergoes important changes with time, although the character of the oxygen supply has not been altered. Certain deposits of corrosion products usually assumed to act as oxygen screens do not actually so behave; others which

do so, cut down corrosion locally instead of stimulating it. Certain types of crevice do not stimulate corrosion by differential aeration as supposed; others stimulate corrosion by interference with the formation of protective films. A convenient way of expressing the facts is outlined as a " film distribution view " of corrosion.—J. S. G. T.

The Electrochemical Theory of Corrosion of Metals. M. Straumanis (*Korrosion u. Metallschutz*, 1933, **9**, 1–11, 29–36).—The electrochemical theory of corrosion is critically reviewed, and an account is given of its development. The expression for the rate of dissolution of metals in acids derived by Aurén and Palmær from their local element theory does not take into account the change in the overvoltage of the local cathodes during the dissolution process as the current density changes, nor the change of potential of the base metal with the change in the conductivity of the acid during the dissolution. The great importance of the dissolution potential for evaluating the corrodibility of a metal is discussed on the basis of Akimov's theory (*J.*, this volume, p. 357). Methods of determining the potential of alloys, the e.m.f. of local elements, and the overvoltage at local cathodes are described; the values obtained for the last-named are very high and approach the potential of the anode as the current density and p_H of the solution increase. The effect of small quantities of more noble metals on the rate of dissolution of numerous base metals is discussed, and it is shown that for zinc the activity of the second metal increases in the order : bismuth, silver, antimony, gold, cobalt, copper, nickel, platinum, whilst thallium, cadmium, tin, lead, and mercury are without effect owing to their high overvoltage. No definite relationship between the activity of a metal in this respect and decreasing overvoltage is to be expected, since the number of local elements and their internal resistance play an important part in the dissolution process. The Aurén–Palmær corrosion formula is applicable to all the cases yet investigated of corrosion in oxygen-free acidic and basic solutions; the formula also applies when access of oxygen is regular and constant over the whole surface of the metal. With irregular access of oxygen, however, the activity of the local elements may be considerably reduced. Many other aspects of the corrosion problem are discussed and 148 references to the literature are given.—A. R. P.

A Modern Theory of Corrosion, and Methods of Testing Metals for their Resistance to Chemicals. N. A. Isgarischev (*Zvetnye Metally* (*The Non-Ferrous Metals*), 1930, 328–347).—[In Russian.] See this *J.*, 1932, **50**, 231.
—S. G.

V.—PROTECTION

(Other than Electrodeposition.)

The M.B.V. Process. Anon. (*Aluminium*, 1933, **15**, (5), 2–3).—The modified Bauer–Vogel system of protecting aluminium and its alloys with an oxide film is briefly outlined. The standard process consists in immersing the article in a 5% solution of sodium carbonate containing 1·5% of sodium chromate and maintained at 90° C. Further protection is afforded by subsequent treatment for 15 minutes at 90° C. in a 3–5% solution of sodium silicate. In special cases protection can be obtained by painting the article at room temperature with a paste of sodium chromate 10, sodium carbonate 4, caustic potash 4, and water 10–15 parts, and washing in cold water after 10–15 minutes.—A. R. P.

" Pantarol " as Protection Against the Oxidation of Metals. Walther Roething (*Apparatebau*, 1933, **45**, 66–67).—Polished sheets of brass, copper, aluminium, iron, and chromium-plated iron which were either unprotected

or protected by varnish and " Pantarol," were subjected to attack by acid vapours, water sprays, combustion gases, &c., over a period of 2 years. Only the samples coated with " Pantarol " remained unattacked. " Pantarol " is a colourless, neutral liquid which dries within 15 minutes of application. The film is about 0·01 mm. thick, contains no pores, is an insulator and is stable up to about 110° C.—M. H.

Anodic Treatment and Dyeing of Aluminium Castings. N. D. Pullen (*Met. Ind. (Lond.)*, 1933, **42**, 633–636; and *Found. Trade J.*, 1933, **48**, 423–424).—Read before the Institute of British Foundrymen. Discusses the preparation of castings for non-decorative and for decorative anodic treatment, the effect of foundry treatment, range of alloys available, types of finish and their permanency, degree of protection against corrosion and abrasion furnished by the films, and the cost and limiting size of the work.—J. H. W.

A New Method of Hot-Galvanizing. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 131)—The articles, *e.g.*, sheet iron, are cleaned, after pickling in acid and washing, by immersion in a 40% alcoholic solution of zinc chloride, then dried in a current of air and immersed directly in the molten zinc.

—A. R. P.

British Standard Specification for the Testing of the Zinc Coating on Galvanized Wires. —— (*Brit. Eng. Stand. Assoc.*, No. **443**, 1932, 1–5).—This specification deals only with inspection of the zinc coating, and has no reference to the wire itself. Two sets of samples are taken, one set being straightened and cleaned in benzene and the other set wound on a mandrel and unwound again before similarly cleaning. The samples are subjected to a copper sulphate dipping test. The solution is made by dissolving 33 grm. of crystalline copper sulphate in each 100 c.c. of distilled water and is shaken with excess copper carbonate or hydrate and allowed to settle. The samples are partly dipped in the solution at 60° F., rinsed, wiped dry, and re-dipped, the time of dipping being one minute or half a minute and the number of dips being varied according to the size of the wire. After the dips specified the samples are required not to show any adherent red deposit of metallic copper on the base metal, except that any deposit within 1 inch from the end is disregarded.

—R. G.

Production, Structural Peculiarities, and Properties of Sprayed Metal Coatings. H. Reininger (*Metallwaren.-Ind. u. Galvano-Tech.*, 1933, **31**, 89–98, 110–112, 130–131, 174–175, 194–196).—A series of articles containing similar matter to that in a series by R. published in *Z. Metallkunde* (see *J.*, this volume, pp. 247, 310).—A. R. P.

The Dry Galvanizing of Iron Articles in the Metal Industry. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 70–71).—A brief description of the sherardizing process is given.—A. R. P.

The Influence of the Base on the Behaviour of Paints. Erich K. O. Schmidt (*Korrosion II. (Bericht über die Korrosionstagung*, 1932), **1933**, 7–20).—The adherence of paint and varnish films to Elektron and Duralumin alloys is very considerably enhanced by roughening the surface or by coating it with an adherent oxide or similar film by one of the chemical or electrochemical oxidation processes. Cellulose acetate lacquer films show an adhesive strength of 42 grm./cm.² on polished Duralumin, 100–155 grm./cm.² on Duralumin roughened by polishing with emery, and 3700 grm./cm.² on sand-blasted Duralumin.—A. R. P.

Developments in the Formulation and Testing of Paint Protective Films. D. G. Darroch (*Chem. Eng. and Min. Rev.*, 1932, **25**, 60–63).—Read before the Sydney Section of the Society of Chemical Industry. The term " paint protective films " includes all materials used for the protection and decoration of surfaces. The oxides of lead, particularly red lead, are of pre-eminent value. For each pigment, there is a mean particle size which determines the

value of the pigment. The comparative opacity is, to a certain degree, judged by the difference in the refractive index. Liquids used in protective film formation are described under the heading of " vehicles." Failure of film surfaces applied to metals is due to improper cleaning of the metal or to unbalanced qualities of the finish. Finishes are tested for (1) water resistance, (2) flexibility and adhesion, (3) grease resistance, (4) yellowing resistance, (5) mar resistance, and (6) opacity.—J. H. W.

VI.—ELECTRODEPOSITION

(Continued from pp. 360–362.)

Cadmium and Its Value in Electroplating Practice. Paul Gerhardt (*Metall-waren-Ind. u. Galvano-Tech.*, 1933, **31**, 10–11, 31–32, 50–52).—The concluding articles of a series (see *J.*, this volume, p. 197). The subjects discussed are the technique of cadmium plating, the colouring of cadmium, and the value of cadmium plating in industry.—A. R. P.

Cadmium-Plating Technology. The Importance of Deposit Thickness. Anon. (*Chem. Trade J.*, 1933, **92**, 279–280).—A minimum deposit of 400 mg. of cadmium per dm.² is necessary to afford any protection to iron in the salt-spray test; with increasing thickness above this minimum the time required for the iron to rust in the salt-spray test is approximately a linear function of the thickness of the coating. To determine the amount of cadmium on a plated article, a measured portion is treated with concentrated hydrochloric acid containing either an inhibitor to prevent dissolution of the iron or about 2–3% of antimony trichloride. A table is given showing the average thickness of cadmium on some commercial articles.—A. R. P.

On the Technique of Cadmium Plating. F. Pietrafesa and E. Lotti (*Metal-lurgia italiana*, 1933, **25**, 167–173).—The best operating conditions have been determined for a cadmium cyanide bath $0.75N$ in cadmium, N in free cyanide and $0.75N$ in sodium chloride, and containing an organic colloidal brightener. Deposits of cadmium 15μ thick were made from this bath on polished copper cathodes, 9 cm. apart from the anodes. The best plates were obtained at 20° C., with a current density of 2 mg./dm.². Photomicrographs of the deposits are shown.—G. G.

Cadmium Plating Instead of Zinc Plating. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 107–108).—Brief details are given of cadmium-plating baths and of the advantages of cadmium plating over zinc plating as a rust preventative for iron.—A. R. P.

On a New Form of Electrolytically Deposited Chromium. B. Rassow and L. Wolf (*Angew. Chem.*, 1933, **46**, 141–142).—The plates obtained on copper and brass under identical conditions of current density, voltage, and time from a chromic acid bath have different chemical properties according to the nature of the " foreign " acid present. When this acid is sulphuric, heating of the plated articles at 330° *in vacuo* results in almost complete diffusion of the chromium into the copper or brass in 2–4 hrs. when the plate is $4–7 \times 10^{-6}$ cm. thick. If, however, a complex fluorine acid, *e.g.* hydrofluosilicic acid, is added to the bath, the deposit obtained is extraordinarily resistant to diffusion under the above conditions, and has a much higher resistance to corrosion than ordinary chromium plate. Further work is in hand to elucidate the nature of the differences between the two plates.—A. R. P.

Chromium Deposits of High-Corrosion and Heat-Resistance. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 48).—Strongly adherent chromium deposits having a high resistance to corrosion and to scaling at

high temperatures can be obtained on iron or copper articles by plating the articles first with a thin layer of nickel or cobalt, then with a thicker layer of chromium, and annealing in pure dry hydrogen at 1100°–1300° C. (for iron) or 1000° C. (for copper) until the nickel or cobalt has diffused both into the base metal and into the chromium layer.—A. R. P.

The " Panzer " Chromium Bath. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 47–48).—The bath (composition not given) operates at 10°–20° C. with a current efficiency of 30% at 18° C. compared with 14% at 45° C. for the usual baths. The voltage required is less than 4 v. and the current density can be as low as 2·5 amp./dm.². The throwing power is stated to be very good and the porosity of the deposits very low.—A. R. P.

Should Chromium Plating Be Done Hot or Cold? Langbein-Pfanhauser-Werke (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 67–69).—It is pointed out that warm chromium baths operate at higher current density than cold baths, and are therefore more economical, even if the higher efficiency of cold baths is taken into account.—A. R. P.

Cold Chromium Plating. —— Birett (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 69–70).—Cf. preceding abstract. The cold chromium bath can be used only in special cases of which examples are given.—A. R. P.

What Rôle Does the " Panzer " Chromium Bath Play in Cold Chromium Plating? [Elektrochem. Fabr. Friedrich Blasberg] (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 88).—The " Panzer " bath is totally different from the usual bath in that it contains neither sulphuric acid nor sulphates. It is claimed to have a larger range of usefulness, in that bright plates can be obtained from it at a higher current yield over a wide range of temperature.
—A. R. P.

What is the Value of the " Panzer " Chromium Bath in Chromium Plating Technique? R. Bilfinger and G. Elssner (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 147–149).—Tests on the operation of the " Panzer " bath have failed to substantiate the claims for its superiority over the ordinary chromium bath made by the patentees. To obtain any deposit at all, a minimum of 3·2 v. is required at a minimum current density of 1·6–1·7 amp./dm.², the current yield only slightly exceeds 10%. the range of bright plating is very narrow at 20° C., the throwing power is not as good as that of the ordinary bath, and the deposits are more porous.—A. R. P.

On the Value of Cold Chromium Plating. W. Kampschulte (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 127).—Comparative tests on plating spoons with chromium in (I) the C.I.G. bath (chromic–sulphuric acid bath) and (II) the Panzer bath (composition not given) have been made. In I at 38° C. with 10 amp. 0·0685 grm. of chromium was deposited in 20 minutes, whereas in II at room temperature with 4·3 amp. only 0·0154 grm. was deposited, hence I has double the current efficiency of II. The deposit from I was stripped in 1 : 1 hydrochloric acid in 1 minute, whereas that from II disappeared in a few seconds. The superiority of the warm bath containing sulphuric acid is thus demonstrated.—A. R. P.

Production of Copper Sheets by Electro-Deposition. Anon. (*Engineering*, 1932, **133**, 697).—Description of the Cowper-Coles process for production of copper sheets, strip, and wire by electro-deposition on a rotating steel cylinder.
—W. P. R.

The Use of Bimetallic Anodes in the Electrolytic Synthesis of Alloys. C. Béchard (*Compt. rend.*, 1933, **196**, 1480–1482).—An investigation has been carried out on the composition of the brass deposited from anodes consisting of copper and zinc plates, having relative surface areas of 5 : 1, 4 : 2, 3 : 3, 2 : 4, and 1 : 5, an ordinary brass (66 : 33 copper-zinc) anode being used as reference. The tests lasted 96 hrs., the anodes and the bath being analyzed every 24 hrs. It was found : (1) that with a brass anode, the anodic solution

of the copper does not keep up with the cathodic deposition, and the bath becomes impoverished in copper, whilst the anode becomes zinc-like in appearance. After a certain time, the zinc on the anode dissolves, the anode again becoming brassy, and the process is repeated; (2) that this auto-regulation occurs similarly with the double anodes, but the amplitude is much greater; (3) that the amplitude is greater when the ratio of the 2 metals of the anode differs more from the composition of the alloy normally deposited in the given conditions; (4) that the mechanism in the case of the bimetallic anodes is not one of simple solution of the excess metal, as in the case of the alloy anode, but is the formation of local couples between the 2 metals and the deposition of one of them on the other. In a copper- and zinc-free cyanide bath, the copper and zinc were deposited on the cathode in the ratio of the respective surface areas of the metals at the anode.—J. H. W.

On the Cause of Rough and Black Deposits during the Nickel-Plating Process and Method of Avoiding Them. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 33).—Some types of nickel anodes do not dissolve with 100% efficiency, since they tend to become somewhat passive, and a thin tenacious film forms on the surface, below which an accumulation of finely-divided graphite, silica, and a black nickel oxide (said to be Ni_3O_2) gradually builds up until eventually the outer film breaks and falls to the bottom of the vat, liberating a large amount of the black slime behind it. Some of this slime becomes attached to the cathode, and gives rise to a rough or black plate. The formation of this slime reaches a maximum with a certain chloride content which varies with the composition of the bath, then falls with more chloride. Further work is being done to throw more light on this problem.
—A. R. P.

Problems in Modern Nickel-Plating. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 29–31).—A review of modern methods of controlling the operation of nickel-plating baths with special reference to p_H, throwing power, anodic corrosion, and testing of the plate.—A. R. P.

Rhodium Plating. Colin G. Fink and George C. Lambros (*Electrochem. Soc. Preprint*, **1933**, May, 107–112; and (abstract) *Met. Ind. (N.Y.)*, 1933, **31**, 208–209).—The plating characteristics of baths prepared by dissolving rhodium hydroxide in various acids and adding neutral salts as buffering agents have been examined. Sulphate and phosphate baths containing sodium sulphate or phosphate give good bright plates at about 50° C. Citric or nitric acid may be added to sulphate baths, but the presence of chlorides prevents plating. The most useful bath was obtained by dissolving rhodium hydroxide in sulphuric acid, diluting to 4 grm./litre of rhodium, and adding 80 grm./litre of sulphuric acid and 3% of ammonium sulphate; at 50° C. with a current of 0·5 amp./in.² a deposit of 0·18 mg./cm.² is obtained in 15 seconds. The deposit is dense and of a brilliant white colour and requires no polishing.
—A. R. P.

Rhodium Plating. A New Method of Protection and Beautification of Silver and Material Resembling Silver. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1933, **31**, 108–109).—The operation of the Wieland rhodium-plating bath is described, but no details of its composition are given.—A. R. P.

Notes on the Efficiency of Rhodium Plating Baths. V. L. Bigsby (*Met. Ind. (N.Y.)*, 1933, **31**, 132–133).—High efficiency baths give the most protective deposit, hence warm sulphate baths are considered the most satisfactory.
—A. R. P.

The Correction of Silver Baths. Karl Bihlmaier (*Mitt. Forschungsinst. Edelmetalle*, 1933, **7**, 24–28).—Numerous examples are given of the methods used in the correction of the composition of silver-plating baths from the analytical figures for silver, free cyanide, and potassium carbonate. The adjustment of the bath may be made by addition of silver cyanide or other

silver salt, potassium cyanide, or barium cyanide, by suitable dilution or by a combination of these.—A. R. P.

A Further Study of Anodes for Zinc Plating. A. K. Graham, G. B. Hogaboom, and L. E. Graham (*Met. Ind.* (*N.Y.*), 1933, **31**, 195–197).— The experiments were made in a bath containing zinc cyanide 8, sodium cyanide 3, and sodium hydroxide 7 oz./gall. with the following anodes : (A) 100% zinc, (B) 99·5% zinc, 0·5% mercury, and (C) 99% zinc, 0·5% aluminium, and 0·5% mercury. At room temperature C has the lowest efficiency and B the highest, but at 120° F. (49° C.) all three anodes show about the same efficiency, the efficiency of C remaining almost constant with rise in temperature, whilst that of the others falls. The efficiency in all cases decreases almost hyperbolically with increase in current density between 15 and 30 amp./ft.^{2}. The polarization voltage of C is 2·9 v. in hot and cold solutions at all current densities, whilst that of B and C is 3·1 in hot and 3·0 v. in cold solutions. B and C produce a fair amount of anode sludge, especially in intermittent plating, whereas C is absolutely free from sludging tendency. Since the roughness of the cathode deposit varies with the sludging tendency, C is considered to be superior to A and B, taking all things into account.—A. R. P.

Electroplating Zinc on Aluminium. Harold K. Work (*Met. Ind.* (*N.Y.*), 1933, **31**, 169–170).—See *J.*, this volume, p. 254.—A. R. P.

Notes on the Metal Plating of Glass and Porcelain. F. Franceschini (*Ind. Silicati*, 1932, **10**, (4), 7–9; *Ceram. Abs.*, 1932, **11**, 436).—Methods are given for covering objects of glass, porcelain, terra cotta, plaster, or wax with a layer of metal. Directions for copper plating are as follows : By means of a brush the object is covered with a layer of conductive material composed of a solution of gold chloride or platinum chloride reduced with a balsam of sulphur or oil of turpentine in which sulphur is dissolved. The object is heated slightly and again coated to make the layer thicker; it is then heated in a muffle kiln until a bright metal layer is formed which makes it suitable for copper plating. The object is placed in a copper bath, where it serves as an electrode and is subjected to the action of a current at 3 v. for a short time. It is well washed, placed in boiling water for a moment, dried with sawdust, and given a coat of transparent lacquer to prevent the copper from oxidizing. The copper bath must be alkaline and contain potassium cyanide, which makes precipitation gradual and homogeneous. The following recipe is given for a copper bath : 8 kg. of potassium copper cyanide are dissolved in 30 litres of hot water; 200 grm. of cyanide of potassium 99% are added, then 100 grm. of powdered soda. The mixture is filtered, the solution diluted with 100 litres of water, and 200 grm. of crystallized ammonium chloride are added. This bath works well at a temperature of 20°–25° and with a current of 2·5–3 v. For light copper plating the following bath is advised : 3 kg. of neutral acetate of crystallized copper are dissolved in 25 litres of hot water; 1·85 kg. of pulverized soda are gradually added, stirring continuously, and then 3·75 kg. of sodium bisulphate. In the greenish solution thus obtained, 3·75 kg. of 99% cyanide of potassium are sifted until the bath becomes clear, when 1·5 kg. of crystallized ammonium chloride are added. This solution is then diluted with up to 100 litres of water and the bath is used at 20°–25° with a current of 2·7–3·5 v. For a small quantity, earthenware basins are used; for a large bath, wood vats. The following processes are also described : (1) silver plating according to the method of Böttger, Wood, Brozette, Bory, Kayser, and Lumiere, (2) gold plating by the method of Böttger, (3) the methods of Vasserot, Dode, and Kundt for platinum plating, and (4) Kattaway's method of copper plating.—S. G.

Low Tension Generators for Plating Plants. R. Schmid (*Metallwaren-Industrie u. Galvano-Tech.*, 1933, **31**, 129).—The construction of modern

generators giving a high ampère output at a low voltage is briefly described.—A. R. P.

Practical Plating. Preparation of Work. III.—Pickling (concluded). E. A. Ollard (*Met. Ind. (Lond.)*, 1933, **42**, 643–644).—Describes pickling with the cyanide dip and the pickling of dissimilar metals. **The Deposition of Nickel. I.—General** (*Ibid.*, 644–645).—Discusses the relative suitability of nickel sulphate and nickel ammonium sulphate solutions and the function of boric acid, chlorides and fluorides in the nickel solution. Cf. *J.*, this volume, p. 362.
—J. H. W.

VII.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-Refining.)

(Continued from pp. 362–363.)

Researches on the Electrolysis of Molten Binary Aluminium Alloys and the Degree of Solubility of Iron in Aluminium at Various Temperatures. Robert Kremann, Ester Inge Schwarz, and Sidy Le Beau (*Monatsh.*, 1933, **62**, 47–60). —The linear distribution of the constituents along a capillary tube when molten aluminium–copper and aluminium–tin alloys are electrolyzed at various current densities, has been determined at various temperatures. The iron electrodes dissolve in the molten metals partly by true solution and partly by anodic action.—A. R. P.

Researches on the Electrolysis of Aluminium–Tin Alloys Containing Iron, as a Model for the Electrolytic Purification of Molten Aluminium from Iron. Robert Kremann and Ludwig Lämmermayr, Jr. (*Monatsh.*, 1933, **62**, 61–67). —Experiments on the electrolysis of molten aluminium–tin alloys containing iron have shown that it is unlikely that this method will prove of value for the elimination of iron from aluminium, since the rate of migration of the iron decreases rapidly with increase in aluminium content of the alloy.—A. R. P.

On the Electrolysis of a Molten Beryllium–Copper Alloy with 10% Beryllium. Ludwig Lämmermayr, Jr. (*Monatsh.*, 1933, **62**, 67–70).—Electrolysis of molten 10% beryllium–copper alloy with a current density of 6 amp./mm.^{2} at 1050° C. in a capillary tube causes the beryllium to migrate towards the cathode and copper towards the anode.—A. R. P.

On the Theory of Electrolysis Phenomena in Metallic Solutions. Karl Schwarz (*Z. physikal. Chem.*, 1933, [*A*], **164**, 223–230).—The assumption that the migration of the ions in molten metal solutions in an electric field is determined only by the resultant of the electrostatic force and the electrohydrostatic buoyancy leads to a relation between the transport number, the density of the charge, and the mobility. This theory has been proved by tests on zinc and cadmium amalgams. Mercury is practically completely dissociated into electrons and Hg· ions, although the possibility of dissociation into Hg·· ions cannot be completely excluded. Cadmium and zinc are dissolved by mercury as Cd·· and Zn·· ions. Mass displacement and conduction of current in liquid metals are two phenomena which are related only in so far as both depend on the field strength of the current. The diffusion constants of cadmium and zinc in mercury have been determined as follows: at 25° C., $D_{Cd} = 1.77$ cm.^{2}/day, $D_{Zn} = 1.73$ cm.^{2}/day; at 35° C. $D_{Cd} = 1.89$ cm.^{2}/day, $D_{Zn} = 1.84$ cm.^{2}/day.—B. Bl.

On the Interpretation of the Electrolytic Portion of Conduction in Amalgams and other Alloys.—II. Carl Wagner (*Z. physikal. Chem.*, 1933, [*A*], **164**, 231–233).—Theoretical note on the paper of K. Schwarz (see preceding abstract).
—B. Bl.

Electrical Conductivity in Aqueous Solutions. A. C. D. Rivett (*Chem. Eng. and Min. Rev.*, 1932, **25**, 17).—Short abstract of a lecture delivered to the A. and N.Z.A.A.S. Describes the work of Sir David Orme Masson on the conducting power of solutions. Variability of both dissociation and mobility of ions is recognized. Conductivity is shown to be the sum of 2 factors, one operative over the whole range of concentration, and the other only in the more dilute solutions, becoming negligible at about the same point with all electrolytes.—J. H. W.

International Congress of Electricity. L. Jumeau (*Science et Industrie,* 1933, **17**, 143–144).—Section VII. Report No. 13: "Evolution of the Accumulator Industry." An historical survey, with special reference to recent developments in iron–nickel accumulators.—P. M. C. R.

VIII.—REFINING
(Including Electro-Refining.)

(Continued from p. 363.)

Silver Extraction by Electrolysis. Present-Day Practice. Anon. (*Chem. Age,* 1932, **37**, Metallurgical Section, 23).—A brief description of the Moebius system for the electrolytic refining of silver.—A. R. P.

The Influence of Metallic Impurities in Technical Zinc Electrolysis. P. Röntgen and R. Buchkremer (*Metall u. Erz.,* 1932, **29**, 449–456).—The intensity of the corrosion of the cathodic zinc caused by the co-deposition of impurities depends on the p.d. between the zinc and the impurity, on the critical current density of the latter, and on the number of nuclei present. Copper and cobalt are readily deposited from very dilute solutions, and give rise to slime formation; with about 1 grm./litre of either metal in the electrolyte the rate of dissolution of the zinc is equal to its rate of deposition, and hence practically no zinc is deposited. The tendency of nickel to deposit is smaller than that of copper, and hence the number of corrosion centres produced is smaller, but their radius of action is greater; the presence of nickel therefore tends to produce a streaky deposit by alternate dissolution and deposition of the zinc. Arsenic and antimony in the electrolyte give rise to warty deposits, since they have a low critical current density and a strong tendency to produce protective films. Antimony reduces the current yield more than any of the metals tested, but this effect is to some extent overcome by addition of colloids. Cadmium also produces warty deposits, but this is due to the preferential deposition of zinc on the cadmium crystals as they are deposited. Iron is found in the zinc deposit only when its concentration in the electrolyte exceeds 5 grm./litre.—A. R. P.

The Causes of Formation of Zinc Dust [in Zinc Distillation]. R. Brosius (*Rev. Univ. Mines,* 1932, [viii], **8**, 317–324).—In the distillation of zinc from mixtures of roasted ore and carbon the proportion of zinc dust formed can be greatly increased by increasing the rate of passage of the metal through the condenser and reduced by addition of 2% of sodium chloride to the charge; in the latter case the dust will be contaminated with chloride. The mechanism of the production of zinc dust has been investigated by distilling pure zinc (99–96%) from an electrically heated retort at 950° C. into a condenser heated at 425°–430° C. and passing various mixtures of hydrogen and carbon dioxide through the apparatus meanwhile. In pure carbon monoxide small quantities of carbon dioxide and zinc oxide are formed which lead to the formation of zinc dust, but no dust at all is formed in hydrogen. The results indicate that zinc distillation can be carried out on the commercial scale without the

formation of dust if a high content of zinc vapour is maintained in the gas stream, which should be kept free from gases which react with zinc, and if the condenser is kept at a temperature somewhat above the melting point of zinc. Commercial zinc dust frequently contains cyanide. A yield of 90% of metallic zinc from commercial zinc dust can be obtained by melting it carefully with ammonium chloride in a special furnace, the construction of which is described.
—A. R. P.

IX.—ANALYSIS

Spectrographic Analysis. E. van Someren (*Met. Ind.* (*Lond.*), 1933, **42**, 331–332).—Abstract of a paper read before the Co-ordinated Societies (Birmingham Local Section of the Institute of Metals, Birmingham Metallurgical Society, and Staffordshire Iron and Steel Institute). A brief history of the development of emission spectra to the qualitative and quantitative determination of metals is given and its modern applications to metallographic analysis are described.—J. H. W.

Spectrographic Analysis. H. V. Churchill (*Met. Ind.* (*Lond.*), 1933, **42**, 132).—Short abstract of an address to the American Society for Testing Materials Committee E–2 on Spectrographic Analysis. Outlines the importance of this method of analysis to metallurgy and the rôle of the spectrograph in industry.—J. H. W.

A Method for Determining the Quality of the Tinning on Tinned Conductor Wires Insulated with Rubber. [A. R.] Matthis (*Technique moderne,* 1933, (1), 18).—See *J.*, this volume, p. 94.—R. B. D.

On a Sensitive Detection of Gold with α-Naphthylamine Hydrochloride. H. Holzer and W. Reif (*Z. anal. Chem.*, 1933, **92**, 12–15).—As little as 1 p.p.m. of Au (sensitivity 0·008 mg.) can be detected by the violet to rose-red colour produced in the $CH_3 \cdot CO_2C_2H_5$ layer when the $AuCl_3$ solution is shaken with 5 c.c. of dilute solution of $\alpha\text{-}C_{10}H_7 \cdot NH_2$,HCl and 2–3 c.c. of $CH_3 \cdot CO_2C_2H_5$. Fe produces a similar colour due to oxidation of the reagent; its effect can be overcome by addition of tartaric acid. Under similar conditions $PdCl_2$ produces a yellow colour; no other metal interferes.—A. R. P.

Detection and Separation of the Chemical Elements of the Second Group (Pb, Hg˙˙, Bi, Cu, Cd). C. Candea and L. I. Sauciuc (*Bul. Soc. Chim. Romania,* 1932, **14**, 69–71).—The Hg is removed directly from the *aqua regia* solution of the sulphides by addition of $SnCl_2$, Pb, and Cr are then precipitated with $K_2Cr_2O_7$, Cu is removed with KCNS and Na_2SO_3, and Cd detected in the final filtrate by $(NH_4)_2S$. The chromate precipitate is treated with NaOH for the separation of Pb from Bi.—A. R. P.

On the Detection and Separation of the Chemical Elements of the Third Analytical Group. C. Candea and L. I. Sauciuc (*Bul. Soc. Chim. Romania,* 1932, **14**, 72–75).—Minor modifications are made in the well-known procedure.
—A. R. P.

The Precipitation of Rhenium Sulphide from Ammoniacal Solution. A Separation of Rhenium and Molybdenum. J. H. Müller and W. A. La Lande (*J. Amer. Chem. Soc.*, 1933, **55**, 2376–2378).—Ammoniacal mixtures of solutions of Re and Mo, treated with H_2S for 48–72 hrs. at room temperature, give an approximately quantitative precipitation except when the proportion of Mo is large.—R. G.

On a New Source of Error in the Precipitation of Potassium Chloroplatinate. R. Strebinger and H. Holzer (*Z. anal. Chem.*, 1932, **90**, 81–86).—The C_2H_5OH used to complete the precipitation of the K_2PtCl_6 must be free from aldehyde, otherwise there is danger of reduction to K_2PtCl_4, which is soluble.—A. R. P.

Colorimetric Determination of Aluminium with Aurintricarboxylic Acid.
Paul S. Roller (*J. Amer. Chem. Soc.*, 1933, **55**, 2437–2438).—In the normal quantitative procedure the reaction mixture is made alkaline. The test is improved by adoption of a fixed acid p_H of 6·3.—R. G.

On the Determination of the Antimony Content of Commercial Copper.
Herbert Blumenthal (*Z. anal. Chem.*, 1932, **90**, 118–121).—Polemical against Böhme and Raetsch (this *J.*, 1932, **50**, 674) who obtained good results with NH_4OH, as their samples contained much Pb. In the absence of Pb the $Fe(OH)_3$ precipitate does not collect all the Sb_2O_5, but by the method previously recommended by Blumenthal (this *J.*, 1930, **43**, 547) all the Sb passes into the ammonia precipitate.—A. R. P.

Determination of Arsenic, Antimony, Tin, and Zinc in Minerals and Alloys by Titration with Potassium Iodate. I. I. Lurie (*Mineral Suirie*, 1931, **6**, 731–742; *Chim. et Ind.*, 1932, **27**, 1080; *Ceram. Abs.*, 1932, **11**, 638).—[In Russian.] L. studied the application of Jamieson's titrimetric method of potassium iodate for determining As, Sb, Sn, and Zn in minerals and alloys. The titration is made in the presence of chloroform which is coloured by I_2 liberated during reaction. The disappearance of the coloration of the chloroform layer shows the end of the titration. The experiments showed that this method is suitable for determining Sb and As and gives excellent results. Sn, however, must be reduced to stannous chloride and titrated in a current of CO_2 or with iodate. For determining Zn, this method gives good results in the absence of Fe. Zn is precipitated in the form of double sulphocyanide of Zn and Hg and then titrated with iodate. In the presence of Fe, L. suggests the following method : 1 grm. of tartaric acid and several drops of a potassium sulphocyanide solution are added to the acid solution containing Zn and Fe. The liquid becomes red. A concentrated solution of sodium carbonate is carefully added until the colour changes to lemon-yellow, 15–20 c.c. of mercuric chloride and potassium sulphocyanide are added, and the mixture is shaken. A white precipitate of double sulphocyanide of Zn and Hg is formed. The solution is left to rest, filtered, and washed with cold water. The determination is made gravimetrically or by titration.—S. G.

Bismuth in Copper. A. J. G. Smout and J. Lester Smith (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 45–46).—In view of the importance of the bismuth content of copper, and of the accuracy of determination by analysis, the matter has been examined by the Technical Sub-Committee of the Fiscal Policy Committee of the Brass and Copper Industries. A set of principles is enunciated which should, in the hands of competent analysts, produce reliable and reproducible values. Within these principles there is ample scope for variation according to individual preference.—R. G.

On the Simultaneous Electrolytic Determination of Lead and Copper.
Heinrich Biltz (*Z. anal. Chem.*, 1932, **90**, 277–288).—A claim for priority over Bjørn-Andersen (cf. this *J.*, 1932, **50**, 631).—A. R. P.

The Determination of Manganese, Iron and Titanium with B. Lange's Photo-Electric Colorimeter. M. Bendig and H. Hirschmüller (*Z. anal. Chem.*, 1933, **92**, 1–7).—The use of the colorimeter in the determination of Mn as $HMnO_4$, Ti as TiO_3, and Fe as $Fe(SCN)_3$ is described.—A. R. P.

A Rapid Colorimetric Method for the Determination of Nickel in Alloys.
V. P. Ochotin and A. P. Sytschoff (*Z. anal. Chem.*, 1932, **90**, 109–111).—For the analysis of Ni–Cu alloys 0·01–0·015 grm. is dissolved in 10 c.c. of HNO_3 and the solution is diluted to 25 c.c., treated with NH_4OH until blue, then with 15 c.c. of 1% dimethylglyoxime solution, and shaken with 15 c.c. of $(C_2H_5)_2O$. All the Ni passes into the upper layer, which is separated, washed twice with H_2O, and treated with 5 c.c. of C_2H_5OH and 5 c.c. of collodion solution. The red colour of the solution is then compared with that of a standard.—A. R. P.

A New Volumetric Determination of Small Quantities of Sodium. Stefan Rusznyak and Ella Hatz (*Z. anal Chem.*, 1932, **90**, 186–189).—The Na is precipitated as $NaZn(UO_2)_3(CH_3 \cdot CO_2)_9$, which is dissolved in hot H_2O and the UO_2 precipitated by addition of an excess of Na_2HPO_4. After filtration, the excess of Na_2HPO_4 is titrated with $(CH_3 \cdot CO_2)_2UO_2$.—A. R. P.

Iodometric Determination of Sodium as Sodium Zinc Uranyl Acetate. Rudolf Lang and Gottfried Mück (*Z. anal. Chem.*, 1933, **93**, 100–102).—The Na is precipitated as the triple salt (cf. Kolthoff, this *J.*, 1927, **37**, 570), the precipitate is dissolved in dilute H_2SO_4, 5 grm. of $(NH_4)_2SO_4$ are added, followed by 2 grm. of KI and starch, and the Zn is titrated with $K_3Fe(CN)_6$ and $Na_2S_2O_3$ (cf. R. L.'s method described below).—A. R. P.

On the Colorimetry of Titanium. III.—A Contribution to the General Technique of Colorimetry. H. Ginsberg (*Z. anorg. Chem.*, 1933, **211**, 401–411).—Measurements with the Leitz universal colorimeter show that the coloured solutions produced by adding H_2O_2 to $Ti(SO_4)_2$ solutions obey the Lambert–Beer law when the Ti concentration is within the range 0·2–4 mg./100 c.c. The colorimetric determination of Ti by the absolute method is described; the results obtained are of a satisfactory degree of accuracy.—M. H.

Use of 8-Hydroxyquinoline for the Quantitative Determination of Tungsten. Siegfried Halberstadt (*Z. anal. Chem.*, 1933, **93**, 86–89).—On treatment of an alkaline or neutral solution of Na_2WO_4 with a 4% alcoholic solution of 8-hydroxyquinoline, boiling, and adding $CH_3 \cdot CO_2H$, the W is precipitated completely as yellow $WO_2(C_9H_6ON)_2$, which is collected in a porous filter crucible, washed with hot water, dried at 120° and weighed; it contains 36·50% W.—A. R. P.

On the Quantitative Determination of Some Metals with Anthranilic Acid. I.—A Simple Method for the Quantitative Determination of Zinc and Cadmium and for the Separation of These Metals from the Alkaline Earths. H. Funk and M. Ditt (*Z. anal. Chem.*, 1933, **91**, 332–340).—The cold solution of the metal is treated with NaOH to slight alkalinity, then with $CH_3 \cdot COOH$ until neutral or very feebly acid. Addition of a 3% solution of Na anthranilate effects complete precipitation of the Cd or Zn. The precipitate is washed first with a 0·2% solution of the reagent, then with alcohol, dried at 105°–110° C., and weighed. The Zn compound contains 19·37% Zn and the Cd compound 29–23% Cd. The precipitates can be determined volumetrically by dissolving in 4N-HCl and titrating with KBr–$KBrO_3$ solution using indigo-carmine–styphnic acid as indicator.—A. R. P.

Determination and Separation of Zinc from Metals of the Ammonium Sulphide Group as Sulphide by the Use of the Chloroacetic Acid–Sodium Acetate Buffer. C. Mayr (*Z. anal. Chem.*, 1933, **92**, 166–174).—Zn can be separated from Mn, Ni, Co, Fe, Al, Cr, and V by precipitation with H_2S in solutions of p_H 2·6–2·7. The following procedure gives excellent results in the analysis of brasses, bronzes, and nickel silvers; the alloy is dissolved in HNO_3 and the Cu removed by electrolysis, any MnO_2 deposited on the anode is dissolved in HCl and added to the spent electrolyte, and the combined solution is evaporated to dryness to expel all free acid; the residue is dissolved in 20 c.c. of H_2O, 10 c.c. of 2N-$CH_2Cl \cdot CO_2H$ and 10 c.c. of N-$CH_3 \cdot CO_2Na$ are added, the solution is diluted to 150 c.c. with hot H_2O and saturated with H_2S, and the granular ZnS is collected in a porous crucible, washed with 150 c.c. of H_2O containing 20 c.c. of the buffer solution, dried, mixed with S, ignited in H_2 until the excess S is expelled, and weighed.—A. R. P.

On the Iodometric Determination of Zinc by the Ferricyanide Process. Rudolf Lang (*Z. anal. Chem.*, 1933, **93**, 21–31).—(Cf. this *J.*, 1930, **43**, 561).—The Zn solution free from Cl′ is treated with 3–5 c.c. of H_2SO_4, neutralized with NH_4OH, made slightly acid with H_2SO_4, diluted to 100 c.c., treated with 2 grm. of KI and a little starch, and titrated with 0·2M-$K_3Fe(CN)_6$ and

$Na_2S_2O_3$ alternately until no further blue colour develops on the addition of the former: 1 c.c. $N\text{-}Na_2S_2O_3 = 0\cdot009965$ grm. Zn. If Mn is present, this may first be determined by conversion to $HMnO_4$ with $K_2S_2O_8$ and $AgNO_3$; 10 grm. of $(NH_4)_2SO_4$ are added to the titrated solution and the Zn is determined as above. HPO_3 must be added if Mo is present.—A. R. P.

X.—LABORATORY APPARATUS, INSTRUMENTS, &c.

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

(Continued from pp. 371–373.)

Improvements in Prytherch's Capacity Dilatometer. John L. Haughton and Frank Adcock (*J. Sci. Instruments*, 1933, **10**, 178–180).—Improvements in the Prytherch dilatometer (*ibid.*, 1932, **9**, 128) are described, and enable the instrument to be used at temperatures up to 1300° C. in a strictly controlled atmosphere.—W. H.-R.

Repairs and Adjustments to Assay Balances. H. R. Hillman (*Chem. Eng. and Min. Rev.*, 1933, **25**, 209–210).—Abstract of a paper read before the Chemical Society of Western Australia. Inaccuracy in assay balances is usually due to bluntness of the central knife edges, and the method of sharpening them is described. Fifteen sources of error and the methods of correcting them are given, the testing of the sensitiveness being described in detail.—J. H. W.

General Considerations on Illumination in Microscopy. E. Lihotzky (*Z. wiss. Mikroskopie*, 1933, **49**, 446–450).—The characteristics and uses of the various illuminating devices for microscopy are described.—B. Bl.

Improved Apparatus for the Measurement of Poisson's Ratio. W. A. Zisman (*Rev. Sci. Instruments*, 1933, [N.S.], **4**, 342–344).—A simple form of lever device fitted with a reflecting mirror, to determine the change of diameter of a strained cylinder, is described. The instrument is capable of detecting a change of the order 10^{-7} cm. Values of Poisson's rates for a sample of soft Bessemer steel were found to be 0·296, 0·303, 0·304.—J. S. G. T.

Moving Film Cameras in X-Ray Analysis. B. Wheeler Robinson (*J. Sci. Instruments*, 1933, **10**, 165–169).—Describes the construction of two X-ray cameras of the type in which the film moves uniformly as the crystal rotates. The first is very simple to construct, but can be used only for equatorial reflections; the X-ray film is wrapped round a cylinder which rotates at the same speed as the crystal, about an axis perpendicular to the X-ray beam and to the axis of rotation of the crystal. The second is of the Weissenberg type in which the cylindrical film moves parallel to its own axis, which is also the axis of rotation of the crystal.—W. H.-R.

Apparatus for the Comparison of the Electromotive Forces of Standard Cells. P. Vigoureux (*Phys. Rev.*, 1933, **10**, 182–183).—Describes an apparatus for comparing the e.m.f.'s of standard cells by a method in which the small resultant e.m.f. of two cells in opposition is measured.—W. H.-R.

An Isothermal Calorimeter for Slow Reactions. E. D. Coon and Farrington Daniels (*J. Physical Chem.*, 1933, **37**, 1–11).—An isothermal calorimeter capable of measuring continuously for many hours reactions which evolve less than a calorie/hr. is described. Evolution of heat is compensated by evaporating carbon tetrachloride or other liquid, absorbing the vapour in silica gel, and weighing. Absorption of heat is compensated by measured electrical heating. The accuracy possible is of the order 1%.—J. S. G. T.

XI.—PHYSICAL AND MECHANICAL TESTING AND RADIOLOGY

Anomalies of the Elasticity of Metals. Damping of Torsional Oscillations. Louis Filliatre and Pierre Vernotte (*Compt. rend.*, 1933, **196**, 1374–1376).— The methods of investigating the torsional damping of rubber has been applied to the study of fusible alloys. Wires 3 m. long were acted on for 8 hrs. by an oscillating weight, which caused an extension of 20 cm. The damping coeff., k, is equal to the ratio $\alpha_{n+1} A_{n+1} : \alpha_n A_n$ of 2 successive maximum elongations, α being the (unknown) position of the nul azimuth at the end of successive semi-oscillations and A the extremes of elongation. By trial, the value $k = 0.810$ was found to be the value required. Modifications of the classic hypothesis and an explanation of the differences observed in the measurements of Young's modulus are suggested.—J. H. W.

Recovery of Steel after Fatigue Testing. R. A. Stephen (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 36–38).—Broken Wöhler test-pieces stored for 10 months showed on X-ray examination indications that large unstrained grains had developed. The results suggest that in a polycrystalline aggregate, subjected to stress of a particular kind, a process of recovery or grain-growth can take place at ordinary temperature.—R. G.

On the Bending and Torsion Vibrations of a Thin Cylindrical Crystal Rod of any Desired Crystallographic Orientation. E. Goens (*Wiss Abhandl. Physikal.-Tech. Reichsanst.*, 1933, **16**, (2), 407–436).—Reprint from *Ann. Physik*, 1932, [v], **15**, 455–484. See *J.*, this volume, p. 144.—M. H.

Cupping Test by the Method of Siebel and Pomp. Henri Fournier (*Compt. rend.*, 1932, **195**, 142–144; and (abstract) *Technique moderne*, 1932, **24**, 603).— A systematic study of the method of Siebel and Pomp has been undertaken, the characteristics determined being : cupping elongation $A_E \% = \dfrac{d' - d}{d} \times 100$, the breaking stress at cupping $R_E = \dfrac{C}{e(D + e - d)}$, and the deflection f, d being the initial diameter of the hole, d' the final diameter, C the maximum load, D the diameter of the cupping tool, and e the thickness of the specimen. The tests were carried out with a number of variable factors. A comparison of this method with those commonly used led to the conclusion that the Siebel and Pomp method is superior to the methods of Persoz and Erichsen, its sensitiveness increasing with metals having greater percentage elongation; but it is of less general application and cannot be used in all cases. Cf. following abstract.—J. H. W.

Results Furnished by Cupping Tests and Their Relation to Tensile Tests. Henri Fournier (*Compt. rend.*, 1932, **195**, 327–329; and (abstract) *Technique moderne*, 1932, **24**, 670).—The methods of Siebel and Pomp, Persoz and Erichsen have been compared using an ordinary semi-hard steel, an austenitic steel (18% chromium, 8% nickel), a 67 : 33 brass, commercial aluminium (99·5%), Duralumin and magnesium. For the Siebel and Pomp method, the relation $R = \dfrac{R_E}{\pi} = \dfrac{1}{\pi} \cdot \dfrac{C}{e(D + e - d)}$ was used, where R is the tensile breaking stress, R_E the cupping breaking stress, D the diameter of the punch, d the initial diameter of the hole, and e the thickness of the specimen. The ratio R/R_E is appreciably affected by the state of the metal in some cases. For the Persoz and the Erichsen methods, the relation $R = \dfrac{C}{Kef}$ was used, C being the maximum load, f the deflection at the moment of fracture, and K

a coeff. depending on the nature of the metal the thickness, and the treatment. It was concluded that the Siebel and Pomp method is preferable for metals having large elongations and showed small diminutions of properties of a given material. The Persoz and Erichsen methods are preferable for metals with small elongations and for investigating wide variations of properties of a metal as a function of the treatment. None of these methods has a simple, rigorous relation with the tensile test, but approximate relationships exist in individual cases. Cf. preceding abstract.—J. H. W.

A New Method of Testing Hardness. T. Matsumara (*Mem. Coll. Eng. Kyoto Imp. Univ.*, 1933, **7**, 159–176).—[In English.] A diamond ball of 4 mm. diam. is used as the stamp, and while the material under test is being indented, the loads at two definite depths of indentation are measured. The apparatus is described and the theory is worked out in detail. The results obtained are compared with those gained by other methods.—E. S. H.

The Standardization of the Scleroscope Test for Specification Use. R. Genders (*Metallurgist* (Suppt. to *Engineer*), 1933, **9**, 46–47).—The scleroscope test, although limited in scope, has certain advantages which render it valuable for certain types of mixture testing, and it has been frequently included in specifications. The " magnifier " hammer, which is desirable for use with non-ferrous alloys, is liable to give erroneous results owing to wear and to variations in contour of the nose between different hammers. A new form of magnifier hammer, in which constant contour of the nose is ensured by the use of a hardened steel ball of 3 mm. diameter, has been adopted as standard by the British Government Services, and has been included in British Standard Specifications. The method of preparing the 3 mm. ball hammer and the standardization and calibration of scleroscopes are described.—R. G.

RADIOLOGY

X-Ray's Place in Non-Ferrous Metal Industry. Herbert R. Isenburger (*Met. Ind. (N.Y.)*, 1933, **31**, 121–122).—The value of X-ray examination in the production and selling of non-ferrous metals is briefly described.—A. R. P.

X-Rays in the Metal Industries. R. A. Stephen (*Metallurgia*, 1933, **8**, 35–36).—The scope of the X-rays in industry in the detection of gas and other inclusions and cracks in castings, forgings, and welds; and in the investigation of crystal structure, effects of heat and mechanical treatment, and alloy phase systems is briefly discussed. Some apparatus is described which has been developed to meet the stringent working conditions, and includes small and medium-size X-ray plant for the examination of steel up to $\frac{3}{4}$ in. in thickness, and aluminium up to 4 in. in thickness, large shock-proof plant with which up to 4 in. of steel can be examined, and shock-proof plant for X-ray crystal analysis.—J. W. D.

The Radiographic Examination of Welds. R. A. Stephen (*Welding J.*, 1932, **29**, 299–303; discussion 331–336; and (abbreviated) *Eng. Rev.*, 1933, **46**, 452–454).—Read before the Institution of Welding Engineers. The useful field of application of X-rays for testing welds : the type of defects which can be detected; and the apparatus used, are discussed. It is stated that, in steel up to $2\frac{1}{2}$ in. thick, flaws of dimensions down to $1\cdot5\%$ of the parent metal can easily be detected. Shock-proof equipment, giving a high-tension supply of at least 180,000 v. is recommended for general engineering work.
—H. W. G. H.

An Industrial X-Ray Laboratory. Anon. (*Engineer*, 1933, **155**, 583).— A laboratory equipped with modern X-ray apparatus for examination of metals has been extablished by Messrs. Philips Metalix in London. There are equipments for dealing with large and small articles and mobile equipment for examination of boilers, &c., at manufacturers' works.—W. P. R.

XII.—PYROMETRY

The Effect of Temperature on the Permeability of Gases through Pyrometer-Protecting Tubes. W. Miehr (*Ber. deut. keram. Ges.*, 1932, **12**, 29–38; *C. Abs.*, 1933, **27**, 2344).—The penetration of gases through pyrometer-protection tubes is less at high than at low temperatures. For example, it takes 40·5 minutes for 13·4 litres of air to pass through a tube at room temperature, whereas it requires 147 minutes at 1000° C. with the same pressure.—S. G.

Pyrometric Economies. W. Bowen (*Gas J.*, 1933, **203**, 48).—A thermocouple composed of Nichrome and another (unspecified) metal or alloy, which is not deteriorated after immersion for some hours in a lead bath at 1350°–1400° C., is referred to. The couple is resistant to oxidizing atmospheres and to CO, SO_2, &c. Twelve months' life is guaranteed when the thermocouple is used in furnaces at temperatures up to 1000° C. The e.m.f. generated at 800° C. is 20 m.v. Resistance coils of the new material are available for use in resistance pyrometers.—J. S. G. T.

XIII.—FOUNDRY PRACTICE AND APPLIANCES

Non-Ferrous Foundry Ingot Shapes.—I, II. Pierce Barker (*Met. Ind. (N.Y.)*, 1933, **31**, 166–167, 204–205).—A description of the characteristics demanded of ingots for foundry use and practical reasons for the various shapes.—A. R. P.

Choosing Aluminium Fluxes. James Brian (*Met. Ind. (N.Y.)*, 1933, **31**, 129).—Cryolite is recommended in cases where zinc chloride cannot be used for fear of contaminating the metal with zinc.—A. R. P.

Recent Advances in Silumin Castings. Development Work by the Metallgesellschaft A.-G. Anon. (*Chem. Age*, 1933, **38**, Monthly Metallurgical Section, 21–22).—A review.—A. R. P.

Casting Hiduminium Alloys. Anon. (*Met. Ind. (Lond.)*, 1933, **42**, 576).—The casting alloys " RR 50 " and " RR 53 " are said to have marked advantages over ordinary aluminium alloys and to remain stable and not age further after casting. Up to 75% scrap, and even more, may be used in the charge.
—J. H. W.

Treatment of Thick Copper Boiler Plate and Red Merchant Copper. V. G. Serdyukov (*Zvetnye Metally (The Non-Ferrous Metals)*, 1930, 516–530; *C. Abs.*, 1933, **27**, 690).—[In Russian.] In order to avoid cracks in copper sheets, caused by an excess of oxides, it is necessary to put a sample of copper from the furnace through a bending test, before the copper is poured. Absence of cracks in the bent piece insures against cracks in rolling. Clipping and cleaning of the ingots before rolling are necessary. The ingots should be heated before rolling in a slightly oxidizing atmosphere to prevent absorption by the copper of reducing gases which is an even greater cause of brittleness than oxides; at the same time a smoky flame should be avoided. To prevent super-heating of the copper, the ingots should be heated between 900° and 950° C. The sheets should not be heated above 850° C.—S. G.

The Casting of Two Large Doors in Bronze. F. H. Landolt (*Met. Ind. (N.Y.)*, 1933, **31**, 90).—A description is given of the procedure adopted in casting two ornate bronze doors, $22 \times 13\frac{1}{2}$ ft. $\times$ 4 in. weighing 5000 lb.
—A. R. P.

Some Brass Foundry Problems. F. Dunleary (*Found. Trade J.*, 1933, **48**, 221–222, 232).—Abstract of a paper read before the Lancashire Section of the Institute of British Foundrymen. Full details of moulding, coring,

melting, and casting a number of brass castings requiring special precautions or presenting novel features are given. Special points in casting aluminium alloys as compared with brass are discussed and illustrated by examples.

—J. H. W.

Fluxes in Brass Melting. Werner Fröhlich (*Met. Ind.* (*N.Y.*), 1933, **31**, 91–92, 123–124).—The functions of the following fluxes are described : charcoal, boric acid and borates, glass, sodium carbonate, mixed borate–carbonate, sodium chloride, reducing fluxes.—A. R. P.

Birmingham Small Wares. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 561–564, 585–586).—A detailed description is given of the manufacture of repetition articles in brass and steel as carried out in a modern Birmingham factory.

—J. H. W.

Non-Ferrous Metal Mould Castings. F. R. Francis (*Chem. Age*, 1933, **38**, Monthly Metallurgical Section, 3–4).—Modern practice in the die-casting of lead, tin, zinc, aluminium, and copper–zinc alloys is briefly described.—A. R. P.

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

(Continued from p. 382.)

The Oxidizing Melting of Gold, Silver, and Copper Residues. E. Raub (*Mitt. Forschungsinst. Edelmetalle*, 1933, **7**, 4–8).—The recovery of gold and silver from scrap by melting the scrap with nitre or other oxidizing flux to remove base metals leads usually to serious loss of values in the slag as well as to an unsatisfactory metal containing much oxide, especially if copper is present. It is preferable to treat the scrap with acids to remove soluble impurities, then to melt it with reducing agents and fluxes to dissolve the non-metallic impurities.—A. R. P.

The Smelting of Complex White Metal Residues. Difficulties Overcome by Present Day Technique. Anon. (*Chem. Age*, 1933, **38**, Metallurgical Section, 17–18).—Modern practice in working up white metal scrap and residues is briefly described with especial reference to the construction of the necessary furnaces.

—A. R. P.

XV.—FURNACES AND FUELS

(Continued from pp. 382–384.)

Melting Equipment in the Non-Ferrous Industry—I, II. R. H. Stone (*Met. Ind.* (*N.Y.*), 1933, **31**, 162–165, 201–203).—The advantages and disadvantages of crucible, open-flame, indirect arc rocking, vertical ring induction, coreless induction, and cupola furnaces for melting non-ferrous metals are discussed.—A. R. P.

Forced-Air Circulation Furnaces. Anon. (*Met. Ind.* (*Lond.*), 1933, **42**, 617–618).—Describes the " Birlec " forced-air circulation furnace, for which are claimed absolute uniformity of temperature, precise control of temperature and time, simplicity of operation, low running and maintenance costs, and safe and clean working conditions.—J. H. W.

Electric Furnace for Melting Aluminium. E. Fr. Russ (*Aluminium*, 1933, **15**, (7), 3–4).—An electrically heated crucible furnace for melting aluminium and zinc is described and illustrated; it is heated by a series of superimposed nickel–chromium wire elements heavily heat insulated on the outside, and surrounding a steel melting crucible which can be raised out of the furnace by depressing a foot pedal which moves upwards the pedestal on which the crucible stands. The current consumption is 45 kw.-hr. for 100 kg. of metal, and the furnace is made in three sizes to hold 10, 25 or 50 kg. of aluminium or 26, 66, or 132 kg. of zinc.—A. R. P.

XXL—INDUSTRIAL USES AND APPLICATIONS

The Most Recent Types of Lagging for Tank-Cars. A. Karsten (*Maschinen-konstrukteur*, 1932, **65**, (9/10), 59–60).—The importance of perfectly dry lagging is emphasized. K. finds that Bohlite, a slag-wool preparation, combines lightness with good insulating and mechanical properties and freedom from moisture. Curves are given showing the rates of cooling of tanks fitted with insulation of Bohlite, Alfol (aluminium foil), and Lambda; also for heat losses through identical thicknesses of these materials at ranging temperatures.—P. M. C. R.

Popularity of Copper Cooking Vessels increases as Manufacturers offer New and Improved Kitchen-Ware. Anon. (*Bull. Copper and Brass Research Association*, 1932, (73), 2–3 and 4–11; and *Daily Metal Reporter*, 1932, **32**, (192), 3).—There appears to be a definite trend in U.S.A. towards the more extensive use of copper cooking utensils. Pages 4–11 are devoted to specific cooking operation in copper vessels.—J. S. G. T.

Canadian Architects Specify Brass and Copper Pipe for Building Improvement. Anon. (*Bull. Copper and Brass Research Association*, 1932, (73), 13).—The use of copper and brass in the reconstruction of the Toronto General Hospital is referred to.—J. S. G. T.

Water is "Incurably Pure." Anon. (*Bull. Copper and Brass Research Association*, 1932, (73), 14).—The imperviousness of copper and brass pipe to hard, corrosive water supplies is exemplified.—J. S. G. T.

Underground Lawn Sprinkler Systems Defeat Corrosion by Soil and Water through Use of Rust-Proof Copper Tubing. Anon. (*Bull. Copper and Brass Research Association*, 1932, (72), 2–3).—Examples of the use of copper sub-surface pipes for distributing water are given.—J. S. G. T.

Pretreatment of Woven-Moulded Brake Lining Controls Quality. Joseph Geschelin (*Automotive Ind.*, 1932, **67**, (24), 745–746).—A flexible brake-lining, consisting of a woven wire and asbestos fabric treated with a plastic rubberless filler, is claimed to show increased efficiency and longer life as compared with various standard linings. The wire employed is of brass, unless zinc is used to give a lower friction coefficient. A metallic powder of unspecified composition is present in the filler in proportions which again can be varied according to the coeff. of friction desired. The thermal conductivity of the wire strands is believed to be responsible for the rapid heat transference in the lining : results of conductivity and friction testing are given.—P. M. C. R.

Building Owners Discover Bronze Window Frames no more Expensive than Rustable Construction due to Complete Elimination of Cost by Upkeep. Anon. (*Bull. Copper and Brass Research Association*, 1932, (72), 10–11).—The use of bronze window frames in large buildings in U.S.A. is illustrated, and economies effected by their use are referred to.—J. S. G. T.

Bronze Applied for Frames and Structural Bars in Two Fine Stained-Glass Windows. Anon. (*Bull. Copper and Brass Research Association*, 1932, (73), 15).—Two artistic stained-glass windows mounted in bronze, recently erected in Philadelphia and Princeton, are illustrated.—J. S. G. T.

B.N.F. Ternary Alloys of Lead. Their Use in Buildings. Anon. (*Dept. Sci. Indust. Research, Building Research, Special Rept.*, No. **19**, 1–25; and (brief abstract) *Met. Ind. (Lond.)*, 1933, **42**, 470).—For roofing purposes and flashings, ternary lead alloys give equal service to pure lead when only two-thirds as thick. The coeffs. of thermal expansion of these alloys are of the same order of magnitude as the coeff. of pure lead.—A. R. P.

B.N.F. Ternary Alloys of Lead. Their Application to the Manufacture of Pipe for Domestic Water Service and of Sheet, &c. Anon. (*Brit. Non-Ferrous Metals Res. Assoc. Development Rept.*, No. **D 3** (Fourth Edition) Aug. 1932;

D.S.I.R. Building Research Special Report, No. **19**, 1933, 7–25).—The alloys consist of lead with (1) 0·25% cadmium and 0·5% antimony and (2) 0·25% cadmium and 1·5% tin. Both alloys have a tensile strength of about 1·68 tons/in.^{2} with an elongation of about 60%, and a much higher resistance to fatigue than pure lead, hence pipe made from ternary alloy will withstand a higher hydraulic pressure before bursting or, alternatively, a thinner pipe of ternary alloy can replace the ordinary thickness of lead pipe. In hard water no tin, cadmium, or antimony is dissolved, and the quantity of lead dissolved is slightly less than with pure lead pipe. In soft water small amounts of antimony are dissolved from alloy (1) and the rate of dissolution of lead is accelerated, but still does not exceed that of pure lead pipe. The bending and joining properties of the alloys are excellent.—A. R. P.

Ternary Alloys of Lead Pipe. Advice as to Its Permitted Use. (*Report of Sub-Committee of the Standing Committee on Water Regulations. Official Circular of the British Waterworks Assoc.*, No. 97, Dec. 1931, **13**, 850–854; *D.S.I.R. Building Research, Special Rept.*, No. **19**, 1933, 28–32.)—Two-feet lengths of various sizes of lead pipes were joined by a wiped joint to similar lengths of ternary alloy (2) pipes (cf. preceding abstract) having wall thickness about 30% smaller than those of the lead pipes, and the composite pipe was subjected to hydraulic pressure until a burst occurred. In all cases this happened in the lead section, and the alloy section showed only a relatively small increase in size. The results are tabulated for pipes of internal diameters from $\frac{3}{8}$ to $1\frac{1}{2}$ in. The Standing Committee on Water Regulations have therefore permitted the use of ternary lead alloy pipes of 30% less weight per yard than ordinary lead pipes for use above ground and in buildings.—A. R. P.

Titanium and Zirconium. F. H. Driggs (*Mineral Ind.*, 1932, **40**, 546–554). —Statistics are given and recent research on these metals is reviewed. Reference is made to the age-hardening of certain alloys of titanium. A new use for titanium has been found in arc welding; the use of ferro-titanium in the electrodes in place of silicon or manganese assists the deoxidation of the weld. The titanium dioxide produced forms a slag which can readily be removed. Patents have been applied for to cover the use of zirconium in detonating compositions, but this work is in an incomplete state of development. Ductile zirconium sheet and wire are now available commercially, but no extended use for the sheet has yet been found.. Zirconium spinnerettes appear to be promising in the rayon industry. The wire is used to some extent in radio valve grids. It has been recommended to use zirconium for soldering tungsten and other difficultly fusible metals.—E. S. H.

Tungsten. Colin G. Fink (*Mineral Ind.*, 1932, **40**, 555–565).—Mainly statistics. Reference is made to a patent for the moulding of articles from powdered tungsten by mixing with the powder a small amount of copper, compacting, heating, and forging at gradually decreasing temperatures.

—E. S. H.

The Manufacture of Incandescent Lamps and Their Uses. J. W. Bateman (*Building Maintenance*, 1932, **6**, (2), 6–10).—An historical survey of the development of the incandescent filament lamp. The making of tungsten wire and "Dumet" wire, and the methods of making modern electric lamps for various purposes, are described, and the principal uses of such lamps are classified and enumerated.—P. M. C. R.

[Widia] Electric Rotary Drilling. H. Mühlhaus (*Colliery Eng.*, 1932, **9**, (95), 27–30).—The preparation, properties, and advantages of Widia tips for drilling bits are discussed, and design, maintenance, and performance are considered.—P. M. C. R.

Working Glass with Widia Tools. A. Fehse and B. Kindt (*Glastech. Ber.*, 1932, **10**, 193–200; *Ceram. Abs.*, 1932, **11**, 523).—F. and K. describe (1) difficulties appearing during the working of glass; (2) the difference between

the working of metal and that of glass; (3) Widia as a material for working glass; (4) glass boring, and (5) glass cutting.—S. G.

A Few Words on [Telephone] Ground Rods. Anon. (*Telephone Eng.*, 1931, **35**, (2), 16).—Hot-galvanized iron rod or pipe is recommended for telephone earths.—H. F. G.

Tentative Specifications for Zinc-Base Alloy Die-Castings (B 86–31 T). —— (*Amer. Soc. Test. Mat. Tentative Standards*, 1932, 295–297).—See this *J.*, 1932, **50**, 108–109.—S. G.

Irish Rail Car Powered with Drumm Zinc–Nickel Battery. Anon. (*Automotive Ind.*, 1932, **67**, (15), 440).—An account is given of the Drumm zinc–nickel alkaline storage battery. The positive plates are grids of nickel or Monel metal, pre-treated in caustic soda solution; the electrolyte is caustic soda (sp. gr. 1·22–1·25 at 60° F.) in which zinc oxide is dissolved to saturation. The positive plates are either flat or tubular, the active material being nickel or silver oxide, or a mixture of the two; to increase the conductivity, graphite is added or a nickel grid introduced. For long-period use a little aluminium hydrate or beryllium hydrate may advantageously be added. The cell has a high e.m.f. (1·9 volts) and a much lower internal resistance than other types of alkaline storage cell.—P. M. C. R.

Report of Committee A–9 [of A.S.T.M.] on Ferro Alloys. N. B. Hoffmann and Charles McKnight (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 134–135).—See this *J.*, 1932, **50**, 497–498.—S. G.

Report of Committee B–2 [of A.S.T.M.] on Non-Ferrous Metals and Alloys. William Campbell and E. E. Thum (*Proc. Amer. Soc. Test. Mat.*, 1932, **32**, (I), 198–200).—See this *J.*, 1932, **50**, 495.—S. G.

A Thermostatic Bi-Metal [Wilco]. C. Clément (*Électricien*, 1932, **48**, 413–418).—A description of the properties and applications of Wilco thermostatic metal. This consists of two closely welded strips; one of Invar (expansion coeff. $7·2 \times 10^{-7}$) and one of a special brass (expansion coeff. $1·73 \times 10^{-5}$).—E. S. H.

Thermostatic Metal—or Bimetal; Nature and Utility. H. Scott (*Metal Progress*, 1932, **22**, (5), 29–33).—The method of making bimetal strip is described, and a formula is given for calculating the degree of deflection for materials of known coeff. of expansion. The selection of suitable materials is discussed : brass–Invar forms the most sensitive practicable combination, but at temperatures above 100° C. certain alloy steels are substituted. Monel metal is used under certain conditions. The necessity for careful treatment prior to calibration, and the use of bimetals in the study of creep, are discussed.
—P. M. C. R.

The Behaviour of Metals in Buildings. W. Wiederholt (*Tonind.-Zeit.*, 1931, **55**, 936; *Building Sci. Abs.*, 1931, [N.S.], **4**, 351).—An abstract of a paper read at the Building Exhibition, Berlin, 1931, in which W. discussed generally the corrosion-resistance of metals used in building. Durability when exposed to the atmosphere, resistance to water and water vapour are essential properties. Two metals should not be used in juxtaposition unless good insulation is provided in order to avoid the action of local electric currents. Lead is not attacked by ordinary tap water, but by water containing little or no carbon dioxide, and by lime and cement mortar; protection is provided by bitumen or tar paint. Zinc is durable in a normal atmosphere, but is very sensitive to sulphurous acid and chlorine compounds, also to alkalis, and should not be used in contact with cement or lime mortars. Aluminium behaves similarly, but in air becomes coated with an oxide layer which prevents further attack. Copper forms a patina; it is coloured black by exposure to hydrogen sulphide and ammonia.—S. G.

Drainage and Sanitary Work. H. H. Clay (*Indian Eng.*, 1932, **102**, 506).—Abstracted from a lecture. The materials, setting, form, and protection of drain-pipes are considered. Lead is recommended for branch pipes, for

connections to iron pipes in order to avoid damage in possible settling, and as a caulking material; copper appears likely to replace lead in the construction of soil pipes. All vent piping below $1\frac{1}{2}$ in. in diameter should be non-ferrous, as the gases vigorously attack iron, whether galvanized or not.

—P. M. C. R.

The One-Pipe System of Drainage. W. Draper (*Architect*, 1932, **132**, 117–118).—Materials for waste pipes in such a system are of especial importance, as both hot and cold water are carried by the same pipes. Cast iron is suggested for the main soil pipes, with a lead or copper branch pipe for household wastes. Copper is preferred to lead as being less liable to puncture and temperature effects. D. considers galvanized wrought iron, a piping material much in use in North America, too easily corroded by sewage gases to be suitable for waste or vent piping. In the discussion on the paper, the liability of lead pipes to creep and brittleness in the one-pipe system was confirmed.—P. M. C. R.

Modern Metals for Decorating a Modern Play House. George Kester (*Metal Progress*, 1932, **21**, (5), 25–29).—Chromium plate, aluminium foil, and " 18–8 " alloy are extensively used in the decoration of the Earl Carroll Theatre, New York. The selection of these materials is influenced by their permanence, reflecting qualities, method of cleaning, and weldability; the matching of colour and of surface lustre is also of great importance.—P. R.

Metals in Modern Shop Fronts. Anon. (*Met. Ind. (Lond.)*, 1932, **41**, 607–609).—Describes the application of bronzes, Monel metal, oxidized silver, stainless steel, nickel–bronzes, and silicon–aluminium alloys to shop front construction.—J. H. W.

Metals Used in Chemical Industry Plant. Chas. J. Elliott (*Met. Ind. (Lond.)*, 1932, **41**, 511–513 and 562).—Elementary considerations governing the selection of metals to be used for various purposes in industrial plant are given.—J. H. W.

Materials Used in Chemical Engineering Operations. B. E. Roetheli and H. O. Forrest (*Indust. and Eng. Chem.*, 1932, **24**, 1018–1027).—Information regarding the materials in use at the present time for such of the unit operations as are involved in the handling of corrosive substances is tabulated under two headings, *viz.*: (1) inorganic chemicals and (2) organic chemicals. Frequently, a slight impurity content markedly affects the corrodibility of a material; so that when a choice is made, it is advisable to consider not only the limiting conditions defined in the tables, which have been compiled from information from all possible sources, but also the factor of purity. The lists are intended as a guide in the choice of materials for preliminary investigations before making the final choice. A number of illustrations of chemical plant equipment accompany the tables.—F. J.

The Relation of Food to Disease. Stanley Dixon (*Institute of Chemistry*, 1932, 1–38).—Discusses the toxic effects of arsenic, antimony, lead, zinc, tin, copper, and their compounds. Zinc-coated iron vessels should never be used for cooking purposes. Reference is made to poisoning due to leaving beverages in contact with enamelled metal containers, the enamel containing antimony or lead compounds.—E. S. H.

Metal as Material for Cellar and Transportation Vessels [in the Brewery]. W. Kluger (*Brauer-Hopfen-Zeit. Gambrinus*, 1932, **59**, 102–107).—An address.

—S. G.

Chemical Engineering Problems in Hardwood Distillation. R. S. McBride (*Chem. and Met. Eng.*, 1932, **39**, 604–608).—In the refining of wood chemicals, the equipment used for the chemical treatment, distillation, and fractionation is of the most modern chemical-engineering type. Copper equipment is general, but for highly-refined acid products, silver is also commonly used.

—F. J.

Heat Transmission from Metal Surfaces to Boiling Liquids. I.—**Effect of Physical Properties of Boiling Liquid on Liquid Film Coefficient.** D. S. Cryder

and E. R. Gilliland (*Indust. and Eng. Chem.*, 1932, **24**, 1382–1387).—An experimental evaporator consisting of an electrically-heated brass tube suspended in the boiling liquid is illustrated and described. In it, direct measurements of boiling-liquid film coeffs. of heat-transmission were made, the temperatures of both pipe and liquid being measured by means of suitable thermocouples at widely varying temperature differences, for each of 11 different liquids. Equations have been developed correlating the heat-transmission coeff. so obtained, with the physical properties of the boiling liquids.—F. J.

Designing Heads for Tanks and Heat Exchangers. C. O. Sandstrom (*Chem. and Met. Eng.*, 1932, **39**, 668–672).—The design of heads or covers of pressure vessels used in the chemical industries assumes increasing importance with the definite tendency to use higher pressures. All phases of head design are discussed in 3 articles, of which this is the first.—F. J.

Pumps. Chas. W. Cuno (*Indust. and Eng. Chem.*, 1932, **24**, 1109–1115).—There is no all-purpose corrosion-resisting material. Acid-proof stoneware, porcelain, and glass come first, and, although used for pumps, they have certain disadvantages, and are expensive. Duriron comes next, but is hard and brittle, unmachineable, and has high thermal expansion. Lead is used because of its resistance to sulphuric acid, but is very soft and is soluble in many other reagents and is used only in certain kinds of pumps. The use of rubber has been almost wholly limited to centrifugal pumps. Copper and copper-base alloys are used extensively, chiefly because of their cheapness and excellent machineability. Iron-base alloys with chromium and nickel are chiefly used in thermal equipment, owing to their resistance to corrosion at high temperatures. Monel metal finds considerable use because of its strength, workability, and resistance to many solutions. Tin, aluminium, aluminium-base alloys, and magnesium alloys are also used. The uses of pumps are classified and discussed, and the various types of pumping equipment described and illustrated.—F. J.

Cooling and Condensing Units. Anon. (*Chem. and Met. Eng.*, 1932, **39**, 571).—Cast-metal cooling and condensing units of novel design intended for use in petroleum refineries, coke plants, and other process industries, have recently been put on the market. Some of their advantages are mentioned, including resistance to corrosion, when made of special cast-irons or non-ferrous alloys.—F. J.

Careful Installation Pays in Plant Piping. Fred D. Hartford (*Chem. and Met. Eng.*, 1932, **39**, 254–256).—The designer of chemical plant is fortunate in having a wide variety of piping materials from which to choose. Steel, wrought iron, cast iron, silicon–iron, lead, aluminium, nickel, brass, copper, rubber, glass, fused silica, wood, and vitrified clay are all familiar to him. Lined pipe is also a possibility for some purposes. The designer is rarely limited to one sort of piping for any particular service. Usually he must weigh first cost, mechanical strength, life, maintenance, and the quantity of impurities which will be introduced by the corrosion of the pipe, if he is to secure the most economical installation. Pipe joints, overhead and underground positions for piping, overhead piping supports, and other details are discussed.—F. J.

Use of Arc-Welded Alloys to Arrest Corrosion. R. S. Hoffman (*Oil and Gas J.*, 1932, **31**, (15), 10; *J. Inst. Petrol. Eng.*, 1932, **19**, 440*A*).—The protection of pipe-joints on cracking apparatus by the application of selected alloys by electric arc welding is described. Considerable savings have been effected because of the increased resistance to corrosion. The alloy used is a chromium–nickel alloy available on the open market, and referred to as KA2 or NCT3. Illustrations are given of the type of weld applied to different kinds of fittings—flanges, valves, crosses, ties, and other carbon steel fittings. The extent of the saving effected and the method of calculating this figure are given in each case. It is shown that the savings in some cases amount to over 80%.—S. G.

Materials Available for Manufacture of Equipment for Oil Industry. R. J. Allen and F. B. Applegate (*Oil and Gas J.*, 1932, **31**, (21), 12; *J. Inst. Petrol. Tech.*, 1932, **18**, 472*A*).—Deals mainly with the question of the correct selection of material for use in the construction of various parts of pumps and compressors. The physical properties and resistance to corrosion of a number of metals and alloys used are stated. The general problem of corrosion is discussed.—S. G.

Requirements in Materials for Valves and Fittings for High-Temperature, High-Pressure Field. J. J. Kanter and H. W. Maack (*Oil and Gas J.*, 1932, **31**, (23), 13–14, 16; *C. Abs.*, 1933, **27**, 253).—Cast iron changes in size and shape through permanent " growth "; malleable iron resists temperature but not chemicals; brasses, bronzes, and nickel–copper compounds do not resist high temperatures. Steel has been made to serve for a majority of valves and fittings. By alloying and by suitable treatment its properties have been modified to suit each requirement.—S. G.

A Metal Element Filter for Cleaning Oils and Liquors. Anon. (*Mech. World*, 1932, **91**, 567).—The greatly increased demand for an efficient form of metallic filter to replace the usual fabric, gauze, or perforated metal type has resulted in the production of the " Purolator " metal element filter, metallic ribbon of taper cross-section being wound on a former, constructed to withstand pressure without damage or loss of efficiency. The effect of the tapered cross-section of the ribbon renders it impossible for wedging to take place behind the edge, thereby obviating difficulty in cleaning by back pressure or agitation. The ribbon may be of brass, copper, stainless steel, or other metal, and can be wound so as to prevent the passage of particles as small as 0·0005 in. The designs of the ribbon and filter are illustrated.—F. J.

The Development of Auto-Klean Strainers. W. R. Beldam (*Queen's Eng. Works Magazine*, 1932, (29), 95–96).—Hollow metal discs are assembled in series on a spindle rotated by an external handle, a cleaner blade being inserted between each pair of discs. The viscosity and degree of contamination of the oils to be cleaned determine individual adjustments. Very accurate machining is demanded by high-grade lubricants. For fuel and lubricating oils, steel plates are used, but the cleaning of petrol necessitates the use of phosphor-bronze, and Monel metal is employed for corrosive liquids. Various applications of the principle are briefly stated.—P. M. C. R.

Metallurgy and the Electrical Industry. Colin J. Smithells (*Met. Ind. (Lond.)*, 1933, **42**, 71–73, 79).—A review of recent metallurgical research and development in the electrical industry, including heat-resisting materials, electric furnaces, bimetallic strip, electric lamps and valves, electrical welding, rolling mill practice, and high-purity metals.—J. H. W.

Communication Conduits and Cables. A. J. Egan (*Engineers and Engineering*, 1932, **49**, 17–19).—Precautions in placing, arranging, and racking cable for underground plant are described, together with suitable insulation methods and details of inspection routine. The testing of soldered joints, and the detection of minute flaws in these, are particularly discussed.—P. M. C. R.

Non-Ferrous Metals in Railway Electrification. Francis A. Westbrook (*Met. Ind. (Lond.)*, 1932, **41**, 515–516).—The use of non-ferrous metals, especially copper and aluminium, in railway electrification is discussed.
—J. H. W.

Low-Capacity Fuses in Telephone Plant. Anon. (*Telephone Eng.*, 1932, **36**, (3), 17–18).—A description of a type of enclosed wire fuse suitable for protecting milliammeters, relays, &c.; capacities down to 0·01 amp. are available.
—H. F. G.

Development of Metal Construction in Aircraft. A. Koppenhöfer (*Z. Flug. u. Motor.*, 1931, **22**, 421–425).—Abbreviated from a paper read before the Wissenschaftliche Gesellschaft für Luftfahrt. Steel, Elektron, or Duralumin

can advantageously replace wood in beams and ribs; the time needed in varnishing wood is an economic disadvantage. Tests on the alloys mentioned led progressively to the adoption of Elektron or Duralumin, the form of members being modified to suit the material as investigations proceeded. Although liable to corrosion, Elektron is preferred on account of its lightness and machinability, but Duralumin is superior for channels. Composite light alloy members are easily assembled, by riveting rather than welding, since the latter often sets up local brittleness. Methods of testing beams and ribs are described. Further applications of Elektron as casing, seats, fuel and oil containers, wheels, spurs, and various small cast fittings, are enumerated in the discussion on the paper.—P. M. C. R.

Materials for Aircraft Construction. Paul Brenner (*Z. Flug. u. Motor.*, 1931, **22**, 637–648).—After a preliminary section on wood, a list of metals and alloys used in aircraft construction is given. It includes Duralumin, Lautal, Elektron, Magnalium (an aluminium alloy with 5% magnesium, used for rivets), and certain steels. Comparative curves for certain mechanical properties are given. The effect of corrosion on tensile strength, elongation and resistance to fatigue is discussed. B. indicates positions specially liable to attack and the desirability of minimizing its effects by the use of thick material where possible. Other methods of protection are anodic oxidation, plating, and selection of suitable materials for use in combination, as in the case of Duralumin rivets and Duralplat sheet. Methods of joining are considered; spot-welding causes the least coarsening of structure among welding methods. Localized stresses due to rivet-holes may easily cause failure.
—P. R.

On Economy in Various Processes of Aircraft Construction. H. Herrman (*Z. Flug. u. Motor.*, 1930, **21**, 553–563, 580).—H. considers all-metal construction appreciably more expensive than the suitable combination of wood and metal. In reviewing the economic construction of body, wings, engines, and other parts he considers in various connections the possibilities of Elektron, Silumin, aluminium, Duralumin, copper, brass, steel and wood; the two latter in combination being preferred to Duralumin in certain cases where extra strength is required. Considerations of safety and efficiency point to rather heavier construction and more powerful engines, even at enhanced cost, but care in the detailed selection of materials partially counteracts this.
—P. M. C. R.

Experiences in the Construction of Aero Engines. Oskar Kurz (*Z. Flug. u. Motor.*, 1932, **23**, 691–701, 721–730).—A summarized description of certain types of air-cooled and water-cooled engine assemblages is followed by detailed consideration of materials and construction of cylinders, blowers, gearing-down apparatus, pistons, valves, bearings, crankshafts, engine casings, and Diesel installations. Light alloys find application as cylinder heads, " Y "-alloy being commonly used. For pistons heat-resisting light alloys, usually containing copper or nickel, are generally employed: strengthening insets are often made of Invar. " Y "-alloy pistons give better service in the die-cast than in the forged condition. Aluminium, Duralumin, Lautal, Silumin, and Elektron are favoured materials for engine casings. White metal appears to be replaced to a great extent by ball bearings for heavy work—or by leaded bronze; a typical analysis of copper 66, lead 33, iron 1% is given. Where white metal is still used, a lead–antimony–tin–nickel–cadmium alloy, Thermit bearing metal, is recommended. " Aluminium–bronze " is found satisfactory for valve-seats, and Kuprodur bronze for guides. The use of mercury-cooled valves has been practically superseded by modifications in valve structure and material; copper insets in valve stems have already increased working efficiency, and developments in heat-resisting materials should effect further improvements. In the discussion, *W. Stieber* stated that careful workmanship

obviated certain disadvantages of the white metal bearing, especially those due to the influence of copper–tin crystals.—P. M. C. R.

Reconditioning Valve Seats in I.C. Road Engines. R. Wake (*Mech. World*, 1932, **92**, 296–297).—The erosion of internal-combustion valve seats causes loss of power, heavy fuel consumption, and, finally, complete engine failure due to burning of the valve. The essential requirements of a renewable valve seat are enumerated, *viz.* : (1) a gas-tight joint between the insert and the housing; (2) tightness and freedom from slackness at all temperatures of the engine; (3) ease of fitting and renewing; (4) facility for being secured by a safe and positive locking device; (5) applicability of the locking device to valve seats of material other than special iron alloy. "Aluminium–bronze" makes a much better valve seat than any other known material, and details of a renewable valve seat of this alloy held in place in the cylinder block by means of a ductile metal connection or locking device are illustrated and described. The composition of the alloy is as follows : aluminium 10·5–11·5, nickel 4·0–6·0, iron 4·0–6·0, magnesium 0·10, and copper 81·4%. Its mechanical properties are in the "as cast" and "as forged" conditions, respectively : tensile strength, 25·4, 35·5 tons/in.^{2}; elastic limit, 16·5, 20·3 tons./in.^{2}; elongation, 22·0, 22·0%; impact strength, 5·0, 2–3 kg./cm.^{2}. It has high resistance to corrosion by acids, sea-water, and hot gases, and retains its hardness at temperatures as high as 1200° F. (649° C.) if heat-treated. Toughness, as well as Brinell hardness increase by heat-treatment.—F. J.

Automobile Machinery in 1931. —— Capère (*Science et la Vie*, 1930, **38**, 503–512).—A section of this review is devoted to light alloys and the conditions governing their maximum performance. The alloys considered are Hiduminium, "F.L." (aluminium–boron–titanium–nickel–silicon), Elektron, Duralumin, and Alugir.—P. M. C. R.

Non-Ferrous Metals in Railway Engineering. Brian Reed (*Met. Ind. (Lond.)*, 1933, **42**, 35–38).—A review of the applications of copper and aluminium and their alloys in railway engineering.—J. H. W.

Steam Locomotive Design ; Piston Heads. E. A. Philipson (*Locomotive*, 1932, **38**, (475), 90).—Drop-forgings of an aluminium–silicon alloy are in use on the Continent instead of forged steel piston heads; corrosion is decreased and weight reduced while maintaining the necessary strength. A rim of ferrous material, normally provided to facilitate repair in cases where head and rod are forged together, is replaced in certain South American railways by a bronze of the approximate composition copper 86–89, phosphor–tin and tin each 4·6%.—P. M. C. R.

Metallurgical Problems of the Diesel Engine. R. J. Allen (*Amer. Soc. Mech. Eng. Preprint*, 1932.)—Deals in a general way with use of light alloys, bronzes, white bearing metals, chromium plating, and welding in Diesel engine practice.—W. P. R.

Metals in Ships. W. R. G. Whiting (*Met. Ind. (Lond.)*, 1933, **42**, 31–34, 38).—A review of the applications of non-ferrous metals in shipbuilding.
—J. H. W.

The Trend in Naval Engineering. C. Huey (*J. Amer. Soc. Naval Eng.*, 1932, **44**, 206–213).—In an article dealing with various devices for improving efficiency a section is devoted to substitutes for brass. It is pointed out that modern warships require hundreds of measuring and indicating devices such as pressure gauges, speed indicators, annunciators, recorders, &c., and that limitation of weight is an important factor. The recent development of corrosion-resisting aluminium alloys has supplied a light-weight substitute for brass which is fairly acceptable for these many devices. Corrosion-resisting properties of such alloys are better reinforced with a coating of lacquer, paint, or enamel, and on account of the electrolytic effect of aluminium in contact with

dissimilar metals special knowledge is required in the application and choice of material for the securing screws, clamps, bolts, nuts, and washers.—J. W. D.

Metallurgical Problems on Naval Construction. J. Chaintreuil (*Science et Industrie*, 1932, **16**, (Special Issue 218B), 57–61).—The warship constructor is faced with problems of corrosion, wear, easy replacement, weight reduction, and enhanced and reliable performance, in their most urgent form. Proper facilities permit the modern metallurgical laboratory to approach the practical solution of these problems. C. outlines 3 main methods of attack : (1) study of failures in service, with careful observation of working conditions, combined with chemical and micrographic analysis; many corrosion problems have thus been elucidated; (2) improvement of existing plant, notably by introducing more suitable alloys as these become available, *e.g.* the increasing use of light alloys, with concomitant advances in protective methods; (3) adaptation of materials to developing technique, as with superheat alloys. The metallurgical laboratory must also act as a centre of information and a repository of accurate records.—P. M. C. R.

The Strachan Half-Drop Window. Anon. (*Tram. and Rail. World*, 1931, **70**, 63).—The metal frames for this type of carriage window are 4 standard types : (1) a brass frame for painting; (2) a brass frame for nickel, chromium, oxidized, or enamel finish; (3) a Duralumin frame for painting, and (4) a frame of polished Duralumin.—P. M. C. R.

Turbines. A Report of the Prime Movers, Committee, Engineering National Section, National Electric Light Association [U.S.A.]. —— (*Nat. Elect. Light Assoc. (U.S.A.) Publ.* No. 234, 1932, 1–38; and (abstract) *Power Plant Eng.*, 1933, **37**, 121).—The report covers the following—a summary of operating records from a number of firms, the effect of age on turbine efficiency, a survey of blade erosion, miscellaneous factors in turbine operation, the results of tests on a 50,000-kw. turbine, and an indication of recent developments. Statements indicating the nature of erosion troubles and suggesting remedies are given. Technique has been developed for the removal of deposits of material from turbine blading.—W. A. C. N.

Problems in Steam Turbine Design. C. Richard Soderberg (*Power Plant Eng.*, 1932, **36**, 526–527).—The high temperatures and pressures, and wide temperature intervals, involved in modern turbine practice have imposed additional strain on blading materials, especially on those of the units composing the last row of blades. Modern requirements call for materials capable of retaining their elastic properties at the operating temperatures. Resistance to erosion may be increased by improvements in blading material. These may be effected by (1) the use of stainless steel and similar alloys, (2) the welding or soldering of shielding strips to ordinary blading. Tantalum and Stellite have been found satisfactory for this purpose. Chromium plating is expensive, and is believed in some quarters to be accompanied by embrittlement. Graphs are appended showing the results of erosion and corrosion tests.
—P. M. C. R.

Possibilities in Steam Turbine Development. W. Kaiser (*Maschinenkonstrukteur*, 1931, **64**, 170–171).—(Part only.) Reference is made to the possibility of effectively protecting turbine blading from erosion by electrodeposited metallic coatings. A more promising development is the recent introduction of mercury vapour as prime mover; the results obtained at the South Meadow installation are discussed : the mercury-driven turbine shows a 15% better performance on a 10 months' run than the corresponding steam-driven plant, and the amount of mercury required is comparatively small.—P. M. C. R.

The Selection of Worm-Gearing. W. A. Tuplin (*Mech. World*, 1932, **92**, 248–250).—The advantages of employing reduction gears for the transmission of power from high-speed electric motors are discussed, as well as the materials

used, choice of types, and main features of worm-gearing. The working surface of the worm-thread must be very hard to resist wear and very smooth to reduce friction. Experience has shown that the best material is case-hardened steel with a nickel content of about $3\frac{1}{2}\%$, which gives a hard-wearing surface in conjunction with high core-strength. The wheel must be made of phosphor–bronze, centrifugally-cast to improve density and resistance to crushing, and must be produced under strict metallurgical control, since the load-capacity of the bronze is extraordinarily sensitive to slight variations in composition or casting conditions.—F. J.

The Vatican Coinage. Anon. (*Rev. Nickel*, 1931, **2**, 87).—The recent new coinage—none has previously been issued for more than 60 years—consists of the following denominations—100 lires in gold, 5 and 10 lires in silver, 2 and 1 lires, and 50 and 20 centesimi in pure nickel, 10 and 5 centesimi in bronze. Some of the pieces are illustrated.—W. A. C. N.

Recent Trends in Alloy Steels. Richard Tull (*Blast-Fur. and Steel Plant*, 1932, **20**, 422–424).—A review of properties conferred on steels by the addition of other metals, such as chromium, nickel, and manganese. Cromansil steel, which contains chromium, manganese, and silicon, is referred to in particular.
—R. Gr.

Applying Metallic Decorations on Glass and Pottery Ware. Roessler & Hasslacher Chemical Co. (*Ceram. Ind.*, 1932, **18**, 170–173; *Ceram. Abs.*, 1932, **11**, 287).—For affixing metal to glass, glaze, or enamel, two general methods are in use: (1) actual deposition of the metallic coating on the ware, as in electrodeposition or precipitation (this method is now of small importance in decoration), and (2) the firing method by which the powdered metal is fixed to the ware. A discussion is given of these preparations and the general methods of applying or fixing them to ceramic ware.—S. G.

Metallic Mirrors. Anon. (*Met. Ind. (Lond.)*, 1932, **41**, 330).—Short note on the manufacture of parabolic mirrors by depositing metal on to glass formers or moulds.—J. H. W.

Manufacture and Use of Powdered Metals. Charles Hardy (*Metal Progress*, 1932, **22**, (1), 32–37, 80; also (reprint) *Met. Ind. (Lond.)*, 1932, **41**, 345–347, and (summary) *Metallurgist* (Suppt. to *Engineer*), 1932, **8**, 127–128).—Methods for powdering metal are outlined. A recent application for powdered metal is its consolidation under pressure into useful shapes; rough-surfaced particles, of the type normally obtained by electrolysis, are most suitable for this, and a high degree of purity is necessary for proper incorporation. Electrolysis is found to be the cheapest method of production. The carefully graded deposits may be used in the production of alloys which, owing to differences in melting-point, cannot be made in the ordinary way. The degree of pressure and the size of the particles determine the strength of the finished product. Powdered metal is much used for " capillary lubrication " of oil-less bearings. It can also be treated after being sprayed or painted on other surfaces. The main advantages of its use are controlled porosity and grain-size, high purity, constant composition, small loss in manufacture; saving of raw material, and the possibility of producing alloys from constituents with widely different melting points, or from metals and non-metals. Heat-treatment is cheap, but must be carefully controlled. An important limitation of the method is in respect of size; dies and plungers require most accurate fitting.—P. M. C. R.

Powder Metallurgy. Charles Hardy (*Met. Ind. (N.Y.)*, 1932, **30**, 179–180). —The production of articles from powdered metals or metal mixtures by pressing and sintering below the melting-point is briefly outlined.—A. R. P.

Powdered Metals by Electrolytic Methods. J. Rossmann (*Met. Ind. (N.Y.)*, 1932, **30**, 321–322, 396–397, 436, 468–469).—A lengthy review of the patent literature.—A. R. P.

Metallization of Wood Opens New Uses. M. Naphtali (*Chem. and Met. Eng.*, 1932, **39**, 269).—This process makes it possible to open the microscopic pores of the wood and, through them, to fill the individual cells with molten metal, whilst retaining the original form of the cells. Thus the finished product is a wooden structure each of the cells of which has an isolated charge of metal. The wood is first dried and then immersed in molten metal, *e.g.* tin, lead, or alloys, and then subjected to moderate pressure in a closed vessel. Impregnation can be confined to the surface or continued to the interior. A considerable increase in sp. gr. occurs, as well as in hardness and compressive strength. The material resists moisture, it being possible to prevent swelling or warping in moist atmosphere or water. It also resists prolonged intense heating, and only when the metal has flowed from the surface does the wood begin to glow like charcoal. The workability of the material is similar to that of wood.—F. J.

Cathode Sputtering—A Commercial Application. Hal. F. Fruth (*Bell System Tech. J.*, 1932, **11**, 283–292; and (lengthy abstract) *Met. Ind. (N.Y.)*, 1932, **30**, 428–431).—Reprinted from *Physics*, 1932, **2**, 280. See this *J.*, 1932, **50**, 694.—S. V. W.

Cathode Sputtering. F. H. Newman (*Phil. Mag.*, 1932, [vii], **14**, 1047–1049).—A more rugged mirror results if the glass to be " mirrored " is heated before introduction into the sputtering chamber, which is preferably made of quartz. A suitable form of sputtering chamber and the necessary technique are described.—J. S. G. T.

Photo-Electric Cells Having Cathodes in the Form of Thin Deposits of Alkali Metals. Rudolf Sewig (*Z. Physik*, 1932, **76**, 91–105).—It is shown that the photosensitivity of photo-electric cells having cathodes of alkali metals can be increased considerably by the use of diffusion cathodes of the kind described by Asaa and Suzuki, but using nickel, tungsten, or tantalum as intermediate metal in place of the gold or silver used by A. and S.—J. S. G. T.

Photo-Electric Cells and Their Application. H. R. Ruff (*Proc. Rugby Eng. Soc.*, 1930–31, **25**, 40–69).—An account is given of the discovery, early development, and modern and possible future applications of the photo-electric effect. The metals most suitable to the construction of photo-electric cells are enumerated, and their relative emissions normal and selective, are considered. The effects of the high vapour pressure of cæsium, originally the cause of electrical leakage between electrodes, can be obviated by methods of cathode manufacture by which only a very thin film of alkali metal is retained on the cathode. The gas-filled cell and the Thyratron valve are described.—P. M. C. R.

XXII.—MISCELLANEOUS

The Installation and Organization of a Modern Metallurgical Laboratory. Pierre Chevenard (*Mem. et compt. rend. Soc. Ing. civils France*, 1932, **9**, 1109–1158).—Describes the general progress of research, the installation and organization of the laboratories, and the methods of testing as carried out at Imphy (France), with special reference to dilatometric measurements and thermo-magnetic analysis of ferrous alloys and alloys of nickel and chromium, giving typical results. Future prospects in the matter of metallurgical research are discussed.—J. H. W.

Science and Technique in the U.S.S.R. [P.] Rosbaud (*Metallwirtschaft*, 1933, **12**, 3–5).—The scientific and technical laboratories, especially those concerned with metals, in Soviet Russia, the scientists working in them, and their sphere of work are enumerated.—v. G.

Sealing Porous Castings. Anon. (*Eng. and Mining J.*, 1933, **134**, 172).— A note on the use of a special sealing liquid, made by the Bakelite Corporation, which is forced into the weak section of the casting at a pressure of 250 lb./in.². This is followed by baking for 1–2 hrs. at 275°–300° F. (135°–149° C.). The treatment may be applied to castings made from aluminium, nickel, silver, brass, bronze, and similar materials. When properly treated, the solution cannot be melted or dissolved. It is unaffected by cold water, steam, and by temperatures up to 400° F. (204° C.), and is resistant to most chemical reagents.—R. Gr.

The Metal Industries. A Symposium on Their Record in 1932 and Prospects for 1933. —— (*Met. Ind.* (*N.Y.*), 1933, **31**, 5–14).—Reviews of the year 1932. *Copper* (Anon.), p. 5. *Zinc* by A. E. Mervine, pp. 5–6. *Tin* by C. E. Mantell, p. 6. *Lead* by F. E. Wormser, pp. 6–7. *Aluminium* by S. K. Colby, pp. 7–8. *Nickel and Its Alloys* by Robert C. Stanley, pp. 8–9. *The Precious Metals*, by G. H. Niemeyer, p. 10. *Secondary Metals* by T. A. Wright, p. 10. *The Brass Foundry* by H. M. St. John, p. 11. *The Brass Rolling Mill* by William J. Pettis, pp. 11–12. *Jewelry Making* by C. M. Hoke, p. 12. *Plating and Finishing* by A. K. Graham, pp. 13–14.—A. R. P.

The Output of Work in the Metallurgical Industries of Great Britain. F. Magri (*Metallurgia Italiana*, 1932, **24**, 654–655).—A discussion of statistical data with the object of obtaining an exact estimate of the output.—G. G.

The Heavy Non-Ferrous Metals in Italy. L. Cambi (*Giorn. Chim. Ind. Appl.*, 1932, **14**, 341–348).—Recent extensions and developments in the Italian non-ferrous metal industry are broadly discussed.—G. G.

The Metal Manufacturing and Finishing Industries of the United States. Adolph Bregman (*Met. Ind.* (*N.Y.*), 1933, **31**, 1–4, 51–53).—Data on the uses of copper, zinc, lead, silver, aluminium, and tin in the U.S.A. are tabulated.
—A. R. P.

A Bird's-Eye View of the [Canadian] Metal-Working Industry. Anon. (*Canad. Mach.*, 1932, **43**, (11), 47–71).—After the presentation of a general survey, for the years 1923–1930 inclusive, the industry is considered under 13 primary classifications, which receive detailed analysis. With the exception of 1924, the years 1923–1929 have shown a continuous expansion in all branches; the non-ferrous metal group leading with a 90·3% increase. The depression of 1930–1931 affected the respective sections to a varying degree, the regression being least in the case of electrical apparatus and supplies.—P. R.

Self-Ignition of Metals. Anon. (*Metallwaren-Ind. u. Galvano-Tech.*, 1932, **30**, 230–231).—Some examples of spontaneous combustion of metal turnings and dust are briefly discussed.—A. R. P.

Receiving and Classifying Sheet Iron, Cast Iron, and the Principal Non-Ferrous Metals. Gérard de Smet (*Aciers spéciaux*, 1932, **7**, 182–190).—The principal points to be considered in specifications of industrial metals and alloys are : (1) micro-examination and chemical analysis, (2) physical tests, (3) macro-examination, (4) classification, (5) method of manufacture, (6) tolerances and number of tests, (7) appearance of product, (8) reasons for rejection. These points are discussed in the cases of copper and copper alloys, light alloys, antifriction alloys, zinc, tin, and lead.—J. H. W.

Variable Pressure Regulated to Prevent Rebound of Molten Metal During Casting [of Dental Plates]. Raymond E. Myers (*J. Dental Research*, 1932, **12**, 327–338; and *Brit. J. Dental Sci.—Prosthetic Section*, 1932, **77**, 216–223, 240–245).—Causes of failure in casting dental plates are discussed and a machine for casting plates under gradually increasing pressure is described; this procedure is shown to eliminate failures caused by rebound of the metal from the base of the sprue and partial or complete blockage of the sprue by freezing.
—A. R. P.

The Aluminium Industry. L. Manfredini (*Alluminio*, 1932, **1**, 213–236).

—A review, in which are discussed: the present status of the world's aluminium industry; the principal producers, their production and capacity; the Haglund process for making alumina; recent theories on the electrolysis of alumina, and recent progress and improvements in this branch; Hoope's method for obtaining very pure aluminium; anodic oxidation as applied to aluminium and its alloys; synthetic view on the output and the consumption of aluminium in the world and in Italy, with special regard to the problem of making aluminium from leucite and to the danger of over-production. It is concluded that the present Italian organization is ample as regards actual consumption, and is more than sufficient, for many years, to face the present and future demands of domestic and foreign markets.—G. G.

The Aluminium Industry of the World. Anon. (*Met. Ind. (N.Y.*), 1933, **31**, 18–19).—A classified list of the world's producers of aluminium and aluminium products with output statistics.—A. R. P.

The German Metal [Aluminium]. Anon. (*Oberflachentechnik*, 1933, **10**, 5).—A review of the aluminium industry in Germany.—A. R. P.

Standard Terms in the Aluminium Industry. F. H. (*Aluminium Broadcast*, 1932, **3**, (28); and *Light Metals Research*, 1932. **2**, (7), 2 pp.).—A list of terms in English, German, and French, standardized by collaboration between leading aluminium producers, describing crude and semi-manufactured products.—J. C. C.

Bauxite and Aluminium. V. Charrin (*Industrie chimique*, 1932, **19**, 646–650).—Discusses the history of aluminium, its manufacture from bauxite, statistics of production, and applications.—E. S. H.

The Research Laboratories of the Aluminium Industrie, A.G., Menhausen. A. von Zeerleder (*Alluminio*, 1932, **1**, 377–387).—An illustrated article.—G. G.

Beryllium Metal from the Oxide. G. D. Fitzpatrick (*Chem. Trade J.*, 1932, **90**, 403).—Some tests on the aluminothermic production of beryllium metal are briefly described. The reaction between aluminium and beryllia cannot be started in the usual way with a fuse but proceeds to completion if the mixture is strongly heated although the metal remains disseminated as fine prills throughout the slag. A mixture of beryllia, aluminium, and barium peroxide can be fired readily with a fuse and if sodium fluoberyllate or fluoaluminate is added as a flux a button of beryllium–aluminium alloy containing 60–83% beryllium can be obtained; the yield of beryllium metal is however equivalent to only 25–40% of the oxide used.—A. R. P.

Cadmium. Anon. (*Mineral Ind.*, 1932, **40**, 597–599).—Statistical.—E. S. H.

Copper. Percy E. Barbour (*Mineral Ind.*, 1932, **40**, 114–144).—A discussion of statistics and economics.—E. S. H.

The Metallurgy of Copper in 1931. Carle R. Hayward (*Mineral Ind.*, 1932, **40**, 152–172).—An outstanding feature is the production in commercial quantities of oxygen-free copper of high conductivity. This has been achieved by the United States Metal Co., not by the use of a deoxidizer, but by keeping the product free from oxygen throughout the whole process. The cathodes are melted in an electric furnace and the copper is protected from oxidation during melting and casting. Annealing in hydrogen has only a slight effect on this copper, indicating that bright-annealing in reducing gases is possible with this product, although not with ordinary copper. The ductility of oxygen-free copper as hard-drawn and soft-annealed wire, respectively, is 80% and 88%, as compared with 55% and 76% for ordinary electrolytic copper. A large amount of literature published during 1931 is reviewed. The main fields of work discussed are: properties (including the effects of impurities on copper), roasting, smelting and smelting plants, refining, leaching, cupola melting of brass, use of high-frequency furnace in melting bronze, alloys of the copper–titanium and copper–silver series, thermal conductivity of copper alloys, effects of strain and heat-treatment.—E. S. H.

Descaling Copper Surfaces. A. P. Harrison (*Chem. and Met. Eng.*, 1932, 39, 455–466).—It is customary in certain industries to cool tanks of liquid by means of evaporation of films of water running down the sides of the vessels. A film of scale of considerable thickness is deposited on the sides of the tanks, largely mitigating the cooling effects. The deposit, apparently consisting mainly of iron oxide, is difficult to remove. Saturated ammonium chloride solution, however, poured over the scale, while the tank is steaming hot will penetrate it and loosen it, facilitating its removal by means of a strong jet of water.—F. J.

Surface-Hardening Copper. Walter J. May (*Mech. World*, 1932, 91, 254).—Occasionally it is required to harden the surface of copper articles without affecting the general body of the metal, and if the metal is not thick this is not difficult. This is done by rubbing tin into the surface, heated to 750° C., until a regular degree of alloying is secured. Surplus tin must be wiped off with a wad of tow. Depth of penetration depends on the duration of heating.
—F. J.

Copper and Brass Industry in Greece Use Hand Labour. Anon. (*Daily Metal Reporter*, 1932, 32, (206), 6).—A short account of the copper and brass products industry in Greece. About 500 tons of imported copper sheet and 1000 tons of brass, much of which is old metal purchased locally, are used each year. Apart from the use of small electric motors for certain processes, hand labour is employed throughout; the product is considered superior to imported machine-made pieces.—P. M. C. R.

On the Copper Age in Ancient China.—I. Tsurumatsu Dōno (*Bull. Chem. Soc. Japan*, 1932, 7, 347–352).—[In English.] Analysis of three ancient Chinese spear heads showed them to consist mainly of copper with a certain quantity of lead and practically no tin. The date of manufacture of these implements is prior to that of the oldest known Chinese bronze materials, hence it is believed that the Copper Age preceded the Bronze Age in China.
—E. S. H.

On the Copper Age in Ancient China. II.—On the Transitional Period Between the Copper and Bronze Age in Ancient China. Tsurumatsu Dōno (*Bull. Chem. Soc. Japan*, 1933, 8, 133–136).—[In English.] Analysis of an ancient spear head showed it to contain copper 88·85, lead 5·85, and tin 2·19%. It thus appears to be intermediate in composition between those of the Copper and Bronze Ages.—E. S. H.

Excavations in Persia Yield Remarkable Collection of Bronze Objects. Anon. (*Bull. Copper Brass Res. Assoc.*, 1932, (73), 12).—The Luristan bronzes, dating from 1000 to 200 B.C., and consisting of objects of personal adornment, tools, household utensils, weapons, chariot fittings and horse trappings, acquired by the Museum of Fine Arts, Boston, are illustrated.—J. S. G. T.

Gold and Silver. H. N. Lawrie (*Mineral Ind.*, 1932, 40, 185–257).—Mainly statistics and economics. A brief description of the more important advances in the hydrometallurgy, pyrometallurgy, and amalgamation of gold and silver is given. Recent literature on alloys of gold is reviewed.—E. S. H.

Porosity of Cast Gold [for Dentistry] and Other Defects. Anon. (*Brit. J. Dental Sci., Prosthetic Section*, 1932, 77, 202–203).—Porosity in dental castings may be due to insufficient feeding, the use of insufficient casting pressure (a pressure of 10–15 lb./in.² is recommended), or the incomplete removal of carbon residue from the mould. To secure ample feeding, a reservoir of molten metal should be provided by attaching to the sprue a ball of wax somewhat thicker than the thickest part of the casting.—J. C. C.

One-Piece [Dental] Casting Technique. Anon. (*Brit. J. Dental Sci., Prosthetic Section*, 1930, 75, 27–32, 51–57).—A detailed illustrated account of the method of making one-piece gold-alloy castings of bridge or partial dentures, using a centrifugal or an air-pressure casting machine.—J. C. C.

Efficient Pig-Lead Stacker. Anon. (*Eng. and Min. J.*, 1933, **134**, 23).—Illustrates a pig-lead hoist capable of stacking 3 loads of 35 pigs in one pile.
—R. Gr.

Lead. R. M. Santmyers (*Mineral Ind.*, 1932, **40**, 321–350).—Mainly statistics of production and consumption. The report includes a reprint on "Metallurgy of Lead in 1931" from the Editorial summary in *Min. and Met.*, 1932, Jan.—E. S. H.

A Note on the Prevalence of Lead Poisoning in India. R. H. Candy (*Indian Med. Gaz.*, 1933, **68**, 136–137; *C. Abs.*, 1933, **27**, 2505).—Plumbism is by no means uncommon in India. The principal source of the intoxication is the habit of " tinning " vessels, the metal being frequently adulterated with lead.—S. G.

Manganese. Chas. H. Behre, Jr. (*Mineral Ind.*, 1932, **40**, 360–371).—Mainly statistical. No important development in the technology of manganese production or in the uses of the metal occurred during 1931.—E. S. H.

My Impressions of Development of Scientific Research in the Nickel Industry in America. Masawo Kamo (*Japan Nickel Rev.*, 1933, **1**, 10–16).—[In English and Japanese.]—S. G.

Nickel-Iron Sponge Produced at Sudbury. Anon. (*Blast-Fur. and Steel Plant*, 1932, **20**, 647); **Nickel-Iron Sponge Made Direct from Ore by New Process.** Anon. (*Compressed Air Mag.*, 1932, **37**, 3853).—A note on the news that nickel–iron sponge has been produced by a direct process from Sudbury ore. The production figures of nickel of the various producing countries are given for 1930.—R. Gr.

Rhenium. Anon. (*Mineral Ind.*, 1932, **40**, 600).—Rhenium is being produced in kilogram quantities by the Vereinigte Chemische Fabrik, Leopoldshall.—E. S. H.

The Technical Recovery of Rhenium and Gallium. Anon. (*Metallbörse*, 1932, **22**, 690–691).—The recovery of these metals from certain residues obtained in working the Mansfield copper schist is described. Rhenium is leached out as potassium perrhenate from the product obtained by a low-temperature roasting of residues containing molybdenum sulphide; the perrhenate is reduced to metal by hydrogen in the presence of sodium chloride. Gallium is recovered from residues rich in aluminium phosphate; about 60 kg. per annum are obtained from this source at a cost of M.10 per grm. The metal has been used for thermometers for use up to 1000° C. and for making non-poisonous dental amalgams.—A. R. P.

Tin. E. Baliol Scott (*Mineral Ind.*, 1932, **40**, 526–545).—Discusses the economic position during 1931, particularly the formation of the International Tin Pool and the system of compulsory restriction of production. The consumption of primary tin in U.S.A. during 1927, 1928, and 1930 is listed under the various consuming industries. No new uses are reported.—E. S. H.

Special Possibilities of Arsine Poisoning [in Tin Refining]. —— Nuck and —— Jaffe (*Arch. Gewerbepath. Gewerbehyg.*, 1932, **3**, 496–508; *C. Abs.*, 1932, **26**, 5520).—Cites cases of arsine poisoning which were caused by fumes given off during tin refining.—S. G.

The Osram Museum. Anon. (*Automobiltech. Z.*, 1932, **35**, 257–258).—An account of the Osram Museum, Berlin. Here are demonstrated the development, manufacture, applications, and testing of the modern electric glow-lamp.
—P. M. C. R.

The Metallurgy and Uses of Zinc. Stanley Robson (*Met. Ind. (Lond.)*, 1933, **42**, 369–372, 421–424, 475–478).—Address to the London Local Section of the Institute of Metals. Early methods of production of zinc and the manufacture of zinc alloys are described. Details are given of the modern Belgian practice of extraction, including descriptions of the English, Belgian, Silesian, Horizontal, and Rhenish distillation furnaces, and the refractories

used in the construction of the retorts. The production of refined zinc by electrolysis, by blast-furnace melting, and by electrolysis of the fused chloride are discussed. The economic aspects of the metal are reviewed, and its applications as protection against corrosion and its use in alloys are described.
—J. H. W.

Zinc in 1932. Julian D. Conover (*Met. Ind. (N.Y.)*, 1933, **31**, 54).—A brief review.—A. R. P.

Zinc. S. D. Strauss (*Mineral Ind.*, 1932, **40**, 566–590).—Statistical and economical.—E. S. H.

Metallurgy of Zinc in 1931. W. R. Ingalls (*Mineral Ind.*, 1932, **40**, 591–593).—No important innovations are reported, but improvements in distilling practice are described briefly.—E. S. H.

American and Canadian Producers of Electrothermic and Electrochemical Products. Anon. (*Electrochem. Soc. Preprint*, 1933, May, 39–44).—A classified list of the names and addresses of producers of various metals, alloys, and chemical and refractory products produced by electrochemical and electrothermic methods.—A. R. P.

New Materials Laboratory at Berkeley. Anon (*Eng. News-Record*, 1932, **109**, 284–286).—A description of the layout and equipment of the new Engineering Materials Laboratory of the University of California.—J. C. C.

Standard Samples : General Information. Anon. (*U.S. Bur. Stand. Circ.*, No. 398, 1932, 1–11).—An account of the function, selection, preparation, and uses of standard samples, with ordering and shipping regulations.—P. M. C. R.

Research in the U.S.A. Anon. (*Aircraft Eng.*, 1932, (38), 104).—Work done by the [U.S.] National Advisory Committee for Aeronautics is reviewed. Under the heading " Structural Materials " reference is made to research on high-frequency fatigue testing of metals, to the study of the fatigue limit/ultimate tensile strength ratio of light alloys, to protection of aluminium against corrosion, to light alloys for use at elevated temperatures, and to stainless steels.—H. S.

Chemical Refrigeration. Influence of Freon on Non-Ferrous Metals. Anon. (*Met. Ind. (Lond.)*, 1932, **41**, 83–84).—An abstract from an article in the *Manchester Guardian Commercial*, 1932, July 9, describing the use of a new refrigerant called Freon, consisting of dichloro-difluoro-methane (CCl_2F_2), and its action on non-ferrous metals.—J. H. W.

The Story of Early Metallurgy. IX.—The Bronze Age in Europe (contd.). R. T. Rolfe (*Met. Ind. (Lond.)*, 1932, **41**, 123–126).—Discussion of the significance of bell-beakers, the origin of European metal working, the chronology of the Bronze Age in Europe, and the connection between the bronze industries in various parts of the Continent.—J. H. W.

The Story of Early Metallurgy. X.—Irish Gold. R. T. Rolfe (*Met. Ind. (Lond.)*, 1932, **41**, 341–344).—An account of the occurrence of gold in Ireland in early times and of the mining of the metal in Wicklow in the eighteenth and nineteenth centuries.—J. H. W.

Early Babylonian Jewelry. Sidney Smith (*Brass World*, 1932, **28**, 115–116).—An account of metal work known to have been made in Babylon as early as 3500–2500 B.C. and of the early use of cloisonné and *cire perdue* casting is given.—J. H. W.

Exploiting Ideas. Zay Jeffries (*Gas Age-Record*, 1931, **68**, 909–910, 914).—Industrial uses of gas, temperature control of furnaces, bimetallism, and international trade are amongst the topics briefly discussed. The development of cemented tungsten carbide cutting tools has rendered many machine tools obsolete.—J. S. G. T.

Some Properties of Pure Silicon. R. L. Templin (*Metals and Alloys*, 1932, **3**, 136–137, 150).—Analysis of the purest available silicon showed the presence of 0·29% iron, 0·15% aluminium, 0·05% chromium, 0·05% titanium, 0·02%

manganese, and 0·01% copper, vanadium, and magnesium. Spectroscopic traces of beryllium, calcium, silver, lithium, lead, and sodium were also found. Compression tests were made on a specimen roughly $1 \times 1 \times 3\frac{1}{2}$ in. made by grinding a casting to shape; the breaking load is 13,470 lb./in.[2] and Young's modulus (assuming the value in compression is the same as the value in tension) 16,350,000 lb./in.[2]. The material breaks up into large fragments on failure by compression. The Rockwell C hardness exceeds 105. Photographs of the structure of cast rods are included.—A. R. P.

High-Temperature Products of Silicon. Frank J. Tone (*Indust. and Eng. Chem.*, 1931, **23**, 1312–1316).—The properties of silicon carbide are discussed and the accidental discovery of the manner in which silicon could be produced in the silicon carbide furnace is described.—F. J.

Some of the Newer Uses of Silicon Carbide. Charles McMullen (*Met. Ind. (Lond.)*, 1931, **39**, 35–36).—Abstract of paper read before the Electrochemical Society. See this *J.*, 1932, **50**, 279.—J. H. W.

Definition of Bimetal. Anon. (*Metallwirtschaft*, 1932, **11**, 452).—Recommendations of the Deutsche Gesellschaft für Metallkunde for a uniform use of the terms bimetal, doublé, electroplated, galvanized, and leonic (*leonisches*) material.—v. G.

Some Aspects of the Selection of Engineering Materials. L. B. Hunt (*Found. Trade J.*, 1932, **47**, 384–385, 397–398; and (abstract) *Met. Ind. (Lond.)*, 1933, **42**,[97–100, 129–131).—Read at a joint meeting of the London Sections of the Institute of Metals and the Institute of British Foundrymen. The following points were discussed : the tendencies in engineering practice; interpretation of test results; the mechanism of failure in metals; cohesion and slip; methods of slip-resistance (grain-refinement by modification : roughening the slip-planes by adding a second metal which enters into solid solution : the presence of a second phase); the action of phosphorus in cast iron; the basis for the selection of material; the function of chemical analysis; correlation with microstructure; significance of mechanical tests; value of elongation figures; notched-bar test, and fatigue testing.—J. H. W.

Discussion on L. B. Hunt's Paper on Some Aspects of the Selection of Engineering Materials. C. H. Kain. H. J. Gough. J. Cartland. S. L. Archbutt. A. J. Murphy. —— Curzon. H. G. Summerfield. W. C. Devereux. L. B. Hunt (*Found. Trade J.*, 1933, **48**, 25–26, 161, 168).— Cf. preceding abstract. C. H. K. suggested that engineers should specify material which could be readily cast or forged into a perfectly sound part. H. J. G. doubted the applicability of the true cohesive force as determined by the force required to break atoms apart; queried the statement that the Izod was not a shock test, and commented on the abuse of the Stanton test. J. C. asked for means of specifying the microstructure, and remarked that 2 materials each with zero elongation might give very different angles of twist. S. L. A. commented on the grain-refinement in the modification of silicon–aluminium alloys; A. J. M. discussed creep values and H. G. S. asked for a ratio between " experimental value " and " service value." W. C. D. questioned the great value of elongation tests and stressed the connection between grain-size and elongation, considered that the impact test was a shock test and thought that the repeated impact test was of considerable value. L. B. H. replied.—J. H. W.

Recent Developments in Engineering Materials. T. H. Turner (*J. Inst. Production Eng.*, 1931, **9**, 248–262).—An address. Non-ferrous materials discussed include zinc, tin, and aluminium alloy die-castings, magnesium and aluminium casting alloys, and aluminium–brass condenser tubes.—J. C. C.

An Engineer's Conception of Matter and Its Application to Materials of Construction. E. W. Stedman (*J. Roy. Aero. Soc.*, 1932, **36**, 861–882).—A memorandum intended to give those engineers who have not the time or

opportunity to study the latest books, a working idea of the trend of modern investigations. The physics of the atom, the liquid, gaseous, and solid states, the crystalline structure of metals, conductivity, solid solutions, metallic compounds, hardening of metals, and heat-treatment of light alloys and steels are treated briefly.—H. S.

Some Phases of the History of Chemical Engineering. Walter L. Badger (*J. Eng. Education,* 1932, **22**, 691–707).—An historical survey of chemical engineering methods from early times. The successive use of copper, stoneware, wood, lead, and iron as piping materials, the development of pump design and construction, and the growth of heating and evaporating plant are traced, with illustrative plates.—P. M. C. R.

Researches on Buckling. Edmond Marcotte (*Science et Industrie,* 1932, **16**, 313–319).—The danger of buckling, formerly guarded against by the introduction of high factors of safety into the empirical formulæ common in structural work, is greatly increased in the case of the complex stresses occurring in such members as machine or aeroplane parts. After a brief discussion of certain cases, and of experimental methods of study, an analogy is traced between the inception of buckling and the " natural " elastic limit (the point at which Lüder's lines make their appearance). A preliminary series of tests on models, designed to supplement and check results obtained by calculation, is outlined, and the necessity of much more such work is emphasized.—P. R.

Stresses in a Plate with Two Holes, and the Examination of Cognate Problems. Seinen Yokota (*J. Fac. Eng. Tokyo Imp. Univ.,* 1932, **20**, 101–113).—[In English.] A mathematical treatment.—E. S. H.

The British Association Standards of Electrical Resistance, 1862–1932. Anon. (*Nature,* 1932, **130**, 600–601).—An historical review. Standard resistance coils of platinum made in 1865 preserve their original value unchanged at the present day, whilst all the coils made of alloys have changed.—E. S. H.

Experiments to Decrease the Limit of the Temperatures Obtained. W. H. Keesom (*Proc. K. Akad. Wet. Amsterdam,* 1932, **35**, 136–143).—[In English.] A temperature of $0.71°$ abs. is reached in a volume of 5 c.c. by exhausting the vapours from liquid helium. The lowest pressure obtained above the liquid helium was 0.0033 mm. A vessel is described in which liquid helium can be transported from the liquefier to an apparatus.—E. S. H.

On a Method for Correcting for Incomplete Thermal Isolation in Measurements of Small Heat Capacities. W. H. Keesom and J. A. Kok (*Proc. K. Akad. Wet. Amsterdam,* 1932, **35**, 294–300).—[In English.] A method is worked out for correcting for heat exchange with the surroundings when measuring very small heat capacities after Nernst and Eucken's method under conditions such that thermal isolation is incomplete.—E. S. H.

Graphical Method for Converting Atomic Per Cent. into Weight Per Cent. Arne Olander (*Indust. and Eng. Chem. (Analyt. Edn.),* 1932, **4**, 438).—The method depends on Menelaos' theorem that if a line from a point O outside a triangle ABC on the extension of one of the sides BA intercepts the other two sides, CA in D and CB in E, then $(OA \cdot BE \cdot CD)/(OB \cdot CE \cdot DA) = 1$. If OA is the atomic wt. of A, OB that of B, AD the weight % of A, and CD that of B, then BE is the atomic-% of A and CE the atomic-% of B.—A. R. P.

Dust Collection by Electrostatic Precipitation. Anon. (*Mech. World,* 1932, **92**, 39–40).—Electrostatic precipitation provides a method of cleaning industrial gases to a degree of fineness which is difficult to obtain by other methods, such as filtering or scrubbing. The process is described and illustrated and a number of applications, including metallurgical ones, are enumerated.—F. J.

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[Contains the following : W. Rohn : " Die Entwicklung der Heraeus-Vacuumschmelze A.-G. 1923–1933 "; O. Buddenberg, F. Duftschmid, u. L. Schlecht : " Reines Carbonyleisen als hochpermeabler magnetischer Werkstoff "; L. Dede : " Normal- und Präzisions-Gewichte aus Molybdän-Chromnickel "; L. Dede : " Ein Elektrodenmaterial für Funkenspektroskopische Zwecke "; K. L. Dreyer u. G. Tammann : " Die Erholung der elastischen Spannungen, verglichen mit der Erholung anderer Eigenschaften "; E. Englert u. W. Gerlach : " Über die transversale ferro-magnetische Widerstandsänderung des reinen Nickels "; H. Gruber u. W. Rohn : " Die Reduktion von Chrom aus Chromoxyd durch Gase "; H. Gruber : " Darstellung kohlefreier Chromlegierungen aus kohlehaltigem Ferrochrom "; A. Grunert : " Kriechgrenze und Kriechgeschwindigkeit "; A. Grunert, W. Hessenbruch, u. K. Ruf : " Widerstandslegierung für Temperaturen bis 1300° "; H. Hagemann u. H. Hiemenz : " Über den Einfluss der Banddicke, der Glühatmosphäre und mitgeglühter Zwischenisolation auf die Anfangs- und Maximal-Permeabilität von gewickelten Bandkernen aus Nickel-Eisen-Legierungen "; W. Hessenbruch : " Vakuumgeschmolzene Beryllium-Legierungen "; W. Hessenbruch u. E. Horst : " Über den Widerstand säurebeständiger und vergütbarer Chromnickel-Legierungen gegen interkristalline Korrosion "; W. Hessenbruch u. W. Rohn : " Hochwertige Chromnickel-Legierungen und deren Lebensdauerprüfung "; H. Ipavic : " Über schwefelbeständige Legierungen "; H. Ipavic : " Zwei analytische Spezialmethoden "; A. Kussmann, B. Scharnow, u. W. Steinhaus : " Über das Permalloy Problem "; G. Masing u. W. Pocher : " Entwicklung eines technischen Giessverfahrens für Beryllium-Kupfer-Legierungen "; H. J. Reusch u. H. V. Wartenberg : " Schmelzpunktsdiagramme hochfeuerfester Oxyde mit Kalk "; W. Rohn : " Induktionsofen für Drehstrom von Netzfrequenz "; W. Rohn : " Walzwerke mit dünnsten Arbeitswalzen "; K. Ruf : " Spulmaschinen mit konstanter Zugspannung "; K. Ruf : " Mehrfachdrahtziehmaschinen aus Einzelmotoren "; R. Straumann : " Über Legierungen für Federn mit kleinem Temperaturkoeffizienten des Elastizitätsmoduls "; A. Thum : " Der Einfluss der Korrosion auf die Dauerfestigkeit von Chromnickel-Legierungen."]

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XXIV.—BOOK REVIEWS

Elementary Metallurgy for Engineers. By G. F. C. Gordon. Pp. ix + 156, 25 illustrations. 1932. London : Constable & Company, Ltd. (8s. 6d.)

In this short volume of 156 pages an attempt is made to present in simple language a general outline of the subject of engineering metallurgy in elementary form. The book is intended, primarily, for the young engineer, but the young metallurgist might also read it with advantage, as well as all those interested in the metallurgical side of engineering. In dealing with an important subject in an elementary manner, difficulty is sometimes experienced in summarizing the subject sufficiently without detracting from its value. The author, however, has met this difficulty in a very practical form, and has produced a book in which few essential details are omitted.

The chapter on the testing of materials is brief, but, at the same time, contains sufficient information, particularly on the question of fatigue, to induce the new reader to seek for further information, and the same remarks apply to the chapters on the production of structural steels and forgings. Special attention is devoted to the thermal changes in metals, a knowledge of which is so essential to the beginner, and which are dealt with as fully as space will allow.

In the chapter on metallography and macrography more space might have been given with advantage to the various macrographic methods of examination. Non-ferrous metals are considered briefly yet very concisely in a special chapter. The metals and alloys dealt with include copper, aluminium, brasses, bronzes, aluminium alloys, cupro-nickel alloys, and white metals, and a brief reference is also made to methods of protection such as galvanizing, metallization, enamelling, and the use of aluminium paint.

The final chapter deals with the selection of materials, and sufficient is said in it to show how important a knowledge of metallurgy is to all those engaged in the engineering industry. The book is illustrated by a number of photographs showing various structures in metals and various types of failures.—J. W. DONALDSON.

Overstrain of Metals and Its Application to the Auto-Frettage Process of Cylinder and Gun Construction. By A. E. Macrae. Med. 8vo. Pp. ix + 378, with 246 illustrations. 1930. London : H.M. Stationery Office. (21s. net + postage.)

In many engineering designs the permissible working stress is obtained by dividing the ultimate tensile strength of the material by a factor of safety which experience has shown to be appropriate to the particular working conditions of the constructional material, and despite the large number of investigatory tests which have been carried out, the factor of safety, in many cases, is still a factor of ignorance. Accordingly, it is pleasing to find that in the auto-frettage process of the manufacture of guns, design is based on the results of experimental work on the stress-strain characteristics of the materials used, and that the factor of ignorance is practically eliminated. A full description of this achievement is now available in Major Macrae's book. The intending reader should understand, however, that the book is almost entirely concerned with auto-frettage of thick cylinders and related problems, and cannot pretend to be a treatise on the general subject of overstraining of all kinds of ferrous and non-ferrous metals.

The earlier chapters of the book give in considerable detail the results of tests in which the breakdown and restoration of the elastic properties of certain steels and other metals have been examined. It is of interest to note that Dalby optical recorders and testing machines were used in this work, and that interesting results of the effects of low-temperature treatments on steels are recorded. Equations for the stress-strain relationships in thick cylinders and for cylinders subjected to auto-frettage (internal pressure producing residual stresses) are then developed ; but it must be remarked that the mathematical treatment is rather elementary and diffuse, although the detailed numerical illustrations are probably useful. The apparatus used in auto-frettage is then described, followed by detailed calculations, manufacturing methods, and tests on monobloc guns and built-up cylinders.

The book is not a " readable " book, and its arrangement is such that it is not very convenient for reference purposes, but it should prove very valuable to those engaged in the design of thick cylinders, and it also places on record a large amount of accurate data on stress-strain relationships beyond the elastic range which should find useful application in other directions.—G. A. HANKINS.

Definitions and Formulæ for Students (Metallurgy). Compiled by E. R. Taylor. Pp. iv + 44. 1932. London : Sir Isaac Pitman & Sons, Ltd. (6d. net.)

The object of this little book is to provide students and those engaged in the business side of the metal trades with definitions of the terms used by metallurgists. The terms are

arranged alphabetically in six sections, covering respectively : general metallurgy, pyrometry, iron and steel, foundry-work, fuels and refractories, formulæ and tests. Taken as a whole, the definitions given are terse and to the point, but in some instances a certain degree of vagueness is apparent, *e.g.* coring, cupellation, electron, creep, and in others the definition given is not sufficiently accurate, *e.g.* gold bullion, white gold, gas pyrometer. In two places it is stated that British silver coinage contains 925/1000 of silver. Nevertheless, the book should prove sufficiently informative to those for whom it was written.—A. R. POWELL.

Die Elektrometrische (Potentiometrische) Massanalyse. Von Erich Müller. Fünfte, verbesserte und vermehrte Auflage. Med. 8vo. Pp. xx + 276, with 92 illustrations. 1932. Dresden und Leipzig : Theodor Steinkopf. (Geh., R.M. 14.50; geb., R.M. 16.)

In the seven years which have elapsed since the fourth edition of this book appeared considerable advances have been made in the field of potentiometric analysis, both in its scope and in its technique, and Dr. Müller and his collaborators have been among the foremost workers in these developments. In preparing this edition, the author has taken the opportunity of rewriting a considerable portion of the book, in order to incorporate the most important and useful of these improvements. The practical part has been rearranged in a systematic way based on a scientific classification of the reactions involved. The new book provides a thorough grounding in the theoretical principles of potentiometric analysis and in its practical applications, and should therefore be of great value to advanced students as well as to practising analysts. No general index of the usual type is included, but there is a table of contents followed by tables showing the various determinations and separations included in the book, and an alphabetical index to authors and references. The book is beautifully printed, and the paper and illustrations are a credit to the printers and publishers. The price is very reasonable for this type of book.—A. R. POWELL.

Forschungsarbeiten auf dem Gebiete des Schweissens und Schneidens. Herausgegeben im Auftrage des Deutschen Azetylenvereins von W. Rimarski. (Geschweisste Kunstschmiedearbeiten, Azetylenschweissung im Stahlbau, Zusatzwerkstoffe, Form des Sauerstoffstrahls bei Schneiddüsen, Oberflächenhärtung, Gleichdruckanlagen, Siliziumwasserstoff, Wasserdampfeinfluss auf die Temperatur der Azetylen–Sauerstoff–Flamme, Prüfung explosionssicherer Schmiermittel.) Siebente Folge. Mit Beiträgen von H. Richter, H. Holler, W. Hoffmann, E. Streb, W. Geldbach, M. Maier, H. Malz, und H. v. Conrady, M. Maier und E. Zorn, W. Rimarski und H. Friedrich, W. Rimarski und M. Konschak, H. Jooss, M. Konschak, W. Rimarski und K. Noack, H. Kahle. 4to. Pp. 120, illustrated. 1932. Halle a. S. : Carl Marhold. (Kart, R.M. 4.90.)

This is yet another collection of papers by Dr. Rimarski and his collaborators on all phases of gas-welding technology. There are fourteen papers, of which five will be of interest mainly to the ferrous man, one deals with copper welding, two with the design of blowpipe nozzles, three with plant, and three with welding gases. The papers of most importance from the point of view of the non-ferrous welder have already appeared in the journal *Autogene Metallbearbeitung* and have been abstracted in this *Journal*. They are Geldbach : "The Influence on the Welding of Copper of Small Additions in the Welding Rods" (this *J.*, 1932, **50**, 187); Jooss : "Contribution to the Knowledge of the Temperature of the Oxy-Acetylene Flame, the Effect of Water Vapour in the Acetylene, and the Consequent Effect on Welding" (this *J.*, 1932, **50**, 501); Rimarski and Friedrich : "Procedure for Testing the Safety in Working of Acetylene Equal-Pressure Plant" (this *J.*, 1932, **50**, 699).—H. W. G. HIGNETT.

Handbook of Chemistry and Physics. A Ready Reference Book of Chemical and Physical Data. Edited by Charles D. Hodgman. Seventeenth Edition. Fcap. 8vo. Pp. xiii + 1722. 1932. Cleveland, O. : Chemical Rubber Publishing Co. ($6.00.)

The seventeenth edition of this useful book of reference differs in many points from the previous edition. Among notable alterations are the addition of tables of (i) magnetic susceptibility of both inorganic and organic substances; (ii) refractive index of aqueous solutions of sucrose; (iii) the arrangement of electron orbits; (iv) correction of boiling point to standard pressure; (v) variation of vapour pressure with temperature; and several mathematical tables. The tables of flame and bead tests, oxidation and reduction potentials, cubical expansion of solids, specific heat of gases, specific rotation and wire gauges have been completely revised. The outstanding change, however, in this edition is the revision and extension by more than 1000 compounds, of the table of physical constants of organic compounds. This table gives

the name, synonym, formula, molecular weight, crystalline form, colour, specific gravity, melting point, boiling point and solubility in water, alcohol, and ether of more than 4000 organic substances.

The handbook is excellently produced and contains a large quantity of data frequently required by chemists and physicists, whom it will save much weary searching in the literature. It can be warmly recommended to these and to others working in engineering and other branches of pure or applied science.—JAMES F. SPENCER.

Kelly's Directory of the Engineering, Hardware, Metal and Motor Trades (Including the Wireless Industry) Throughout England, Scotland, and Wales. Twentieth Edition. $6\frac{1}{2} \times 10$ in. Pp. lvi + 2661 + 35 + 115. London: Kelly's Directories Ltd. (45s. net.)

This Directory should prove invaluable to all connected with or interested in the metal trades. It is designed to give complete lists of those engaged in the trades mentioned in the title of the volume and in various other businesses and occupations allied thereto. Its wide scope is indicated by the fact that merely the index to the trades listed covers no fewer than fourteen pages of closely printed matter. The geographical arrangement of the book is very convenient, as it enables one to turn up the entry of any town in the United Kingdom, and find there the names of local firms and individuals listed according to their trades. Another useful section of the Directory is that containing a comprehensive list—covering 115 pages—of proprietary articles and trade names, with the addresses of the makers.

American Institute of Mining Engineers. *American Institute of Mining Engineers Series: Technical Writing.* By T. A. Rickard. Third edition. Pp. xi + 337. *Choice of Methods of Mining and Metallurgy. A Record of Experience in Making Engineering Decisions.* By Pope Yeatman, Robert E. Tally, F. W. Bradley, E. De Golyer, Howard N. Eavenson, L. D. Ricketts, Arthur L. Walker, W. H. Bassett, Eugene McAuliffe, Newell G. Alford, and A. B. Parsons. Pp. ix + 178. *Mineral Economics. Lectures under the Auspices of the Brookings Institution.* By H. F. Bain, E. C. Eckel, J. R. Finlay, J. W. Frey, J. W. Furness, D. F. Hewett, C. E. Julihn, C. K. Leith, L. Logan, G. F. Loughlin, R. S. McBride, T. T. Read, E. B. Swanson, F. G. Tryon, and F. E. Berquist. Pp. x + 311, with 31 illustrations in the text. *A History of American Mining.* By T. A. Rickard. Pp. xii + 419, with 27 illustrations in the text. *The Examination of Prospects. A Mining Geology.* By C. Godfrey Gunther, revised by Russell C. Fleming. Second edition. Pp. ix + 220, with 65 illustrations in the text. Demy 8vo. 1932. New York: McGraw-Hill Book Co., Inc.; London: McGraw-Hill Publishing Co., Ltd. (five volumes, £3 15s. net).

The last four books of this series are of interest only to those concerned in prospecting, mining, and ore dressing although the second book has an interesting chapter on " Learning how to Refine and Cast Copper." They form a most interesting and instructive series for all who intend to follow any of these professions. The first book has already been reviewed in this *Journal*, and this edition is similar to the second in all respects except that several minor errors therein have been rectified. We can thoroughly recommend a purchase of the series to all mining and metallurgical students.—A. R. POWELL.

Bibliography of Bibliographies on Chemistry and Chemical Technology. Second Supplement 1929–1931. Compiled by Clarence J. West and D. D. Berolzheimer. (Bulletin of the National Research Council. Number 86.) Sup. Roy. 8vo. Pp. 150. Washington, D.C.: National Research Council of the National Academy of Sciences. ($1.50.)

This bulletin includes the bibliographies which have been published between 1929 and 1931, as well as some which were omitted from the earlier bulletins Nos. 50 and 71. Quite a number of subject headings are included for the first time. It should prove of great use to those in search of information on published bibliographies on all branches of chemistry and chemical technology, whether these appear in books, journal articles, or encyclopædia articles.

—A. R. POWELL.