

# METALLURGICAL ABSTRACTS

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# METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

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Part 2

## I.—PROPERTIES OF METALS

\***The Effect of Working on the Physical Properties of Molybdenum.** J. W. Marden and D. M. Wroughton (*Trans. Electrochem. Soc.*, 1946, **89**, 217–224; discussion, 225–228).—Properties of molybdenum after varying amounts of working are recorded in graphs, from which the following ranges have been taken: density, 9.8 for heat-treated ingot up to about 10.4 when reduced in cross-section from about 0.5 to 0.0001 in.<sup>2</sup>; V.P.N. hardness, about 170 for ingot 1 in. thick to about 270 for sheet and wire about 0.02 in. thick; ultimate tensile strength, about 50,000 lb./in.<sup>2</sup> for unworked metal to about 200,000 lb./in.<sup>2</sup> for the finest wire or thinnest sheet; and elongation on 2-in. test length, a few per cent. to an average of about 17% (with lowest values of about 7% and highest of 50%) for the thinnest wires and sheets. Molybdenum with V.P.N. hardness of about 230 at room temp. showed a progressive decrease to about 100 at 1200° C. Hardness and bend tests on material annealed at various temp. showed that loss of hardness began at about 1000° C. and was rapid at 1200° C.—A. B. W.

\***The Influence of Crystal Face on the Electrochemical Properties of a Single Crystal of Copper.** (Leidheiser and Gwathmey). See p. 47.

\***Influence of Strain Rate and Temperature on the Mechanical Properties of Monel Metal and Copper.** (McAdam, Geil, and Woodard). See p. 35.

†**The Separation of Gases from Molten Metals.** Albert J. Phillips (*Metals Technol.*, 1947, **14**, (4); *A.I.M.M.E. Tech. Publ.* No. 2208, 30 pp.).—The 26th Annual Institute of Metals Division Lecture of the A.I.M.M.E. The general principles underlying the absorption and evolution of gases from solid and liquid metals, and during the process of solidification, are outlined. The cases of oxygen, hydrogen, steam, sulphur dioxide, and carbon dioxide are discussed, and their effects in the solidification of copper are described in detail. The effects of each gas alone are discussed, and then their effects when present as binary or ternary combinations. The bearing of the results on copper-refining practice is then indicated, and a number of interesting conclusions and generalizations are reached. The author also deals with gases in brasses, bronzes, silver, silver alloys, and iron. The lecture gives an excellent review of one class of work, and shows the way in which the results may be applied.—W. H.-R.

**Effect of Prior Tensile Strain on Fracture.** Edward Saibel (*Metals Technol.*, 1947, **14**, (4); *A.I.M.M.E. Tech. Publ.* No. 2186, 8 pp.).—Theoretical. In the thermodynamic theory of the fracture of metals (Saibel, *A.I.M.M.E. Tech. Publ.* No. 2131; see *Met. Abs.*, 1947, **14**, 359), it was shown that a critical strain energy per unit vol. exists which is characteristic of the material and may be calculated from basic thermodynamic theory. According to Ludwig ("Elemente der Technologischen Mechanik", Berlin: 1909), a material has two fundamental properties: (1) a resistance to flow and (2) a resistance to fracture. These ideas are used to analyse the method in which specimens are strained to varying degrees at room temp. and then pulled to fracture at a lower temp. The theory is in general agreement with the variation of fracture strength with prior tensile strain.—W. H.-R.

\* Denotes a paper describing the results of original research.

† Denotes a first-class critical review.



**The Plasticity of Brittle Materials.** — (*Indust. Diamond Rev.*, 1946, [N.S.], 6, (72), 339-344).—A summary of E. Ryschkewitsch, *Ber. deut. keram. Ges.*, 1941, 22, 54, 363; and *Glastechn. Ber.*, 1942, 20, 166.—R. W. R.

**Friction and Lubrication.** E. V. Paterson (*Mech. World*, 1947, 122, (3157), 67-71).—P. describes the fundamental laws of solid, boundary, and fluid friction and current theories of lubrication, with particular reference to journal bearings. A discussion of bearing materials is included.—R. W. R.

**A Comparison of the Mechanical Properties of Wood and Metals.** — (*Usine Nouvelle*, 1947, 3, (4), 12).

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## II.—PROPERTIES OF ALLOYS

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**\*Curved [Aluminium] Plates [Tested] in Compression.** — (*Rep. Nat. Research Council Canada*, No. MM180; and (summary) *Aircraft Eng.*, 1947, 19, (221), 230).—Tests on 155 curved and 24 flat aluminium plates were carried out; from the results empirical equations for critical buckling stress, reduced buckling stress after loads exceeding the initial buckling stress, and post-buckling behaviour or effective width are derived. These equations are compared with equations derived by other investigators. Modifications in testing technique and specimen dimensions are discussed.—J. L. T.

**\*Thermodynamic Activities and Diffusion in Metallic Solid Solutions.** C. Ernest Birchenall and Robert F. Mehl (*Metals Technol.*, 1947, 14, (4); *A.I.M.M.E. Tech. Publ.* No. 2168, 16 pp.).—Previous data on the vapour pressure of zinc in copper-zinc alloys at different temp. are used to deduce the activities and activity coeff. of zinc and copper in these alloys. The results are presented graphically and in the form of tables. Application of diffusion laws in the customary form to diffusion phenomena in alloys has shown that the diffusion constant varies with composition in all cases. The question arises as to whether the diffusion coeff. would become a constant, independent of concentration throughout a single phase if the concentration gradient in the diffusion equation were replaced by an activity gradient. The activities determined as described above are applied to previous data on diffusion in copper-zinc and iron-carbon alloys, and it is concluded that activity is more fundamental than concentration in the process of diffusion. The driving force is provided by a difference in free energy. The process of diffusion is examined in detail on these lines, and it is concluded that in binary substitutional solid solutions the results agree better with a direct exchange of atoms on adjacent lattice points, than with a process involving hole-diffusion mechanism. In general, chemical and radio-active methods for determining diffusion rates in substitutional solid solutions will not measure the same process.—W. H.-R.

**\*Interaction and Structure in Copper-Zinc Alloys.** C. Ernest Birchenall (*Metals Technol.*, 1947, 14, (4); *A.I.M.M.E. Tech. Publ.* No. 2169, 8 pp.).—The work of Birchenall and Mehl (see preceding abstract) indicates that, in so far as it is justifiable to speak of bond strengths between adjacent atoms in an alloy, the Cu-Zn bond is stronger than the Cu-Cu or Zn-Zn bonds, the last named being the weakest of the three. Assuming that this order of stability is the same in the different phases of the copper-zinc system, the stable phase should be that which provides for the greatest ratio of Cu-Zn to Zn-Zn pairs. At 50 at.-% zinc, the body-centred cubic lattice fulfils this condition with respect to the face-centred cubic lattice, while at a composition  $\text{Cu}_5\text{Zn}_8$  the ordered  $\gamma$ -phase satisfies this condition better than the body-centred cubic phase.—W. H.-R.

**Corrosion-Resistant [Hastelloy] Alloys.** — (*Steel*, 1946, **119**, (5), 70–75, 112).—The corrosion-resistance and working properties of four “Hastelloy” nickel-base alloys (exact composition unstated) are described. Recommended machining speeds and feeds and abrasives for grinding are given.—M. A. V.

**Magnesium and Magnesium Alloys.** Allen G. Gray (*Steel*, 1946, **119**, (17), 92–96, 112, 115, 116).—Magnesium alloys are described and the composition and properties of the commoner alloys tabulated. Capacities and production data and costs at a number of plants are given. Applications, and factors of importance to the designer are reviewed.—M. A. V.

**\*Rates of High-Temperature Oxidation of Magnesium and Magnesium Alloys.** T. E. Leontis and F. N. Rhines (*Metallurgia*, 1947, **36**, (213), 171).—Abridged from *Metals Technol.*, 1946, **13**, (4); see *Met. Abs.*, 1946, **13**, 350.—J. L. T.

**\*Influence of Strain Rate and Temperature on the Mechanical Properties of Monel Metal and Copper.** D. J. McAdam, Jr., G. W. Geil, and D. H. Woodard (*Amer. Soc. Test. Mat. Preprint*, 1946, (54), 49 pp.).—The conditions which may cause failure by intercrystalline cracking at the commencement of the third stage of creep are (contrary to the prevailing view) a sufficiently low rate of straining or a high testing temp. In a normal test, the creep rate increases in the third stage of creep owing to necking of the specimen. The result is that ductility increases, it being considered that then “the increase in the technical cohesive strength with the strain rate is rather greater than the increase in the flow rate”. The effects of creep rate and temp. were studied by creep tests on cold-drawn Monel metal at 700°–1000° F. (370°–538° C.) and on cold-rolled, oxygen-free copper at 110°–375° F. (43°–191° C.), the strain rate being maintained approx. const. by repeatedly decreasing the load. By combining the results with previously published data, curves are derived showing the influence of temp. and strain rate on the strength and ductility of the metals over the whole range from –100° C. to the m.p.—J. C. C.

**\*Graphite Formation in Cast Irons and in Nickel–Carbon and Cobalt–Carbon Alloys.** H. Morrogh and W. J. Williams (*J. Iron Steel Inst.*, 1947, **155**, (3), 321–371; and *Iron and Steel*, 1947, **20**, (6), 241–257; discussion, 288–289).—The first part of this paper is mainly a critical review, at considerable length, of published information on the metallography and mechanism of solidification of cast irons, with particular reference to the mode of formation of the graphite; current theories are discussed in some detail. This section also contains a number of experimental observations made by the authors; it is shown that the graphite-refining action of titanium and zirconium is due to the presence of carbides of these elements, and the existence of two different kinds of inverse chill is demonstrated. The experimental work reported in the succeeding sections is concerned with the systems nickel–carbon and cobalt–carbon and the analogy between these and the iron–carbon–silicon system. Graphite formation in these systems was studied microscopically and by thermal analysis, and the structures of hypo- and hyper-eutectic alloys were shown to be closely similar to those obtaining in cast irons; graphite structures of both the normal flake and undercooled varieties were obtained, the eutectic temp. of the former being higher than that of the latter. The existence of the carbides  $\text{Ni}_3\text{C}$  and  $\text{Co}_3\text{C}$  was demonstrated. When eutectic and hyper-eutectic alloys in these systems solidify normally, coarse graphite separates directly from the melt and a eutectic of graphite and solid solution results, but if solidification is accompanied by undercooling, a eutectic of solid solution and carbide is formed which subsequently decomposes, yielding a fine dispersed eutectic structure of graphite in solid solution. The presence of sulphur in the alloys tends to prevent the formation of undercooled structures. The alloys are susceptible to inoculation by graphite. Spherulitic graphite is formed during the solidification of these alloys when calcium or magnesium is present; like undercooled graphite, such structures are thought to be

formed by decomposition of the carbide, the effect of the calcium and magnesium being partially to suppress the transformation, which then takes place at lower temp., yielding spherulitic instead of undercooled graphite. Spherulitic structures are more easily produced in nickel-carbon alloys than in cobalt-carbon alloys; in the former they may be produced by rapid cooling. The authors confirmed the findings of Eash that undercooled structures in cast iron result from transformation of carbide eutectic. When specimens, 5-7 g. in weight, of irons which normally yield undercooled structures, were quenched immediately after solidification was complete, white-iron structures were obtained; the structure obtained in this way differed from a normal white-iron structure in that the carbide was plate-like. Spherulitic structures may, in certain conditions, be produced in cast irons without heat-treatment. Variations between the different systems, in the ease with which spherulitic structures may be produced, are ascribed to differences in the persistence of the carbides,  $\text{Fe}_3\text{C}$  being most and  $\text{Ni}_3\text{C}$  least persistent. A general discussion of undercooling phenomena is presented. Undercooling in cast irons, nickel-carbon, and cobalt-carbon alloys is compared with that occurring in modified aluminium-silicon alloys, and reference is made to the existence of metastable eutectics in the systems zinc-antimony, cadmium-arsenic, and iron-phosphorus, due to the suppression of peritectic reactions.—R. W. R.

**\*Thermodynamic Studies of Dilute Solutions in Molten Binary [Tin] Alloys.** John A. Yanko, A. E. Drake, and Frank Hovorka (*Trans. Electrochem. Soc.*, 1946, 89, 357-371; discussion, 371-372).—See *Met. Abs.*, 1946, 13, 248.

### III.—STRUCTURE

#### (Metallography ; Macrography ; Crystal Structure.)

[For all abstracts on the constitution of alloy systems, including X-ray studies, see II.—Properties of Alloys.]

**\*X-Ray Studies of the Superficial Deformation of Single Crystals of Iron and Aluminium by Mechanical Polishing.** Jacques Bénard and Paul Lacombe (*Métaux et Corrosion*, 1946, 21, (246), 30-31).—A note to the Académie des Sciences. The structure of single crystals of iron and aluminium after abrasion with No. 2 emery (5-10  $\mu$  grain-size) has been investigated, using the back-reflection technique, both directly and after removal of 20  $\mu$  and 60  $\mu$  layers by electrolytic polishing. The abraded surfaces gave diffraction rings indicating random orientation of crystal fragments, while at an intermediate depth the rings were incomplete, indicating a degree of preferred orientation. At greater depths from the surface, the Laue spots became progressively clearer, corresponding to the underlying crystal. The preferred orientation observed seemed principally related to the orientation of the underlying crystal and not to be influenced by the direction of abrasion.—A. B. W.

**Back-Reflection Diagrams in X-Ray Crystallography, Technique and Applications.** Jacques Bénard (*Métaux et Corrosion*, 1946, 21, (247), 33-40).—The principles and advantages of the high-angle, back-reflection method with a calibration substance are briefly explained; suitable cameras are described and a number of examples of applications given. The latter include the determination of lattice parameters in solid solutions and the study of their variation in diffusion layers, and the study of superficial deformation caused by abrasion (see preceding abstract).—A. B. W.

**\*Interaction and Structure in Copper-Zinc Alloys.** (Birchenall). See p. 34.



**\*A New Method for Making Rapid and Accurate Estimates of Grain-Size.** Frederick C. Hull (*Metals Technol.*, 1947, 14, (4); *A.I.M.M.E. Tech. Publ. No. 2160*, 13 pp.).—The method is based upon a comparison of the image of the sample on the ground-glass plate of a metallograph with a grain-size standard transparency illuminated by transmitted light. The magnification of the image is varied by altering the extension of the bellows of the metallograph until the grain-sizes of the standard and of the specimen appear identical. This is more rapid than methods involving the taking of photographs, and is more accurate than methods in which an image is compared with standard photographic prints. Various other methods of measuring grain-sizes are described, and their errors are discussed.—W. H. R.

**The Diffraction of Electrons and Its Applications.** J. J. Trillat (*Experientia*, 1947, 3, (3), 85–95).—[In French]. The theory and technique of electron-diffraction methods are outlined. The application of this technique in the following fields is described: determination of crystalline structure and its modifications, and the study of deposited metals, superficial oxidation and adsorption, polished surfaces and the surface state, fatty substances and their application to lubrication, physico-chemical phenomena, and the internal structure of gaseous molecules.—S. J. K.

**Conference on Industrial Applications of X-Rays, Prague, December 1945.** J. Bénard (*Métaux et Corrosion*, 1946, 21, (246), 25–27).—A brief review of the proceedings. The greater part of the conference was devoted to the consideration of applications to metals. Synopses of communications are given under these heads: deformation, precision determinations of parameters, identification of constituents of a mixture, and radiography.—A. B. W.

**Determination of the Size of Sub-Microscopic Particles by X-Rays.** A. Guinier (*U.S. Bur. Mines Inform. Circ.*, 1946, (7391), 17 pp.).—Translated from *J. Chim. Phys.*, 1943, 40, 133.—J. L. T.

**Applied Photography.** George A. Jones (*Discovery*, 1947, 8, (6), 184–188).—Among the uses of photography demonstrated at the Exhibition of Applied Photography recently held in London by Kodak, Ltd., were the reproduction of line drawings on sensitized metal, photo-elastic analysis for analysing stresses, and electron and X-ray diffraction.—J. L. T.

## V.—POWDER METALLURGY

**Carbides in Powder Metallurgy.** James R. Longwell (*Steel*, 1946, 119, (23), 130, 132, 159–160, 162).—The properties of parts made from hard metal carbides with metallic binders are summarized.—M. A. V.

**Germans Failed in Search for Sintered Carbide Substitute.** H. Crump (*Indust. Diamond Rev.*, 1946, [N.S.], 6, (68), 205).—A summary of *Product. Eng. and Management*, 1945, 18, 122; and *Chem. Age*, 1945, 53, 577.

—R. W. R.

**Copper-Base Powder-Metallurgy Parts.** Herbert Chase (*Materials and Methods*, 1946, 24, (6), 1439–1444).—Small machine parts are now made from porous bronzes, as well as bearings, flame arresters, and diffusers. Copper and brass powders are also used commercially. Some applications are described and illustrated.—J. C. C.

**A Challenge: Powder Metallurgy.** A. J. Langhammer (*Modern Metals*, 1947, 3, (5), 13).—In L.'s opinion, progress in the powder metallurgy of aluminium will be impeded until an oxide-free powder has been produced.

—N. B. V.

## VI.—CORROSION AND RELATED PHENOMENA

**\*Some Aspects of the Corrosion of Aluminium.** P. F. Thompson (*J. Council Sci. Indust. Research, Australia*, 1946, **19**, (2), 157–165).—Isothermal time-potential and also temp.-potential curves of aluminium micro-electrodes (0.05 mm.<sup>2</sup>) immersed in various neutral glycol-water coolants are reported and discussed in relation to corrosion behaviour. Potentials of  $-1.18$  and  $-1.31$  V. on the saturated calomel scale have been observed during abrasion in such solutions, while the limiting potential necessary to produce hydrogen bubbles on aluminium is estimated at  $-0.96$  V. In confirmation, hydrogen-bubble evolution has been observed with the microscope, at scratches during abrasion and for a few seconds afterwards, on aluminium surfaces immersed in neutral solutions.—A. B. W.

**\*Corrosion Tests of Multi-Arc-Welded High-Strength Aluminium Alloys [24S and 75S].** Loren W. Smith (*Trans. Electrochem. Soc.*, 1946, **89**, 83–103; discussion, 103).—Investigations are reported on the corrosion-resistance of welded aluminium alloys 24S (copper 4.2; manganese 0.6; magnesium, iron, silicon 1.5; and aluminium 93.7%) and 75S (zinc 5.5, magnesium 2.5, copper 1.6, chromium 0.27, manganese 0.20, and aluminium 89.93%), both with and without aluminium cladding. Bare alloy is susceptible to intergranular corrosion to a very marked degree in the as-welded condition, on either side of the weld bead. Heat-treated welds offer increased resistance to intergranular corrosion tests, but the overheated zone cannot be restored to the condition of the parent sheet by heat-treatment. Aluminium cladding protects the alloys very effectively. The rate of corrosion for Alclad 24S welded specimens is not greatly accelerated by the application of high stresses. With welded Alclad 75S in the heat-treated condition, stress-corrosion cracking was observed in chromic acid + sodium chloride + dichromate solution, but not in boiling 6% sodium chloride solution. Further laboratory work correlated with field-service data appears to be necessary.—A. B. W.

**\*Corrosion Studies on Electrolytic Chromium.** Norman Hackerman and Donald I. Marshall (*Trans. Electrochem. Soc.*, 1946, **89**, 195–204; discussion, 204–205).—See *Met. Abs.*, 1946, **13**, 252.

**\*Corrosion of Metals. Metals in Aircraft-Engine Cooling Systems [Copper, Iron, Aluminium].** P. F. Thompson (*Australian Council for Aeronautics, Report No. ACA24*, 1946, 54 pp.).—The mechanism of corrosion is described. The addition of triethanolamine phosphate (T.E.A.P.) to glycol renders it conducting; also, a condensation process occurs, producing a caramel-like substance. Pure de-aerated glycol has no effect on copper, iron, or aluminium (even at  $170^{\circ}$  C.), but aeration produces attack in the cold on copper and iron, in spite of the addition of T.E.A.P. Sodium mercaptobenzothiazole serves to inhibit the inhibitor T.E.A.P., and the addition of sulphonated oils is not really effective. A detailed study has been made of the corrosion of copper, iron, and aluminium, using small electrodes (0.05 mm.<sup>2</sup> in area). *Copper*: the addition of T.E.A.P. to glycol results in complex ion formation and subsequent deposition of the copper elsewhere with consequent corrosion. The fact that glycol is hygroscopic ensures the presence of water. *Iron*: T.E.A.P. has no marked effect on the corrosion of iron in glycol solutions. It takes some time for a cathodic film to be built up on an iron surface. *Aluminium*: A more detailed study has been made in this case, including continuous abrasion of the surface produced by adding an abrasive powder to the liquid and passing a gas through it to secure the necessary scouring action. The existence of two potential-temp. zones is indicated, corresponding to stabilized and unstabilized films, the former calling for considerable



abrasive action to expose a fresh surface. These two types of film may correspond to a different degree of hydration or involve the formation of a peroxide.—S. J. K.

**A Review of Factors Affecting the Corrosion of Iron and Steel Used in Building.** David W. James-Carrington (*Structural Eng.*, 1946, 24, (9), 449–499).—The practically most important results of investigations of atmospheric corrosion and its mechanism, as well as combative measures at present available, are effectively reviewed.—A. B. W.

**\*Corrosion-Resistance of Magnesium and Certain of Its Alloys Under Various Accelerated Atmospheric Conditions.** R. R. Rogers, D. A. Tetu, and H. Livingstone (*Electrochem. Soc. Preprint No. 90–25*, 1946, 315–322; and (summary) *Metal Ind.*, 1947, 70, (1), 9–10).—Investigations of the corrosion-resistance of commercially pure magnesium and of the magnesium alloys AZ31X, AZ61X, and M-I are reported. Accelerated tests were used, representative of the following conditions: (1) inland indoor atmospheric, (2) inland outdoor atmospheric, and (3) marine atmospheric. The accelerated corrosion procedures used were: (1) humidity cabinet with 100% relative humidity at  $49^{\circ} \pm 1^{\circ}$  C. and with air circulation, for 70 days, (2) exposure to ordinary air at about  $38^{\circ}$  C. in the radiation from an arc, with 3 min. tap-water spray out of every 20 min. throughout the test of 40 days actual running time, and (3) salt-spray cabinet at  $35^{\circ} \pm 1.5^{\circ}$  C. with 20% sodium chloride solution, maintained at pH 6.8–7.1, used for the spray, this test lasting from 24 to 60 days according to corrosion-resistance. The results indicate good resistance to corrosion in the first two conditions, but much less resistance in the third. It is pointed out that resistance to marine conditions should be satisfactory for most of these materials when properly protected with paint.—A. B. W.

**\*Tin-Zinc Coatings [Corrosion Properties].** — (*Tin and its Uses*, 1946, (17), 5–8, 14).—Corrosion tests in salt spray, humidity chamber, and out-door exposure of tin-zinc, tin, zinc, and cadmium coatings of various thicknesses on mild steel are compared. The tin-zinc coatings showed outstanding corrosion-resistance, as is clearly apparent in colour reproductions of the test series. Two compositions are particularly attractive, the 80% tin–20% zinc, which has been applied to steel chassis of radio sets, and the 50% tin–50% zinc, which is preferable when a considerable degree of sacrificial action is desirable, as when a coating is required to withstand mechanical damage. Both alloys are easily solderable. Other possible applications are also envisaged, such as underlay for nickel-chromium automobile plating.

—A. B. W.

**Corrosion of Galvanized Hot-Water Storage Tanks.** J. M. Bialosky (*J. Amer. Water Works Assoc.*, 1946, 38, (9), 1012–1017; discussion, 1017–1020).—The various internal and external factors having a bearing on the corrosion of galvanized hot-water storage tanks are discussed, as well as the different views held by various authorities on the relative importance of these factors, especially in seeking to explain the apparent diminution of tank service life in some circumstances in recent years. Owen Rice, discussing the paper, puts the conflicting requirements of soft-water supply and tank life very clearly, and cites interesting observations on the corrosion of steel and zinc, both coupled and separately, by Pittsburgh water (pH 6.7) at  $176^{\circ}$  F. ( $80^{\circ}$  C.) to which varying “Calgon” additions had been made.—A. B. W.

**The Mechanism of Oxidation and Tarnishing.** U. R. Evans (*Electrochem. Soc. Preprint No. 91–5*, 1947, 73–96).—Various relations between film thickness and time are observed: rectilinear, logarithmic, and parabolic. Outward migration of cations and electrons through an adherent film, normally by lattice defects, gives rise to parabolic film growth, but mechanical break-downs due to compressional stresses may lead to other time relations. Blistering, which is likely if adhesion is poor and cohesion good, should lead to rectilinear

or logarithmic thickening according as the rifts in the blister wall do or do not admit tarnishing gas. Flaking should lead to periodical recommencement of rapid attack. Shear cracking, which is likely if cohesion is poor and adhesion good, may produce parabolic, rectilinear, or intermediate forms of growth. The theory is applied to interpret the results of Vernon and others, and particularly to explain why conditions obtaining at the time when a specimen is first exposed decide the corrosion rate, which often continues unchanged even if conditions subsequently alter.—A. B. W.

**Corrosion Fatigue.** G. T. Dunkley (*Mech. World*, 1947, 122, (3160), 137–141).—An elementary discussion of the mechanism of corrosion fatigue and of the corrosion-fatigue properties of ferrous and non-ferrous alloys; means of minimizing corrosion-fatigue failures are described.—R. W. R.

**\*The Chemical De-Scaling of Boilers.** R. H. Burns (*J. Inst. Heating Ventilating Eng.*, 1947, 14, (139), 376–392; discussion, 392–403).—The effect of adding inhibitors to the acid (hydrochloric acid, 31 wt.-%, diluted 1 : 7 and 1 : 10 with cold and hot water, respectively) has been investigated. Preliminary tests showed that hexamine and glue are the most effective organic inhibitors and that the addition of copper sulphate is not advantageous. Finally, using  $1\frac{1}{4}$ – $1\frac{1}{2}$ % of size or 0.3% of hexamine (less effective in hot solutions), the attack on mild steel was found to be negligible, on wrought iron only little, and on cast iron considerable (though less with hexamine). Copper alloys were but slightly attacked, and inhibitors were of little value. There was a tendency to the removal of about 0.00001 in. of the metal before the inhibitor became effective. Details of recommended procedures are described for the treatment of (i) Lancashire type, (ii) hot-water supply, and (iii) water-tube boilers, aimed at ensuring the proper mixing and circulation of the acid, together with simple control tests.—S. J. K.

**Glossary of Terms Used in Corrosion.** (*Electrochem. Soc. Preprint No. 90-12*, 1946, 8 pp.).—This glossary was prepared for inclusion in the forthcoming Corrosion Handbook, sponsored by the Electrochemical Society and to be published by John Wiley and Sons, Inc., New York. It is the result of the joint efforts of the Editorial Advisory Board of the Corrosion Handbook and Sub-Committee V of the American Co-ordinating Committee on Corrosion.

—A. B. W.

## VII.—PROTECTION

(Other than by Electrodeposition.)

**The Hardness of Anodic Coatings on Aluminium.** W. Schwan (*Indust. Diamond Rev.*, 1946, [N.S.], 6, (63), 51).—See *Met. Abs.*, 1945, 12, 186.

—R. W. R.

**\*Surface Hardening of Aluminium.** K. G. Robinson and B. W. Mott (*Product Eng.*, 1947, 18, (7), 133–134).—Condensed from *Metallurgia*; see *Met. Abs.*, 1947, 14, 323.—J. L. T.

**Calorizing.** B. J. Sayles (*Corrosion and Material Protection*, 1946, 3, (7), 11–12).—The original calorizing process for steel parts was a single treatment of 4–6 hr. at 1800° F. (982° C.) in aluminium-containing powder, producing surface alloying to a depth of about 0.0008 in. containing about 60% aluminium. Such coatings were brittle and the bond weak. A second-stage diffusion treatment of about 48 hr. at the same temp., but in absence of cementation material, was developed later, and this enables the aluminium content to be distributed through a depth of 0.030–0.040 in., with an aluminium content of 20–25% at the surface. Such coatings have some ductility, and articles can be bent after treatment providing the bends are not

too sharp and the temp. is not below a red heat. Information on costs of treatment and economic applications is included.—A. B. W.

**The Treatment of Magnesium in Chromic Solutions.** Jean Frasch (*Métaux et Corrosion*, 1946, **21**, (245), 11–18).—The nature of the action of various solutions on magnesium is correlated with the electrode potential assumed by the metal in the solution, viz. pickling, less than 0.8 V.; chemical coating, more than 1.35 V.; and galvanic anodic coating, 0.8–1.3 V., all potentials being referred to the saturated calomel electrode. In the galvanic process, the magnesium object is connected to a graphite cathode immersed in the bath through an external resistance. The process is stated to have the following advantages compared with chemical coating: (1) less attack and hence preservation of dimensions; (2) control of porosity and thickness of coating by variation of electrical conditions, bath composition, and time of treatment; (3) a single bath composition serves for all magnesium alloys; (4) this type of bath does not attack iron, aluminium, or copper, or alloys of these metals, and it is thus possible to treat assemblages of these metals with magnesium; (5) the baths are easily maintained, and the chromic acid consumption per unit area treated is quite low; and (6) the protection afforded by anodic coatings is superior to that of chemical coatings and may be further improved by sealing with paraffin or by painting. The baths used range about the following composition:  $\text{CrO}_3$  10,  $\text{MnCO}_3$  6, and  $\text{H}_2\text{SO}_4$  1.7–5 g./l., with pH 2.8–4.5.—A. B. W.

**\*Magnesium as a Galvanic Anode: Some Factors Affecting Its Performance.** H. A. Robinson (*Electrochem. Soc. Preprint No. 90–4*, 1946, 49–71; and (summary) *Metal Ind.*, 1946, **69**, (21), 426).—Performance characteristics of the magnesium anode have been studied in the laboratory under carefully controlled conditions. The methods and apparatus used are illustrated and discussed. The general conclusions derived from this work are as follows: (1) The potential of the magnesium anode is ample for cathodic-protection purposes in most naturally occurring electrolytes. (2) Both anode current efficiency and the uniformity of anode consumption improve with increasing c.d. Efficiencies of 50–60% (approx. 500–600 amp./hr./lb.) are obtained with magnesium alloy anodes for c.d. in excess of 50–100 m.amp./ft.<sup>2</sup> (5.4–10.8 m.amp./dm.<sup>2</sup>). (3) The high-purity magnesium–aluminium and magnesium–aluminium–zinc alloys operate much more efficiently than pure commercial magnesium at c.d. up to about 700 m.amp./ft.<sup>2</sup> (75 m.amp./dm.<sup>2</sup>). Of the various compositions tested, the magnesium–6% aluminium–3% zinc–0.2% manganese alloy exhibits the best over-all performance characteristics. (4) Saturated aqueous solutions of either  $\text{CaSO}_4$  or  $\text{MgSO}_4$  provide the most generally satisfactory electrolytes for magnesium anode operation. An electrolyte pH of 9.5–10.5 is best. Higher pH values produce polarization, and lower pH values reduce current efficiency by stimulating local corrosion.—A. B. W.

**\*Advancements in Nickel-Dipping Practice.** G. H. McIntyre (*Bull. Amer. Ceram. Soc.*, 1946, **25**, (9), 333–337).—Experimental data are presented to substantiate recommendations for good nickel-flash practices. These are particularly adaptable to surfaces for one-coat white application directly on steel, but are also advantageous for regular ground coat. Procedures for large-scale production as well as research studies have shown that the following conditions and sequence of operations give an effective nickel coating on steel without the dangers attendant on the use of iron salts: (1) after acid pickle, 5 min. rinse in sulphuric acid (pH 3.0–3.5) at room temp.; (2) nickel dip,  $\frac{3}{4}$ –1½ oz. single nickel salts per gal. (preferably 1 oz./gal.), pH 3.0–3.5 (adjusted by sulphuric acid or caustic soda additions but no boric acid or ammonium salts), maintained at 155° F. (68.3° C.), and time of dipping chosen to suit plant conditions; (3) rinsing should be avoided if possible, but where necessary should



be sulphuric acid (pH 3.0) with minimum time lag between nickel dip and subsequent neutralizing dip; (4) two neutralizer tanks should be used, the first fairly strong and the second weaker. The solutions should be operated at 140° F. (60° C.) and free from carbonates. Two alternative compositions are: (a) 0.4 oz. sodium cyanide and 0.2 oz. sodium hydroxide per gal. for 1½ min., and (b) 0.12 oz. sodium cyanide and 0.10 oz. sodium hydroxide per gal. for 2½ min.—A. B. W.

**Nickel-Zinc Corronizing.** L. C. Conradi (*Corrosion and Material Protection*, 1946, **3**, (7), 12-13).—Nickel-zinc diffused coatings are produced by heat-treatment at 700° F. (371° C.) of objects previously electroplated with nickel (next to basis metal) and zinc. The resultant coating consists of some residual nickel, nickel-zinc alloys, and possibly some free zinc at the outside. Comparative salt-spray corrosion tests of specimens with zinc and nickel-zinc electrodeposited coatings and nickel-zinc diffused coatings are reported, and show considerably less corrosion for the diffused coats. Applications and costs are briefly discussed.—A. B. W.

**Hot-Dip Galvanizing Practice.** William H. Spowers, Jr. (*Steel*, 1946, **119**, (7), 108-110, 130-131; (9), 100, 103-104, 106; (10), 127-128; (11), 136-138, 140, 155; (12), 122, 124; (13), 149-150, 152; (14), 74, 76, 78, 102, 105; (15), 134, 137, 172-174; (17), 118, 121, 137-141; (18), 114, 116, 126, 128, 130; (19), 118-120; (21), 112-114; (22), 88-90, 92; (23), 123, 126, 129.—W. G. A.

**Full Automatic Hot Zinc Galvanizing of Tanks.** Raymond F. Lodford (*Iron Age*, 1947, **160**, (5), 56-60).—L. explains the advantages of fully automatic methods of hot zinc galvanizing and describes several examples of "conveyorized" tank-galvanizing installations, including the make-up and other characteristics of baths for mechanical operation.—J. H. W.

**Zinc Spraying.** John Howat (*Corrosion and Material Protection*, 1946, **3**, (7), 8-10; and (abridged) *Products Finishing*, 1947, **11**, (6), 74, 76).—The capabilities of this method of zinc coating are listed and examples of applications and performance in service given.—A. B. W.

**Zinc-Coating Structural Members.** — (*Steel*, 1946, **119**, (10), 122).—Structural members of bridges have been zinc sprayed to improve corrosion-resistance.—M. A. V.

**\*The Use of Metallic Pigments in the Preparation of Protective Paints [Zinc, Magnesium, Aluminium].** J. E. O. Mayne (*J. Soc. Chem. Ind.*, 1947, **66**, (3), 93-95).—Incorporation of zinc dust in a polystyrene lacquer produced a paint film with appreciable conductivity, while magnesium and aluminium powders did not do so. Measurement of the electrode potential of a steel specimen coated with the paint and having a scratch on the surface to expose the iron, partly immersed in sea water, showed that with zinc the potential was similar to that of zinc whereas with magnesium and aluminium it differed little from that of iron. Even after 3 months' exposure, the zinc specimen was free from rust at the scratch. These differences in behaviour may be attributed to variations in the properties of the respective oxide films.—S. J. K.

**Preparation of Metals for Painting.** R. E. Gwyther (*Corrosion and Material Protection*, 1947, **4**, (2), 8, 10-11).—Presented at the symposium on "Modern Metal Protection" held in Cleveland, September 1946, by the local sections of the American Chemical Society, the American Institute of Chemical Engineers, and the Electrochemical Society.—J. L. T.

**Anti-Corrosive Protection of Metals by Phosphatization.** J. H. Frydlander (*Rev. Produits Chim.*, 1946, **49**, (19/20), 171-175).—The use of phosphate coatings for the protection of metals is briefly reviewed with reference to patents and recent British and German articles under the heads: fundamental principles; surface preparation; bath composition, time, and temp.; phosphating non-ferrous metals; phosphate coatings to promote lubrication; and legal aspects.—A. B. W.

**Formation and Application of Phosphate Coatings.** Van M. Darsey and Walter R. Cavanagh (*Electrochem. Soc. Preprint No. 91-1*, 1947, 1-14; and (summary) *Products Finishing*, 1947, **11**, (5), 66, 68).—The evolution of the phosphate coating of metals is outlined, and the theory of their formation is discussed. The applications of such coatings (i) for corrosion prevention, (ii) as a base for paint, (iii) to reduce wear, and (iv) as an aid in deep drawing, are reviewed for ferrous materials, zinc and zinc alloys, and aluminium and aluminium alloys.—A. B. W.

**Temperature-Resistant Ceramic-Base Coatings for Metals.** W. J. Plankenhorn and Terry F. Newkirk (*Indust. Heating*, 1947, **14**, (2), 296-297).—A summary of Section VI of Report No. 16 of the Department of Ceramic Engineering of the University of Illinois.—W. G. A.

**New Coatings and Applications Expand Use of Porcelain Enamels [for Melting Pots &c.].** (—) See p. 56.

### VIII.—ELECTRODEPOSITION

**Electroplating on Aluminium.** E. G. West (*J. Electrodepositors' Tech. Soc.*, 1946, **21**, 211-226; discussion, 290-293; and *Metal Ind.*, 1946, **69**, (11), 224-226; (13), 264-266, 268).—The cleaning and special surface treatments applied to aluminium as a preliminary to deposition of coatings are surveyed and discussed in detail. Surface treatments may be summarized as follows: (1) mechanical roughening, (2) chemical etching, (3) simultaneous chemical etching and formation of an immersion deposit, (4) anodic oxidation, followed by modification or complete removal of the anodic film, and (5) anodic oxidation to produce a porous film which permits direct plating and anchoring of the deposit. At present, the immersion deposits have given satisfactory results industrially, especially the zinc immersion process. Anodic treatments are promising, but not widely accepted yet. References to technical literature and to patents are included.—A. B. W.

**\*Routine Control of Brass-Plating Processes. Polarographic, Electrochemical, and Chemical Analysis of Plating Solutions and Deposits.** (Zentler-Gordon and Roberts). See p. 50.

**\*Electrochemical Jet Method for Determining the Local Thickness of Metallic Electrodeposits [Chromium, Nickel, Copper, Tin, Zinc, and Cadmium].** A. Ogarev (*Metal Ind.*, 1947, **70**, (19), 338-340).—A translation of *Zhur. Priklad. Khim.*, 1946, **19**, (3), 311-315; see *Met. Abs.*, 1947, **14**, 117.—J. L. T.

**\*Distribution of Current Along a Cylindrical Anode Inside of a Concentric Tube.** Arnold Weisselberg and Staff (*Electrochem. Soc. Preprint No. 90-1*, 1946, 1-8).—The potential and current distributions derived on the assumptions of uniform solution resistance, finite anode resistance (current entering at one end), negligible cathode resistance, and electrode polarizations independent of c.d., have been compared in a practical case with direct determinations of potentials and (converting c.d. into thicknesses of deposit, making use of the known bath c.d.-current-efficiency characteristics) with the distribution of deposit. The case in question was internal chromium plating of gun barrels, and agreement was satisfactory.—A. B. W.

**\*The Electrodeposition of Cobalt and Nickel from Co-Ordination Compounds.** Margaret Davis Kramer, Sherlock Swann, Jr., and John C. Bailar, Jr. (*Electrochem. Soc. Preprint No. 90-27*, 1946, 339-345).—Deposition on copper cathodes for periods of 5-15 min., from cobaltic, cobaltous, and nickel amines with various co-ordinating groups at a concentration of 0.5%, has been studied. The results suggest that the nature of the co-ordinating groups, as well as the stability of the complex ions, are important in determining the character of the deposit. In the case of cobaltic amines, the quality of plate

deteriorated on passing from complexes with ethylenediamine to propylenediamine, and further on passing to those with butylenediamine and stilbenediamine.—A. B. W.

**\*The Protective Value of Lead and Lead-Tin [Electro-] Deposits on Steel.** A. H. DuRose (*Trans. Electrochem. Soc.*, 1946, 89, 417-428; discussion, 429-432).—See *Met. Abs.*, 1946, 13, 256.

**\*The Control of pH in Nickel-Plating Solutions.** H. Bandes (*Electrochem. Soc. Preprint No. 90-34*, 1946, 423-437).—Equations are given for computing the amount of acid or base addition necessary to lower or raise the pH of nickel-plating solutions of the Watts type. The equations are derived from glass-electrode titration curves of a series of solutions in which nickel salt (sulphate and chloride) and boric acid concentrations were systematically varied. Families of iso-pH curves are plotted relating one of the concentrations as variable,  $y$ , with the addition of standard acid to 1 l. of solution,  $x$ , necessary to reduce the pH from a datum value of 5.35 to the value pertaining to the particular curve. These curves are approx. linear,  $y = mx + b$ , and tables are given of the parameters  $m$  and  $b$  for nickel sulphate, nickel chloride, and boric acid concentrations varied singly with other concentrations const. The addition of acid,  $\Delta x$ , necessary to produce a desired change in pH from  $pH_1$  to  $pH_2$  is evidently the difference of the abscissæ at the concentration  $y$  to the two iso-pH curves involved; or, in terms of the parameters, with subscripts 1 and 2 corresponding to the two pH's,  $\Delta x = [(y - b_1)(m_1 - m_2) + m_1(b_1 - b_2)]/m_1 \cdot m_2$ . In the rare cases when an increase of pH is desired,  $\Delta x$  is negative, and the equivalent addition of nickel carbonate or hydroxide of known titration value is made. Nickel sulphate acts as a buffer over the pH interval 3.25-4.0, while boric acid acts as a buffer above pH 4.0.—A. B. W.

**Nickel Baths Containing Sodium Sulphate.** A. Pollack (*Galvano*, 1947, 16, (120), 9-11).—A translation from *Oberflächentechn.*; see *Met. Abs.*, 1945, 12, 117.—J. L. T.

**\*The Electrodeposition of Speculum.** R. M. Angles, F. V. Jones, J. W. Price, and J. W. Cuthbertson (*Galvano*, 1947, 16, (124), 10-12; (125), 11-13).—From *J. Electrodepositors' Tech. Soc.*, 1946, 21, 19-44; see *Met. Abs.*, 1946, 13, 175.—J. L. T.

**Continuous Electro-Tinning of Steel Strip in the Manufacture of Tinplate ["Ferrostan" Process].** C. Frenkel (*J. Electrodepositors' Tech. Soc.*, 1946, 21, 129-139; discussion, 143-148).—The plant developed by the Carnegie-Illinois Steel Corporation for the electro-tinning of steel strip by the "Ferrostan" process is described. Eleven such plants are in operation in U.S.A., and a plant of this type is under construction in S. Wales. It is pointed out that though most electro-tinplate produced during the war had 0.5 lb. tin per base box, coatings of any thickness can be produced by this process. Further, electro-tinplate was developed before the war, and, though applications were greatly accelerated by the war, it was far from a war-time expedient. The operating data for a "Ferrostan" line are briefly as follows: (1) speed, 300-1000 ft./min.; (2) annual output, about 1,000,000 base boxes; (3) strip: 30-36 in. wide, 30-32 gauge, length per coil 1-2 miles, weight 4.5-10 tons; (4) line consists of: coil holder, double shear, welder, looping pit, pinhole detector, electro-limit gauge, alkali cleaner, washer, pickle, scrubber, plating, scrubber, drier, pinhole detector, emulsion oiling, flying shear, branner, and pilers; (5) plating: stannous sulphate electrolyte, c.d. about 200 amp./ft.<sup>2</sup>.—A. B. W.

**Electrical Equipment for Continuous Strip Electro-Tinning Lines.** P. F. Grove (*J. Electrodepositors' Tech. Soc.*, 1946, 21, 139-142).—The handling, plating, reflowing, and inspection equipment are briefly surveyed. The handling is divided into three main sections for control: entry end, plating



zone, and finishing end. Variable-speed drives are operated in groups from variable-voltage generators. For plating-current supply, the advantages and disadvantages of motor generators and rectifiers of copper oxide and selenium types are compared. Selenium rectifiers are most efficient, and being oil-immersed are protected from corrosion, but are expensive. Motor generators were, however, specified for the S. Wales plant built under war conditions. Reflowing, i.e. the melting of the tin coat, can be carried out by several methods. The electrical ones are considered to be the best. They are: conduction, and high frequency. In the former, current is passed through the moving strip from conductor rolls, and, by suitable location of quenching, pick-up of tin on the exit conductor roll is avoided. In H.F. reflowing, the strip passes through an inductor supplied with H.F. current at about 200,000 c./s. from a valve generator. Initial cost and replacements are considerable for the H.F. equipment, and conduction heating is likely to be pre-eminent for some time.—A. B. W.

**\*Electro-Tinplate. II.—The Influence of Coating Thickness on the Porosity and Resistance to Corrosion of Electro-Tinplate.** R. Kerr, R. M. Angles, and K. W. Caulfield (*J. Soc. Chem. Ind.*, 1947, **66**, (1), 5–7).—When subjected to porosity tests (thiocyanate, hot-water, humidity-chamber, salt-spray, and outdoor-exposure), no appreciable difference in behaviour was observed between the deposits obtained in stannous sulphate and sodium stannate baths. In the range studied (corresponding to 2–133 oz. of tin per basis box), there was a marked falling off in the protection afforded below 8 oz., and with outdoor exposure only the thickest coatings gave a long-term resistance.

—S. J. K.

**\*Electro-Tinplate. III.—The Influence of Pickling Conditions on the Porosity and Corrosion-Resistance of Electro-Tinplate.** K. W. Caulfield, R. Kerr, and R. M. Angles (*J. Soc. Chem. Ind.*, 1947, **66**, (1), 7–11).—Cf. preceding abstract. The relative effects of pickling in sulphuric, nitric, phosphoric, hydrochloric, and mixtures of sulphuric and perchloric and of phosphoric and chromic acids, and of anodic etching and pickling, on plates tinned in acid and alkaline baths (8 oz./basis box) have been studied. On the basis of these tests it is recommended that: (1) alkaline bath deposits be pickled for 20–30 sec. in 6% sulphuric acid, inhibited with "Stannine", at 85° C.; (2) acid bath deposits be given anodic treatment in 42% sulphuric acid at room temp. with a c.d. of 200 amp./ft.<sup>2</sup>; and (3) 1 : 1 hydrochloric acid be used for either type of deposit, pickling for 30 sec.–5 min. at room temp., this treatment giving slightly poorer results but being simple to carry out.

—S. J. K.

**Electrodepositing Tin-Zinc.** J. W. Cuthbertson (*Tin and its Uses*, 1946, (17), 13).—The conditions recommended for deposition of tin-zinc coatings on mild steel are:

	80 : 20 Tin-Zinc.	50 : 50 Tin-Zinc.
Tin content of bath, g./l. . . .	30	30
Zinc content of bath, g./l. . . .	2.5	8
Free sodium hydroxide, g./l. . . .	4–6	6–8
Sodium cyanide, g./l. . . . .	25	50
Cathode c.d., amp./ft. <sup>2</sup> . . . .	15–30	15–30
Temp. . . . .	70° C. (158° F.)	70° C. (158° F.)
Anodes . . . . .	80% tin–20% zinc	50% tin–50% zinc

Iron tanks are satisfactory. It is important for all tin to be in the stannate form. This is achieved by maintaining the anodes in a filmed condition, as

in tin plating from a stannate bath. At 15 amp./ft.<sup>2</sup>, deposits of about 0.0005 in. thickness are obtained from the above-mentioned baths in  $\frac{1}{2}$  hr.—A. B. W.

**\*Co-Deposition of Tungsten and Nickel from an Aqueous Ammoniacal Citrate Bath.** Luther E. Vaaler and M. L. Holt (*Electrochem. Soc. Preprint No. 90-9*, 1946, 151-162; and *Metal Ind.*, 1946, 69, (21), 434-436).—Deposits containing 10-35% tungsten were obtained from a bath containing sodium tungstate, citric acid, nickel sulphate, and ammonium hydroxide. The max. tungsten content was obtained from a bath with low nickel content, high tungstate concentration, pH of about 7, high temp., and a fairly high c.d. The most satisfactory bath contained 20 g.  $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$ ; 50 g.  $\text{Na}_2\text{WO}_4 \cdot 2\text{H}_2\text{O}$ ; and 66 g. citric acid per litre, with sufficient ammonia to give a pH of 8. At 70° C. with a c.d. of 7-15 amp./dm.<sup>2</sup>, bright shiny deposits containing about 35% tungsten were obtained with a cathodic efficiency of 40-45%. The tungsten content of deposits and the current efficiency were lower at lower temp. Cobalt and iron were also co-deposited when their sulphates were substituted for the nickel sulphate in this bath.—A. B. W.

**Electroplating of Zinc.** Leo Schmidt (*Corrosion and Material Protection*, 1946, 3, (7), 10-11).—The advantages and disadvantages of the acid and cyanide zinc baths are briefly compared, and minimum thicknesses suitable for various types of exposure recommended. Chromate treatment of coatings is advocated to prolong useful protection, or as a preliminary to painting.

—A. B. W.

**Bright Zinc Plating Cuts Costs at Philco Plant.** Clarence W. Smith (*Iron Age*, 1947, 160, (2), 46-50).—S. describes the equipment and procedure for bright zinc-plating sheet-metal radio and television parts, giving a step-by-step description of the plating cycles, and detailing solutions, times, and temp. It is claimed that a great economy is effected by the substitution of bright zinc plating for cadmium plating.—J. H. W.

**The Adhesion of Electrodeposits.—IV.** A. L. Ferguson (*Monthly Rev. Amer. Electroplaters' Soc.*, 1946, 33, (7), 760).—Additional references to a paper by F., *Monthly Rev. Amer. Electroplaters' Soc.*, 1946, 33, (6), 620-629, 632-635; see *Met. Abs.*, 1947, 14, 117.—J. L. T.

**Defects in Plating Solutions and Their Remedies.** P. Berger (*J. Electro-depositors' Tech. Soc.*, 1946, 21, 195-209; discussion, 289; and *Metal Ind.*, 1947, 70, (11), 171-173; (13), 206-208).—The remedies given are those which a practical man with the usual facilities of a plating shop at his disposal can reasonably be expected to employ. The following types of solutions are covered: brass, cadmium (cyanide), chromium, copper (acid and cyanide), lead (fluoborate and sulphamate), nickel (Watts' type and bright), silver, tin (stannate), and zinc (cyanide).—A. B. W.

**Analysis of Electroplating "Strike" Solutions.** — (*Steel*, 1946, 119, (6), 124-125, 141, 144).—A dip-type cell is recommended for the electrolytic analysis of silver and copper "strike" baths for routine control. The experimental procedure is described.—M. A. V.

**Periodic Reverse-Current Electroplating.** — (*Mech. World*, 1947, 122, (3159), 122).—In this method, which may be used with normal plating baths, the current is briefly reversed at frequent intervals; these reversals have the effect of deplating any unsound or inferior metal deposited during the previous plating period. A typical cycle consists of a plating period of 2-40 sec. followed by a reversal lasting  $\frac{1}{2}$ -5 sec. Greater smoothness, brightness, and density of the deposit, increased plating speed, and other advantages accrue from use of the method.—R. W. R.

**Specifications are Essential to Electroplating Finishing Operations.** C. E. Heussner and Carl O. Durbin (*Products Finishing*, 1947, 11, (6), 68, 70, 72, 74).—A paper presented at the second annual symposium on "Modern Metal Protection", at Cleveland, U.S.A.—J. L. T.

**Some Impressions of Electroplating in U.S.A.** A. W. Hothersall (*J. Electrodepositors' Tech. Soc.*, 1946, **21**, 171–179; discussion, 283–286; and (condensed) *Metal Ind.*, 1946, **68**, (23), 456–458).—Specifications for nickel and chromium plate are compared with corresponding British ones. American electrodeposition practice is then surveyed under the following heads: bright nickel, pyrophosphate copper, pattern and colour plating, coronizing, silver plating of bearings, chromium plating of cylinder bores, tin and zinc plating of steel strip, miscellaneous (covering brass immersion deposition on aluminium, anodic cleaning, agitation, Hull-cell thickness testing, and training), and research and development. Selected references to American technical literature are given.—A. B. W.

**Military Applications of Electroplating in World War II.** William Blum (*Electrochem. Soc. Preprint No. 90-32*, 1946, 403–410; also *Metallurgia*, 1947, **35**, (209), 246–248; and *Metal Finishing*, 1947, **45**, (1), 66–68).—In this brief survey, consideration is given to electroplating of eight different metals or classes of deposit, viz. hard and porous chromium, nickel, copper, zinc and cadmium, lead, tin, silver, and platinum-group metals.—A. B. W.

## IX.—ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition.)

**Electrolytic Cobalt: A Commercially Feasible Process.** F. K. Shelton, Ruth E. Churchward, J. C. Stahl, and C. W. Davis (*Electrochem. Soc. Preprint No. 91-4*, 1947, 55–71).—A method of electro-winning cobalt from cobaltite ores (arsenical sulphide) is described which has been successfully operated in a pilot plant producing 5 lb. (2.3 kg.) cobalt per day. The process comprises: (i) roasting; (ii) caustic leach to remove over 80% of the arsenic; (iii) acid leach of residue with an over-all cobalt recovery of above 98%; (iv) ferric arsenate precipitation from leach liquor in the pH range 4.0–4.5, followed by treatment with  $H_2S$  under pressure at pH 2.0 to remove acid sulphide group metals and zinc; (v) a final iron precipitation by aeration at 70° C. with pH adjusted to between 4 and 5; (vi) precipitation of cobalt carbonate from the purified solution at 25° C. in the pH range 6.48–7.2 with purified soda ash solution; (vii) recovery of the less-pure carbonate from the filtrate in the pH range 8.5–8.8; and (viii) electrodeposition of cobalt from cobalt sulphate or fluoborate electrolyte (prepared from the pure  $CoCO_3$ ) operated at 60° C. at 25 amp./ft.<sup>2</sup> using lead anodes, and in the case of the  $CoSO_4$  electrolyte in the pH range 1.2–1.5. The  $CoSO_4$  appears to be preferable on account of more economical maintenance. Spectrographic analyses of cobalt metal produced in two campaigns showed 99.2 and 99.1% cobalt, 0.74 and 0.81% nickel, and traces of aluminium, calcium, copper, iron, lead, magnesium, silicon, and zinc.

—A. B. W.

**\*The Influence of Crystal Face on the Electrochemical Properties of a Single Crystal of Copper.** Henry Leidheiser, Jr., and Allan T. Gwathmey (*Electrochem. Soc. Preprint No. 91-6*, 1947, 97–108).—Experiments are described and discussed in which spherical single crystals were subjected to various electrochemical treatments in a typical acid copper sulphate electrolyte (containing 205 g./l. of  $CuSO_4 \cdot 5H_2O$  and 48.8 g./l. conc. sulphuric acid). On simple immersion in the aerated electrolyte, (111) faces were greatly attacked and (100) faces were unattacked. Anodic treatment converted the sphere into an octahedron with faces parallel to (111), these being most rapidly attacked and the (100) faces most slowly. On cathodic treatment at low c.d., the initial rate of deposition was greatest on (111) faces and least on (100) faces; at higher c.d., the deposit on (100) faces became polycrystalline, but that on



the (111) faces remained monocrystalline. A.C. (60 c./s.) at high c.d. led to the development of faces parallel to (100). Cathodic treatment at a low c.d. with superimposed A.C. gave results varying from those obtained without A.C. for low superimposed c.d. to those obtained with A.C. alone when this c.d. was high. Replacement reactions with dilute silver nitrate and gold chloride varied with crystal face as revealed by patterns obtained on dipping crystals in such solutions. When two specimens prepared to expose only (100) and (111) faces respectively were immersed in aerated electrolyte, the (100) was 0.0065–0.0057 V. positive with respect to the (111); when immersed in boiled electrolyte the difference was 0.0022 V. of the same sign but rose to 0.0059 V. on bubbling air through the solution.—A. B. W.

**Electrolytic Production and Use of Lithium.** — (*J. Four Elect.*, 1947, 56, (2), 24).—Reprinted from *Echo Mines Mét.*, 1946, p. 194.—J. L. T.

**\*Electrolysis of Manganese Into a Metal Cathode from Suspensions of Manganese Oxide and Carbon in Molten Manganous Chloride.** Burke Cartwright and S. P. Ravitz (*Trans. Electrochem. Soc.*, 1946, 89, 373–382; discussion, 382).—See *Met. Abs.*, 1946, 13, 257.

**\*The Transference Number of Nickel in a Nickel Sulphate Solution.** C. J. B. Zitek and H. J. McDonald (*Trans. Electrochem. Soc.*, 1946, 89, 433–441; discussion, 441–442).—Determinations were made at  $40^{\circ} \pm 0.1^{\circ}$  C. in a 0.1N-NiSO<sub>4</sub> solution by the gravimetric (Hittorf) method, using a modified Findlay cell. Extrapolation to zero hydrogen evolution, i.e. 100% cathode efficiency, gave an average value for the transport number of 0.366.—A. B. W.

**\*An Electrolytic Method for Pointing Tungsten Wires.** W. G. Pfann (*Metals Technol.*, 1947, 14, (4); *A.I.M.M.E. Tech. Publ.* No. 2210, 4 pp.).—The problem of forming points on tungsten wires from 0.002 to 0.010 in. dia. arose in connection with the use of silicon and germanium point-contact rectifiers in micro-wave radar. The method described involves electrolytic pointing in an aqueous solution (38 wt.-%) of potassium hydroxide, to which a little cupric chloride is added. The method is flexible, and differences in wire size, or in the shape of the point desired, involve only changes in the value of the shut-off current.—W. H.-R.

**Rectification and Power Supply for the Electrolytic Industry.** T. R. Rhea and B. R. Connell (*Electrochem. Soc. Preprint* No. 90–5, 1946, 73–93).—The conversion equipment installed in the U.S.A. and Canada for the electrolytic industry (aluminium, magnesium, chlorine, copper, and zinc) is surveyed by industry, paying attention to size and type of equipment, i.e. whether rotating or rectifier. Of the grand total of approx. 4.5 million kW., about 3.5 million is mercury-arc rectifier equipment. A discussion of the advantages and disadvantages of rotating apparatus and rectifiers is given.

—A. B. W.

**Electric Metering of Electrolytic Pot Lines.** E. L. Kirk (*Electrochem. Soc. Preprint* No. 90–8, 1946, 139–150).—The requirements of adequate metering are stated, a typical (magnesium) pot-line metering installation is described, typical metered load data are presented, methods of improving the accuracy of metering are suggested, and the economic value of adequate metering is emphasized. Metered D.C. data have not such a high assurance of accuracy as A.C., and yet it is of the greatest importance for operating adjustments on the plant. Checking D.C. meters directly is difficult, and a procedure based on calculated conversion losses has proved useful in the daily checking of D.C., kWh., and indicated D.C. ampère readings. An instance is given of such checking, enabling discrepancies in the operation of two pot lines to be explained and eliminated with consequent improvement in efficiency.

—A. B. W.

## X.—REFINING

**The Production of Beryllium Compounds, Metal, and Alloys.** Henry C. Kawecki (*Trans. Electrochem. Soc.*, 1946, **89**, 229–245; discussion, 258–261).—See *Met. Abs.*, 1946, **13**, 241.

**The Production of Beryllium Oxide and Beryllium Copper.** Bengt R. F. Kjellgren (*Trans. Electrochem. Soc.*, 1946, **89**, 247–258; discussion, 258–261; and (condensed) *Metal Ind.*, 1946, **68**, (20), 385–388).—See *Met. Abs.*, 1946, **13**, 247.

**The Production of Metallic Calcium by Thermal Reduction.** C. C. Loomis (*Trans. Electrochem. Soc.*, 1946, **89**, 207–224; discussion, 225–228).—See *Met. Abs.*, 1946, **13**, 241.

**Lead Refining.** W. T. Isbell (*Metal Ind.*, 1947, **71**, (3), 47–48).—Abridged from *Metals Technol.*, 1947, **14**, (3); see *Met. Abs.*, 1947, **14**, 392.—J. L. T.

**\*Laboratory Preparation of Lithium Metal by Vacuum Metallurgy.** W. J. Kroll and A. W. Schlechten (*Metals Technol.*, 1947, **14**, (4); *A.I.M.M.E. Tech. Publ. No. 2179*, 9 pp.).—Lithium metal was produced readily by the reduction of  $\text{Li}_2\text{O}$ – $\text{CaO}$  mixtures with silicon or aluminium in a vacuum of less than one micron at 950°–1000° C. Recoveries of better than 75% of the lithium content of the charge were obtained with silicon, and better than 80% with aluminium as reducing agent. Magnesium–lithium alloys can be prepared by reducing  $\text{Li}_2\text{O}$ – $\text{CaO}$  mixtures with magnesium at 950° C., but the magnesium is too volatile for the method to be used for the preparation of pure lithium. The lithium prepared by these methods is very pure. Other less successful or unsuccessful methods, and further possibilities, are discussed.—W. H.-R.

**\*Ductile Zirconium from Zircon Sand.** W. J. Kroll, A. W. Schlechten, and L. A. Yerkes (*Trans. Electrochem. Soc.*, 1946, **89**, 263–275; discussion, 275–276; and (summary) *Chem. Eng. Min. Rev.*, 1946, **39**, (2), 5).—A process is described for making ductile zirconium, using zircon sand as starting material. The operations are as follows: (1) production of a mixture of zirconium and silicon carbides by reduction of zircon sand in a carbon resistance furnace (carborundum-type furnace) with 100% zircon and 83% silicon recovery; (2) chlorination of mixed carbides, which commences at 500° C. and is strongly exothermic, with condensation of zirconium chloride in a condenser maintained at 80° C. to give a product containing only 0.05–0.3% silicon; (3) sublimation of chloride at 500° C. in hydrogen to eliminate iron which remains as  $\text{FeCl}_2$  (boiling point 1024° C.); (4) reduction of purified  $\text{ZrCl}_4$  vapour with magnesium in a helium atmosphere; (5) elimination of excess magnesium, magnesium chloride, and most of the hydrogen by distilling off *in vacuo* (1 micron mercury) at 800°–900° C., at the same time sintering the zirconium somewhat, followed by further degassing and sintering *in vacuo* in a high-frequency furnace; (6) remelting of irregular lumps of metal in a vacuum-arc furnace with a low pressure of helium. The ingots thus obtained have a bright smooth surface, a Brinell hardness number as low as 197, and can be rolled if the Brinell hardness is less than 300, at first hot (700° C.) and thereafter cold with annealing after several passes. The resulting sheet can be bent cold 180° without cracking. Solid zirconium can be heated to 700° C. in air without burning. The process and equipment described is not limited to the production of zirconium, but can be used for the reduction of  $\text{TaCl}_5$ ,  $\text{CbCl}_5$ ,  $\text{BeCl}_2$ , and  $\text{UCl}_4$ , which have boiling points ranging from 233° to 618° C. Other metals such as calcium, lithium, or sodium could also be used as reducing agents, but magnesium is the most convenient.—A. B. W.

**Zirconium Metal.** D. B. Alnutt and C. L. Scheer (*Metal Ind.*, 1946, **68**, (18), 343–345).—Condensed version of a paper read to the Electrochemical Society. See *Met. Abs.*, 1947, **14**, 392.—W. G. A.

## XI.—ANALYSIS

**Chemical Analysis of Aluminium Alloys.** F. H. Smith (*Light Metals*, 1947, 10, (112), 255).—A letter giving the results of the analysis of a standard sample of "Y" alloy, prepared by the Light Metal Founders' Association and analysed independently in the laboratories of some of the members of the Association. These results are compared with those obtained by members of the Association of Light Alloy Refiners. The figures are in close agreement.

—J. L. T.

**Determination of Small Amounts of Copper in Metallic Aluminium by Means of Internal Electrolysis.** N. A. Suvorovskaya (*Metallurgia*, 1947, 38, (212), 110).—Abridged translation from *Zavod. Lab.*; see *Met. Abs.*, 1946, 13, 327.—M. A. V.

**\*Contribution to the Study of an Inorganic Semi-Quantitative Method of Analysis: Analysis of Chromium and Nickel.** Paul E. Wenger, D. Monnier, and Y. Rusconi (*Anal. Chim. Acta*, 1947, 1, (3), 190–200).—[In English]. The first part of the paper is a general discussion of a new semi-quantitative method of analysis, in which the unknown element is determined by spot reactions with specific organic reagents. The solution of the unknown element is progressively diluted until the limit of detection of the spot reaction is reached; the percentage of the element present in the original solution is then estimated, with the aid of a calibration curve, from the dilution required to reach the limit of detection. In general, several reagents are employed with one solution, to increase accuracy, and, where other ions interfere, a preliminary separation may be necessary. In the succeeding sections of the paper, the authors present methods and calibration curves for the analysis of Cr and Ni, and describe the steps in the analysis of a Cr-Fe alloy, a Ni-Fe alloy, and the determination of Cr and Ni in a steel. Reagents recommended for the estimation of Cr are gum guaiacum, strychnine, and diphenyl carbazide, while, for Ni, the authors suggest cyclohexanedionedioxime, rubeanic acid, and diammonium tetrathiocyanatomercurate.—R. W. R.

**\*On a Spot-Reaction of Cobalt.** Clément Duval (*Anal. Chim. Acta*, 1947, 1, (3), 201–204).—[In French]. A study is described of the reaction between  $\text{Co}^{++}$ , a bicarbonate, and  $\text{H}_2\text{O}_2$ , which gives rise to a green coloration and which may be used as a microchemical test for Co. The green compound has been isolated and shown to be Co carbonatocobaltate. In the spot-test, two drops of the Co solution are placed on a tile, a drop of saturated  $\text{NaHCO}_3$  solution and a few crystals of  $\text{Na}_2\text{O}_2$  are added, and, after the reaction has subsided, the colour is stabilized with a crystal of mannitol or a drop of glycerol. The limit of detection is  $0.43 \mu\text{g./ml.}$ , and the test is satisfactory in the presence of Ni. Other ions of the Co group do not interfere.—R. W. R.

**\*Note on the Spot Reaction of Cobalt as Potassium Hexanitritocobaltate.** Clément Duval and Colette Soye (*Anal. Chim. Acta*, 1947, 1, (3), 205–206).—[In French]. A drop of glacial acetic acid, a drop of conc. potassium nitrite solution, and a drop of the Co solution are placed on a tile; after about 2 min. a yellow coloration, or precipitate of potassium hexanitritocobaltate, appears. The absolute sensitivity of the reaction is  $0.04 \mu\text{g. of Co.}$  Ni does not interfere; interference by  $\text{Cu}^{++}$ ,  $\text{V}^{5+}$ ,  $\text{CrO}_4^{--}$ , and other ions is discussed.

—R. W. R.

**\*Routine Control of Brass-Plating Processes.** Polarographic, Electrochemical, and Chemical Analysis of Plating Solutions and Deposits. H. E. Zentler-Gordon and Eric R. Roberts (*Electrochem. Soc. Preprint No. 90-2*, 1946, 9–22; also (condensed) *Metal Ind.*, 1946, 69, (19), 392–394; (21), 433–434; and (summary) *Metal Finishing*, 1947, 45, (4), 66–69).—Satisfactory bonding between rubber and brass depends on both composition and structure of the



latter, and necessitates rigid control of the electroplating process. Effectiveness of control depends in turn on rapid and accurate analyses of solutions and deposits. The determinations required are Cu, Zn, CN, Fe, and ( $\text{CO}_3$ ) in the plating solution and Cu and Zn in the deposit. Polarographic methods have been applied to the determination of Cu and Zn in the solution and also the ratio Cu : Zn in deposits. In the case of the plating solution, a filtered or centrifuged sample is taken to dryness with an equal vol. of conc. HCl on a water bath, taken up with a few drops of HCl, and made up to a suitable vol. (e.g. 100 ml.), aiming at concentrations of approx. 100 mg. Cu and 40 mg. Zn/l. An aliquot portion with an equal vol. of a base solution, 4N with respect to both ammonia and ammonium chloride and containing 2% xylose, is then polarographed over the range 0 to  $-2.1$  V., or, in the case of a non-recording polarograph (e.g. a voltamscope), readings are taken at  $-0.25$  V., between the Cu steps, at  $-0.9$  V., between the Cu and Zn steps, and at  $-1.25$  V., beyond the Zn step. The ratio of copper to zinc is obtained by multiplying the ratio of polarographic steps by the inverse ratio of the atomic weights, since the diffusion coeff. are identical. Individual Cu and Zn concentrations are obtained by the use of calibration charts in the usual way. As a check on the polarographic method, it was applied to a series of synthetic plating solutions made up from analysed salts, and the results showed agreement with gravimetric values within 1%. Brass deposits are stripped for analysis by the use of an ammoniacal ammonium persulphate solution (containing  $(\text{NH}_4)_2\text{S}_2\text{O}_8$  75 g.; ammonia (sp. gr. 0.880) 335 ml.; and water 660 ml.) and the solution obtained acidified with HCl and treated as for the plating solution. Determinations of Cu can also be made electrolytically, in which case the solution sample is acidified with  $\text{HNO}_3$  and  $\text{H}_2\text{SO}_4$  and treated in the usual way. Zn may be determined volumetrically on the Cu-free solution remaining after the electrolytic Cu determination, using 0.05N-potassium ferrocyanide solution and diphenyl benzidine indicator. Total CN is determined by distillation of a filtered sample with dil. HCl, collecting the distillate in 10% NaOH, and titrating with 0.1N- $\text{AgNO}_3$ , using iodide indicator.—A. B. W.

**Analysis of Electroplating "Strike" Solutions.** (—) See p. 46.

**Polarographic Determination of Zinc in Aluminium Alloys.** W. Stross (*Metallurgia*, 1947, **36**, (214), 223–225).—S. discusses details of the technique used in applying the method described in a previous article (*Metallurgia*, 1947, **36**, (213), 163; *Met. Abs.*, this vol., p. 18).—M. A. V.

**Electrolytic Methods for Microchemical Analysis.** A. J. Lindsey (*Metallurgia*, 1947, **35**, (209), 267–268).—Summary of a paper presented to the Society of Public Analysts.—W. G. A.

**Electrographic Methods of Analysis.** Eric A. Arnold (*Electrochem. Soc. Preprint No. 90–37*, 1946, 469–473; and (summary) *Steel*, 1946, **119**, (24), 88–89).—In this technique, which affords a useful means for qualitative and quantitative examination of metals and alloys, the test specimen is made the anode against an inert cathode, the electrolyte and necessary reagents being carried by a piece of bibulous paper clamped between the electrodes. Typical applications are: (1) qualitative: the examination of coatings for pinholes, e.g. Cr–Ni–Cu electroplate on steel with paper saturated with a solution containing 1% dimethylglyoxime and 1% barium hydroxide, which reveals pinholes in the nickel as red spots; (2) quantitative: the determination of alloy metal content by comparison with standards, electrographing at various known c.d. for various known periods and matching the stains.—A. B. W.

**The Direct Reading of Spectral-Line Intensities. A Review of Some Recent Applications to Spectrographic Analysis.** J. H. Oldfield (*J. Iron Steel Inst.*, 1947, **156**, (1), 78–80).—O. reviews the literature relating to the direct measurement of spectral-line intensities by means of photo-multiplier tubes,

and describes the "Quantometer", a commercial instrument, comprising a source unit, a spectrometer, and a recording unit capable of determining eleven elements in an alloy. The principal advantage of the direct-reading method lies in its speed, but it possesses the disadvantages (1) of requiring a more stabilized source, and (2) of dependency on the characteristics of the photo-cell, which are highly individual; replacement of a photo-cell necessitates complete recalibration of the instrument. The method is likely to find its greatest use in rapid routine analysis; it is not at present suitable for qualitative work.—R. W. R.

## XII.—LABORATORY APPARATUS, INSTRUMENTS, &c.

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

**The Electron Microscope and Its Applications in Metallography.** P. Grivet, H. Brück, and F. Bertein (*Métaux et Corrosion*, 1946, 21, (245), 1-10).—An exposition of the principles of electron microscopy and of emission and transmission instruments is followed by a description of the microscope manufactured by Compagnie Général de T.S.F. (Paris) and by some examples of its applications to metallographic subjects. The specification of the microscope is as follows: electrostatic lenses; objective, 5.4 mm. focus (magnification 62), projection lens, 4.7 mm. focus (magnification 111), giving a total magnification of 6500; resolution, about 8  $\mu$ ; field size, 5  $\mu$  for 24  $\times$  36 mm. picture or 10  $\mu$  for 60  $\times$  60 mm. picture; field depth, 10  $\mu$ ; object carrier hole, 0.1-0.2 mm. dia.; high-tension supply, max. 75,000 V., 300  $\mu$ amp., normal 65,000 V., 25  $\mu$ amp.; photographs, 36 exposures 24  $\times$  36 mm. or 12 exposures 60  $\times$  60 mm.; time of exposure, 1 sec.; time for change of object, 3 min.; time for change of film, 10 min. Both intermediate and final images can be examined on fluorescent screens swung into position for this purpose. The electron micrographs reproduced to illustrate applications are: profile of tungsten wire 0.0003 mm. dia., before and after electrolytic polishing; magnesium and zinc oxide smokes; and technical and high-purity aluminium oxide replicas. Techniques for the production of synthetic resin and silica replicas are described, and reference is made to the possibility of using glancing reflection directly in examining metal surfaces. The paper concludes with a *bibliography* containing some 15 references to the literature from 1940 onwards, most of which are German.—A. B. W.

**\*Simple Device for Preventing the Formation of Hard Deposits in Laboratory Stills Fed with Water Partially Softened by Base-Exchange Treatment.** U. R. Evans (*Chem. and Ind.*, 1946, (49), 434-435).—A copper-zinc couple, immersed in the boiler but insulated from it, ensures deposition of loose, non-adherent sludge, apparently as a result of cathodic precipitation on the couple, though zinc dissolved anodically may modify the character of the deposit by protective colloid action or by the provision of suitable nuclei.—A. B. W.

## XIII.—PHYSICAL AND MECHANICAL TESTING, INSPECTION, AND RADIOLOGY

**Correlation of Diamond Pyramid and Magnetic Hardness.** — (*Machine Tool Rev.*, 1946, 34, 50; and (summary) *Indust. Diamond Rev.*, 1947, [N.S.], 7, (77), 120).—R. W. R.

**Modern Hardness-Testing Machines.** — (*Indust. Diamond Rev.*, 1946, [N.S.], 6, (70), 263-267).—A composite abstract of articles by K. Meyer, *Festigungstechn.*, 1943, (1/77), 232; 1944, (1/78), 17, 47; and W. Ermlich, *Metallwirtschaft*, 1942, 21, 306.—R. W. R.

**New Hardness Tester.** T. Dobry (*Hutnické Listy*, 1946, 1, 177; and (summary) *Indust. Diamond Rev.*, 1947, [N.S.], 7, (81), 244).—R. W. R.

**Specifications for Knoop Indenters.** — (*U.S. Bur. Stand. Letter Circular* 819, 1946; and (summary) *Indust. Diamond Rev.*, 1947, [N.S.], 7, (77), 119).—R. W. R.

**Micro-Hardness Testing Fine Wire and Small Parts.** G. E. Shubrooks (*Indust. Diamond Rev.*, 1947, [N.S.], 7, (74), 10–11).—See *Met. Abs.*, 1947, 14, 397.—R. W. R.

**The Automatic Sonigage; A New Ultrasonic Testing Instrument.** Wesley S. Erwin and Gerald M. Rassweiler (*Iron Age*, 1947, 160, (4), 48–55).—E. and R. describe an improved ultrasonic testing device for rapid non-destructive tests of flat metal parts and tubes.—J. H. W.

**\*The Detection of Cracks in Steel by Means of Supersonic Waves.** C. H. Desch, D. O. Sproule, and W. J. Dawson (*Iron Steel Inst. Preprint*, 1946, 23 pp.; and (summary) *Aircraft Prod.*, 1946, 8, (92), 259–265).

**Magnetic-Particle Testing.** — (*Engineering*, 1946, 161, (4185), 302; and *Tech. Moderne*, 1947, 39, (1/2), 25).

**Photographic Projection: Inspection and Lay-Out [of Castings].** C. J. Kettle (*Iron Age*, 1947, 160, (5), 45–49).—K. describes a new, simple, and rapid method of inspecting and laying-out intricate castings, involving essentially the accurate projecting of lay-out drawings on to the surface of the casting by optical means. This method differs in many respects from previously described photographic methods, particularly in the use of a light wand for establishing a base line for the castings to be inspected.—J. H. W.

#### RADIOLOGY

**Interpreting Spot-Weld Radiographs [in Aluminium Alloys].** Robert C. McMaster (*Steel*, 1946, 119, (16), 104–107).—Typical radiographs of spot welds in 24S-T and 75S-T aluminium alloys are reproduced and explained. Common defects are illustrated.—M. A. V.

**Safety X-Ray Code Protects Workers.** — (*Steel*, 1946, 119, (14), 81).—A safety code has been published by the American Standards Association to protect workers in X-ray and radium industrial testing.—M. A. V.

### XIV.—TEMPERATURE MEASUREMENT AND CONTROL

**The Selection and Installation of Thermocouple Extension Lead-Wires.** C. C. Roberts and C. A. Vogelsang (*Indust. Heating*, 1947, 14, (3), 370–372, 374, 376, 378, 380, 382; and (summary) *Iron Age*, 1947, 159, (10), 82–84).—The authors outline the various factors governing the selection of the proper kind of lead-wire, and give a few simple rules to be followed to ensure accurate measurement and control.—J. H. W.

### XV.—FOUNDRY PRACTICE AND APPLIANCES

**Melting Practice for Sand Casting [Aluminium Alloys].** Fred Carl, Walter Bonsack, W. E. McCullough, Wm. Rogers, and H. J. Rowe (*Modern Metals*, 1947, 3, (2), 24–27).—An authoritative review in which are discussed gas absorption, dross formation, furnace equipment, temp. measurement, melting precautions, alloying, and the use of grain refiners. See also abstract below.

—N. B. V.



**Aluminium Fluxing and Melting Practice.** Fred Carl, Walter Bonsack, W. E. McCullough, Wm. Rogers, and H. J. Rowe (*Modern Metals*, 1947, 3, (3), 18-23).—Cf. preceding abstract. Methods of fluxing using solid fluxes, chlorine, and nitrogen; melting equipment and procedure for pressure and gravity die-casting; and methods of charging are described.—N. B. V.

**Fluxes—Degasifiers and Grain Refiners [for] Aluminium Casting Alloys.** James D. Kline (*Amer. Foundryman*, 1947, 11, (4), 123-124; and *Metal Ind.*, 1947, 71, (4), 71-72).—A general review, in which fluxing alloys, salt fluxes, and gaseous fluxes are briefly described.—J. E. G.

**Theory and Practice of the Aluminium Sand Foundry. Present-Day Role of the Metallurgist.** F. Raybould (*Found. Trade J.*, 1947, 81, (1594), 171-176; (1595), 197-202; discussion, (1594A), 223-225).—Read before the London Branch of the Institute of British Foundrymen. A detailed account is given of the application of metallurgical control in the foundry. Particular topics discussed include the control of moulding and core sands, mould facings, chills, alloy melting, and the influence of design and alloy composition on solidification characteristics.—J. E. G.

**Aluminium Sand Castings.** — (*Steel*, 1946, 119, (7), 80-82, 84).—A brief illustrated description of equipment and operations in the foundry of Aluminum Industries, Inc., of Cincinnati, U.S.A.—M. A. V.

**Aluminium Casting.** R. E. Paine (*Amer. Foundryman*, 1947, 11, (7), 48).—A summary of a paper presented at the Western Metals Congress, Oakland, Cal.—J. L. T.

**Technology of Aluminium and Magnesium [Casting].** L. W. Eastwood (*Metals Rev.*, 1947, 20, (2), 7-8, 51).—New aluminium-beryllium alloys for casting, and studies on the dimensional stability of aluminium castings, are briefly described. Recent work on (i) the corrosion and stress-corrosion characteristics of aluminium, (ii) aluminium bearings, and (iii) the centrifugal casting of aluminium, is discussed. The reduction of microporosity in magnesium alloys, and the grain refinement of magnesium casting alloys, are described.—J. L. T.

**\*Unsoundness in Cast Light Alloys.** J. C. Dehaven, R. F. Hauser, Walter Bonsack, L. W. Eastwood, C. E. Nelson, and W. E. Sicha (*Amer. Foundryman*, 1947, 11, (1), 24-40; (2), 35-47).—The report of an A.F.A. Sub-Committee (Aluminium and Magnesium Division) on shrinkage and porosity. In light alloys, the type of defect caused by shrinkage and/or gas evolution depends chiefly on: (1) the composition of the alloy, (2) the gas content of the melt, and (3) the nature of the solidification process, as determined by such factors as casting design, method of gating, and section thickness of the casting. Depending on the magnitude and combination of these factors, localized shrinkage merges into microporosity. Similarly, gas porosity also merges into microporosity.—J. E. G.

**The Effect of Melting Conditions on Light Alloys.** A. J. Murphy, S. A. E. Wells, and R. J. M. Payne (*Fonderie*, 1947, (18), 708-710).—See *Met. Abs.*, 1940, 7, 266.

**The Founder and His Clients [Casting Light Metals].** E. Carrington (*Light Metals*, 1947, 10, (111), 193-200).—C. deals with the advantages of the casting process as compared with the production of parts by mechanical-working methods, and discusses various procedures in relation to available aluminium alloys. Applications are also briefly described.—F. A. F.

**Difficulties Encountered When Using Recovered Light Alloys for Casting.** Jean Duport (*Fonderie*, 1947, (14), 527-538).—After reviewing chemical methods of analysing light alloys, D. tabulates the tensile properties of the most important French alloys; methods of testing the properties of castings are also considered. Impregnation of moulds is very important, the best results having been obtained with (1) lamp-black produced from acetylene,

and (2) a solution containing : Spanish white 2.5, graphite 0.4, sodium silicate 0.2 kg., and water 10 l.—M. E.

**Casting Magnesium Alloys.** Allen G. Gray (*Steel*, 1946, **119**, (19), 92–95, 130, 132, 134, 136, 139–140).—Magnesium alloy sand-casting technique is described generally. Details are given of the compositions, characteristics, mechanical properties, and uses of magnesium alloy castings, and of the compositions and characteristics of suitable fluxes.—M. A. V.

**Removing Dissolved Gases from Molten Metals.** P. M. Hume (*Steel*, 1946, **119**, (15), 108–111, 160, 163; (16), 110–111, 122, 125–126, 128).—A general review of present knowledge and practice, in which published work is summarized. A short *bibliography* is appended.—M. A. V.

**Practical Procedures for Reducing Gas Porosity in Non-Ferrous Castings.** A. E. St. John (*Iron Age*, 1947, **160**, (1), 46–48).—St. J. outlines simple and practical means for reducing gas porosity in tin bronzes, aluminium bronzes, silicon bronzes, yellow brasses, and manganese brasses. He discusses the effects of fuel-fired and electric-furnace melting, atmosphere control, melting practice, superheating, stirring, deoxidizing, and pouring.—J. H. W.

**Introduction to the Study of Foundry Defects.** François Boussard (*Fonderie*, 1946, **1**, (12), 431–434).—67 causes of failure in the foundry are enumerated.  
—M. E.

**Foundry Control in Aviation.** René Buquet (*Fonderie*, 1946, **1**, (12), 453–454; discussion, 454).—An account of non-destructive testing methods for castings (X-ray, supersonic, and magnetic).—M. E.

†**Mare Island's Accurate Method of Propeller Manufacture.** Milton M. Metcalf (*J. Amer. Soc. Naval Eng.*, 1947, **59**, (1), 33–42).—The historical development of methods of casting ship propellers at Mare Island Naval Shipyard (California, U.S.A.) from 1890 to the present day is described with the aid of 22 photographs. The modern method of manufacture involves the use of metal patterns and sectional mould boxes, and produces propellers which require only a small amount of finishing in order to satisfy the specifications.—H. J. A.

**Core and Moulding Sands for Aluminium Foundries.** C. E. Heussner, Donald M. Bigge, Harvey J. Cole, Gordon Curtis, Harry Dietert, Robt. E. Schenck, and Norman Smith (*Modern Metals*, 1947, **3**, (5), 21–25).—A review dealing with moulding sands, binders, sand testing, reprocessing moulding sands, core sands and binders, core washes and spraying, inhibitors, core baking, and reclamation of core sand.—N. B. V.

**Magnesium Foundry Core Practice.** George W. Kurachek (*Foundry*, 1946, **74**, (9), 76–77, 162, 164, 166, 168, 170; and *Metal Ind.*, 1946, **69**, (16), 323–324, 330).—A review.—W. G. A.

**Electronic Core Baking.** R. W. Crannell (*Foundry*, 1947, **75**, (7), 66–69, 420).—A review of dielectric-heating methods of core baking as practised at a large American foundry. The principles of core manufacture are explained and the modifications in composition of the core-binding materials outlined. Photographs illustrate some of the production operations and the types of high-frequency ovens in use.—D. M. L.

\***Moulding Sand Binders.** L. Jenicek (*Amer. Foundryman*, 1947, **11**, (4), 132–140).—From theoretical considerations, it is submitted that those bonding materials which behave as solids up to the greatest possible shear stresses possess the best properties for the development of max. green compressive strength in moulding-sand mixtures. These conditions are approached most closely by sodium bentonite. The characteristics of sodium bentonite are approached by certain organic substances which exhibit swelling in the presence of water. Other bond clays are characterized by less-favourable characteristics. J. also discusses the development of strength after "drying", and the strength of sand mixtures at elevated temp.—J. E. G.

**The Use of Mixed Sands in the Foundry.** Ladislav Jenicek (*Fonderie*, 1946, 1, (12), 462; discussion, 463).—A list of sands in common use is given.  
—M. E.

**Drying of Foundry Sand Cores by Dielectric Heat.** J. R. Calhoun, L. E. Clark, and H. K. Salzberg (*Found. Trade J.*, 1946, 80, (1583), 405–406, 410).—Reprinted from *Industrial Ovens*.—W. G. A.

**Foundry Sand Laboratories.** O. Jay Myers (*Amer. Foundryman*, 1947, 11, (4), 117–122).—A summary of the objects of sand control and a description of the chief methods of sand testing.—J. E. G.

**Patterns for Production.** John E. Gill (*Amer. Foundryman*, 1947, 11, (4), 127–128).—A brief review.—J. E. G.

**Pattern-Making. A New Machine for Cutting Irregular Shapes.** B. Levy (*Found. Trade J.*, 1947, 81, (1595A), 239–244; discussion, (1596), 271–272).—Read before the London Branch of the Institute of British Foundrymen. An illustrated account is given of a new, mechanically-operated machine primarily suited for cutting irregular shapes, such as foundry patterns, in wood and in very soft metals.—J. E. G.

**New Coatings and Applications Expand Use of Porcelain Enamels [for Melting Pots &c.].** — (*Steel*, 1946, 119, (20), 154, 156, 218, 220, 222).—Recent industrial uses of porcelain-enamel coatings include heat-resistant coatings for melting pots, and marine and aircraft exhaust systems. Good results have been obtained by spray application.—M. A. V.

**Speeding Production in the Foundry [Moulding Machines].** P. Peel (*Mass Prodn.*, 1946, 22, (6), 277, 279, 281, 283).—P. describes various kinds of moulding machine, and discusses the ways in which combinations of the different types of machine are employed so as to secure max. production rates.—R. W. R.

**Foundry Mechanization.** C. O. Bartlett (*Amer. Foundryman*, 1947, 11, (4), 82–90).—A general illustrated survey.—J. E. G.

**The Handling and Transport of Materials in a Modern Factory.** W. L. Beeby and W. Symes (*Manchester Assoc. Eng. Preprint*, 1946–47, 15 pp.).—A general review of the problems involved in materials-handling processes in an engineering works. Topics discussed include the handling of raw materials, scrap, and swarf; and the use of hand- and mechanical trucks, cranes, and mechanical conveyers.—J. E. G.

**Uses of "32" Alundum Abrasive in the Foundry.** C. A. Carlson (*Grits and Grinds*, 1946, 37, (9), 12–13).—A brief summary of the use of grinding wheels in this material for fettling castings.—R. W. R.

**Foundry Dust-Control Systems: Hoods and Piping.** E. A. Carsey (*Amer. Foundryman*, 1947, 11, (3), 42, 46–47).—A review.—J. E. G.

**Foundry Dust-Control Systems: Maintenance.** Kenneth M. Smith (*Amer. Foundryman*, 1947, 11, (3), 43–45).—A general illustrated account.—J. E. G.

**Foundrymen Survey Vocational School Facilities.** — (*Amer. Foundryman*, 1946, 10, (2), 77–79; and *Nassau*, 1946, 8, (9), 3–9).

**Centrifugal Casting.** L. Northcott (*Found. Trade J.*, 1947, 81, (1591), 151–155; discussion, (1594), 177–178).—Read before the London Branches of the Institute of British Foundrymen and the Institute of Metals. A review is given of the chief production methods of centrifugal casting and the factors involved therein.—J. E. G.

**The Present Position of Centrifugal Casting.** Jacques Boucher (*Fonderie*, 1946, 1, (12), 435–437; discussion, 437).—An illustrated account of methods of centrifugal casting. The dia. of tubes which can be cast can vary from 1.25 to 18 mm. and the thickness from 2 to 100 mm.—M. E.

**Centrifugal Casting.** — (*Usine Nouvelle*, 1947, 3, (16), 12).—A brief elementary review.—J. L. T.



**Centrifugal Casting in Germany.** — (*Steel*, 1946, **119**, (17), 100–101, 130, 132).—A summary of the investigations of the U.S. Technical Field Information Agency on the status of centrifugal casting in Germany. The works visited included Kupfer und Drahtwerk, Osnabrück, where large brass and bronze tubes were cast.—M. A. V.

**Continuous Casting.** H. Kästner (*Metal Ind.*, 1947, **71**, (5), 83–85; (6), 106–108; (7), 131–132).—A translation of *Stahl u. Eisen*, 1947, **67**, (1/2), 10–19; see *Met. Abs.*, 1947, **14**, 175.—J. L. T.

**New Continuous-Pouring Induction Melting Furnace.** (—) See p. 58.

**Recommended Practices for Aluminium and Magnesium Permanent-Mould Castings.** Alfred Sugar (*Aluminum and Magnesium*, 1946, **2**, (8), 12–14, 32–33; (10), 8–9, 16–17).—S. discusses mould design, types of mould, manufacture of mould, cores, venting, gates, runners and risers, the melting, degassing, and casting of aluminium and magnesium alloys, and the control of temp. of the moulds. The finishing of both types of alloy is described.

—E. C. E.

**Permanent-Mould Aluminium Castings: Operations at Alumicast.** — (*Indust. Gas Times*, 1947, **10**, (112), 110, 112, 114, 116).—See *Met. Abs.*, 1947, **14**, 273.

**Making Permanent Moulds [for Aluminium].** Vincent J. Sedlon (*Amer. Foundryman*, 1947, **11**, (2), 49–54).—An illustrated account, in which an outline is given of the chief factors to be kept in mind in the production of gravity die-casting moulds (permanent moulds) for aluminium alloy castings.

—J. E. G.

**An Engine Without Valves Cast Under Pressure [Use of Aluminium–12% Silicon Alloy].** V. Boghossian (*Rev. Aluminium*, 1947, (130), 57–61).—Aluminium–12% silicon alloy (A.S. 13) is used by Jack and Heintz for the die-castings in their four-stroke, six-cylinder, 75 h.p. Skinner engine.—M. E.

**German Die-Castings Made by Hot-Shot Goose-Neck Method.** J. R. Townsend (*Product Eng.*, 1946, **17**, (7), 81–83).—Captured German telephone and wireless equipment contained aluminium and magnesium die-castings which were remarkable, not only for their size and intricacy, but also for their freedom from blow-holes and surface defects. Very small gates had been used, and high pressure and velocity probably ensured that the metal completely filled the mould before freezing began.—H. V.

**Brass Die-Casting.** Herbert Chase (*Steel*, 1946, **119**, (15), 112–114, 164, 166, 169–170).—Brass die-casting equipment and technique are described, and properties of brass die-casting alloys tabulated.—M. A. V.

**Production of Magnesium Alloy Castings. Gravity and Pressure Die-Castings Technique.** G. B. Partridge (*Metallurgia*, 1947, **36**, (211), 7–12; correspondence, (212), 82).—Cf. *Met. Abs.*, 1947, **14**, 400. The difficulties and advantages of the die-casting process for magnesium alloys are summarized, and the technique described generally. The latest method of counteracting oxidation is the addition of small quantities of beryllium, but this has the disadvantage of increasing grain-size.—M. A. V.

**Production of Magnesium Alloy Castings. Some Commercial Applications.** G. B. Partridge (*Metallurgia*, 1947, **36**, (213), 125–132).—Cf. preceding abstract. The design and application of magnesium alloy castings are discussed from the points of view of engineering properties and costs. Illustrated examples of Elektron castings are given.—M. A. V.

**Die-Casting Magnesium Alloys.** Allen G. Gray (*Steel*, 1946, **119**, (20), 150–152, 212, 214, 217).—A general account of magnesium alloy die-casting practice. Limitations in design are considered.—M. A. V.

**1,000,000 Pounds of Small [Zinc] Die-Castings.** Herbert Chase (*Steel*, 1946, **119**, (26), 56–58, 99–100).—Details are given of zinc alloy die-casting practice at one of Fisher Body's Ternstedt plants.—M. A. V.

**A Small Die-Casting Machine for Zinc-Base Alloys.** — (*Machine Tool Rev.*, 1946, 34, (201), 23-24).—The machine is suitable for casting zinc-base alloys up to 5 oz. in weight. It is a light-weight, hand-operated machine, and 400-500 shots per hr. can be maintained without undue fatigue. Automatic or hand-operated side cores can be arranged when required, and only the fixed half of the die is water-cooled. Dies can be quickly changed, reducing idle machine time. Dies are hand-operated by lever and toggle mechanism, giving a pressure of 6 tons. The melting pot has a capacity of 70 lb. and is heated by atmospheric burners using town gas. No air equipment is required, and gas consumption is 100-120 ft.<sup>3</sup>/hr. The nozzle does not require independent heating.—H. V.

**Timer for Die-Casting Machine.** Gerald DeLong (*Electronics*, 1947, 20, (3), 110-112).—An illustrated description of an electronic timer for die-casting machines for automatically controlling the time interval between the filling of the mould and opening for ejecting the casting. This time interval has been found to be critical for all types of die-castings in zinc and aluminium alloys. Each die-casting machine requires its own timer. The instruments for the whole shop are mounted together in a control rack only accessible to a foreman for adjustment.—D. M. L.

**\*A Study of the Hazards of Exposures to Metallic Fumes and Dust in Brass Foundries.** William W. Stalker (*J. Indust. Hyg. Toxicol.*, 1947, 29, (2), 96-112).—S. describes atmosphere tests carried out during the melting and casting of brass in 5 foundries. The max. figure found for lead concentration was 8 mg./10 m.<sup>3</sup>, while the max. figure for zinc concentration was 1824.7 mg./10 m.<sup>3</sup>; these figures are the mean of several determinations. Medical tests on the urine and blood of 94 foundrymen were also carried out. Lead contents above the safe maximum were found in both the urine and blood of one-third of the workers, but it was not found possible to correlate this with either foundry atmosphere or with abnormal ill-health. About half the workers examined did, however, exhibit symptoms of mild alimentary lead poisoning. Recommendations are made with regard to the control of fumes in brass foundries.—R. W. R.

**Experiences with Polarographic Methods in Controlling a Lead Hazard in Brass Foundries.** Herbert J. Wheeler (*J. Indust. Hyg. Toxicol.*, 1947, 29, (3), 158-167).—W. describes rapid polarographic methods for the estimation of lead in urine and blood, which are sufficiently accurate for controlling lead hazard in brass foundries.—R. W. R.

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## XVI.—SECONDARY METALS : SCRAP, RESIDUES, &c.

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**Reclaiming Brass Scrap.** — (*Steel*, 1946, 119, (8), 100).—A brief account of the separation of brass machine-shop scrap from iron and steel, for subsequent reclamation.—M. A. V.

**Treatment of Galvanizing-Bath Residues.** A. Gordet (*Galvano*, 1947, 16, (123), 15-17).—Answers to correspondence.—M. E.

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## XVII.—FURNACES, FUELS, AND REFRACTORY MATERIALS

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**New Continuous-Pouring Induction Melting Furnace.** — (*Iron Age*, 1947, 160, (4), 55).—A brief description of a new design of melting furnace for aluminium, brass, and zinc. There are two chambers, one for charging and the other for pouring, connected by straight-line melting channels. An illustration shows the furnace in operation.—D. M. L.

**\*Experiments on High-Frequency Heating.** L. Hartshorn and E. Rushton (*Trans. Liverpool Eng. Soc.*, 1946, **67**, 111–132; discussion, 133–136).—The general principles of induction heating are outlined and illustrated by reference to: (1) the bonding of laminated wood, (2) the dehydration of vegetables, and (3) the sterilization of meat. A table of the dielectric properties of representative materials is given.—H. J. A.

**Heat-Treating Furnaces in Foundry Work.** Victor Paschakis (*Indust. Heating*, 1946, **13**, (10), 1612, 1614, 1634).

**Heat-Treatment Furnaces. Some Recent Installations.** — (*Metallurgia*, 1947, **36**, (211), 31–38).—Illustrated descriptions are given of some newly installed furnaces, including a Wellman continuous reheating furnace for nickel-chromium and other non-ferrous billets, an Efco-Lindberg Cyclone tempering and heat-treatment furnace, a Birlec belt-conveyor bright-annealing furnace for copper sheets, and a Wild-Barfield bell-type bright-annealing furnace.—M. A. V.

**Infra-Red Heating by Gas: Its Development and Practice To-Day.** J. B. Carne (*Metallurgia*, 1947, **36**, (214), 193–196).—Infra-red radiant heating is a comparatively recent industrial application, having been first used by the Ford Motor Company in 1933 for stoving car bodies. Its use was greatly extended in World War II. Infra-red gas units are briefly reviewed, and the basic principles and advantages of the process (mainly higher temp. and greater speed) are discussed.—M. A. V.

**Drying with Infra-Red [Rays].** Jean Maisonneuve (*Rev. Aluminium*, 1946, (128), 377–383).—Rays between 7600 and 30,000 Å have given the best results. The rays are emitted from lamps, the filaments of which are at 2450° K., and the efficiency of the process reaches 73%. Drying starts close to the metal, and thus the risk of cracking is diminished; this is especially useful when the rays are used for drying transparent plastic coatings on metals.

—M. E.

**Special Finishing Installation Eliminates Production Problem [Use of an Infra-Red Oven].** E. L. Verhagen (*Products Finishing*, 1947, **11**, (5), 70–72).—V. describes briefly the use of a “dual-heat” electric infra-red oven for stoving ivory enamel finish on can-openers. Rows of lamps set at criss-cross angles give an even and const. heat.—G. T. C.

**†Fuel Economy.** Leslie Aitchison (*Metal Ind.*, 1946, **69**, (17), 339–342; (18), 364–366; (19), 385–386).—Read at the Ministry of Fuel conference on “Fuel and the Future”.—W. G. A.

## XVIII.—HEAT-TREATMENT

**Advancements in the Art of Heat-Treating Aluminium.** James F. Carland and P. R. Watson (*Aluminium and Magnesium*, 1947, **3**, (4), 9–11, 19, 22).—A practical review of some factors in the heat-treatment of the strong alloys, dealing briefly with pit-quenching, standardization of quenching procedure, and temp. variations in the furnace. A 600 kW. furnace installed in 1944 in the St. Louis plant of the Curtiss and Wright Corporation, which is said to solve heat-treatment problems, is then described in some detail. The furnace had special (“Reactrol”) temp.-control equipment, and an automatic quench mechanism.—F. A. F.

**Heat-Treating Aluminium.—I, —II, —III, —IV, —V.** G. W. Birdsall and O. L. Mitchell (*Steel*, 1946, **119**, (8), 98–99, 156, 159–162; (9), 78–79, 127–128, 130–131; (10), 103–104, 106, 108; (11), 118–120, 122, 124, 126; (12), 103–104, 106, 148–149).—(I.—) A popular exposition of the changes which take place in aluminium alloys when they are heat-treated, in particular, differential



freezing, precipitation, segregation, and homogenizing are surveyed. (II.—) The physical metallurgy of the heat-treatment of aluminium-copper alloys is explained by reference to the phase diagram. The mechanism of quenching and ageing is described. (III.—) The heat-treatment characteristics of wrought aluminium alloys are described, and the effect of previous cold work, and the necessity of annealing (to remove the effects of plastic deformation), explained. (IV.—) A detailed discussion of the annealing and solution heat-treatment of aluminium alloys, illustrated by photomicrographs. (V.—) Precipitation-hardening, equipment, furnaces, and salt baths are discussed, and details are given of heat-treatment cycles for solution heat-treatment and age-hardening.

—M. A. V.

**\*Controlled Annealing of Strain-Hardened Aluminium Alloys [52S and 3S].** P. W. Boone and David Lewis, Jr. (*Aluminum and Magnesium*, 1947, **3**, (4), 8, 20).—A brief description of annealing tests and procedure applied to batches of half-hard aluminium alloy sheet (52S and 3S) to bring them to a condition equivalent, from the tensile-strength point of view, to quarter-hard sheet. The use of an electrically heated re-circulating type of furnace is stated to be satisfactory; non-circulating air furnaces are not suitable. The treatments used were  $\frac{1}{2}$  hr. at 600° F. (316° C.) for both alloys, and the temp. variation in the furnace was less than 10° F. (6° C.). Material equivalent to quarter-hard 52S sheet could be obtained by annealing the half-hard alloy for  $\frac{1}{2}$  hr. at 550° F. (288° C.); a similar change for 3S sheet required  $\frac{1}{2}$  hr. at temp. between 600° and 650° F. (316° and 343° C.). The authors recommend pilot tests on each lot of sheet before annealing the batch, so as to allow for variations in initial properties.—F. A. F.

**Ageing Heat-Treatments of 75S Aluminium [Alloy].** F. R. Kostoch (*Iron Age*, 1946, **158**, (7), 49).—Summary of an address to the Aviation Section of the American Society of Mechanical Engineers. K. describes three classes of ageing treatment for Alcoa 75S, and the advantages of each.—J. H. W.

**Controlled Atmospheres for Magnesium Alloy Heat-Treatment.** F. A. Allen (*Light Metals*, 1947, **10**, (111), 169–172).—A. points out that oxidation of magnesium alloys is not necessarily very rapid, and discusses the amount of sulphurous material needed in the heat-treatment furnace to inhibit oxidation. Brief mention is made of the use of atmospheres of carbon dioxide, of dried, partially burnt town gas, and of water vapour and oxygen. The latter is claimed to be particularly successful, and is a patented process.

—F. A. F.

**Developments in the Applications of Controlled Atmospheres.** I. Jenkins (*Metallurgia*, 1947, **36**, (211), 23–27).—Modern controlled-atmosphere practice is reviewed from the technical and economic viewpoints, and a table of characteristics of atmospheres for various purposes is given. This includes burnt ammonia for bright annealing and hardening of non-ferrous metals, completely burnt fuel gas for bright annealing copper and brass and copper brazing, and charcoal gas for bright annealing and melting copper.—M. A. V.

**Heat-Treatment of Steels and Various Alloys.—I.** — Sourdillon (*Tech. Moderne*, 1947, **39**, (5/6), 73–80).—A good general survey of the heat-treatment of ferrous and non-ferrous alloys.—M. E.

**High-Frequency Induction Heating.** E. May and T. G. Tanner (*J. Inst. Prod. Eng.*, 1946, **25**, (12), 331–352; and (summary) *Engineer*, 1947, **183**, (4753), 178–180).—An illustrated account of the theory, modern industrial equipment, and applications of induction heating.—W. G. A.

**High-Frequency Industrial Heating.** — (*Electronic Ind. and Instrumentation*, 1947, **1**, (3), 5).—A series of photographs is given, showing some uses of high-frequency generators in textile manufacture, plastics production, and metallurgical industries. Illustrations show equipment for high-temp.

melting, brazing operations on shafts and carbide-tipped tools, through heating of bars and tubes for forging, and high-speed hardening of steel gears.

—D. M. L.

**Induction Heating.** M. Gourod (*Tech. Moderne*, 1947, **39**, (11/12), 206–208).—A summary of the principles, equipment used, and the diverse applications of induction heating using frequencies from 50 c./s. to 5 Mc./s. Equations for current penetration and heating intensity are given in the discussion of skin effect.—D. M. L.

**Current Transformers in Induction Heating.** R. A. Whiteman (*Radio News*, 1947, **37**, (4), 16–19, 31).—Current transformers, usually known in Britain as “concentrators” are assuming some importance for the production of very high-intensity H.F. fields for hardening operations and also for matching low-impedance loads, e.g. copper or brass, to the high-impedance output circuits of R.F. heating generators. W. analyses the design of current transformers and reports the results of tests carried out on transformers of various sizes.

—D. M. L.

**Induction Heating with Electronic Generators.** — (*Steel*, 1946, **119**, (14), 84, 87).—A brief description of R.C.A. 2 kW. and 15 kW. H.F. generators.

—M. A. V.

**Electronic Heating Units Show Economy, Speed.** — (*Electronic Ind. and Electronic Instrumentation*, 1947, **1**, (3), 2–3).—A review of the present uses of induction and dielectric heating. The advantages of radio-frequency heating over normal methods are discussed.—D. M. L.

**Some Notes on Radio-Frequency Heating.** — (*Mass Prodn.*, 1946, **22**, (11), 566–567).—A brief review, including some metallurgical applications.

—R. W. R.

**Radio-Frequency [Heating] Aids Mass Production.** — (*Mass Prodn.*, 1947, **23**, (3), 42–47).—An account of the industrial uses of radio-frequency dielectric and induction heating, including certain metallurgical applications such as soldering, brazing, and surface hardening.—R. W. R.

**The Tocco “Heat Gun”.** — (*Machinery (Lond.)*, 1947, **70**, (1808), 653).—An illustrated description of the “heat gun” developed by the Tocco Division of the Ohio Crankshaft Company. The portable inductor, working at a frequency of 10,000 c./s., actually generates heat within the conducting work-piece, giving heating speeds more than twice that of the oxy-acetylene flame. The gun takes 11 kW. from the motor-generator set. There is no electrical danger to the operator, and safety goggles are not required. The gun has been applied to lap brazing of steel boxes using silver-solder foil, local hardening and annealing of steel bars, brazing of carbide tips to lathe tools, and for solder melting in automobile-radiator assembly.—D. M. L.

**\*Some Experiments on Quenching Media.** F. W. Jones and W. I. Pumphrey (*J. Iron Steel Inst.*, 1947, **156**, (1), 37–54).—In an attempt to devise a standard test for the comparison of the (steel-) hardening properties of various media, the authors measured the cooling rates at the centre of a silver cylinder  $\frac{3}{4}$  in. dia.  $\times$  3 in. A silver-platinum thermocouple was used, and the temp. was recorded with the aid of a D.C. amplifier and a high-speed milliammeter pen recorder. Results are presented in a table showing the time taken to cool to various temp. for the following quenching media: agitated water at 20° and 80° C., stagnant water at 80° C., and 5 oils, all agitated. The fastest rate of cooling was obtained with the cold water (2.0 sec. to 100° C.); the oils and agitated hot water all gave times of cooling to 100° C. in the range 12.8–15.5 sec., while the stagnant hot water yielded the much longer time of 26.5 sec. An attempt was made to correlate the hardnesses of cylinders of nickel-chromium-molybdenum steels with the cooling rates afforded by the different media, but no such correlation was found. Further experiments of a similar nature using  $\frac{3}{4}$ ,  $1\frac{1}{2}$ , and  $3\frac{1}{2}$ -in. cylinders of 18 : 8 stainless steel were car-

ried out, and it was found possible to relate qualitatively the cooling rates obtained with the hardnesses of the alloy steel specimens. It is shown that the heat-transfer factor varies considerably with temp. The "effective" value of this factor was found to decrease with increase of specimen size. Some of the experimental cooling rates found for the stainless-steel cylinders are compared with those predicted by calculation using Schmidt's method for the solution of problems in unsteady heat flow. This method and its application to the case of the cylinder are described in two Appendices.—R. W. R.

### XIX.—WORKING

**Upsetting Aluminium [18S] Heads.** Harry G. Howell (*Steel*, 1946, 119, (13), 108–111, 176–177).—A description of the forging, heat-treatment, quenching, and finishing of cylinder heads of 18S aluminium alloy for radial aircraft engines.—M. A. V.

**Tolerances for Impression Die Forgings.** — (*Materials and Methods*, 1947, 25, (6), 125).—Engineering File Facts No. 143.—J. L. T.

**Impact Extrusion. The Application of the Process to the Production of [Aluminium] Radio-Condenser Components.** — (*Machinery (Lond.)*, 1947, 71, (1810), 3–11).—The production from 99.5% aluminium of trimmer-condenser stators and rotors, electrolytic condenser anodes, and other components of complicated shape by impact extrusion at the Mitcham Works of the Philips organization is described and illustrated.—J. C. C.

**Achievements and Trends in the Copper and Brass Industry.** Clement Blazey (*Australasian Eng.*, 1946, (Dec.), 61–69; 1947, (Jan.), 37–41).—A paper read before the Australian Institute of Metals, Sydney Branch. B. describes in detail the production of wire bars, wire drawing, the production of billets for tubes, piercing and extrusion of tubes, extrusion of rods and sections, and rolling of sheet and strip. 29 references are given.—N. B. V.

**\*The Effect of Speed of Rolling in the Cold-Rolling Process.** H. Ford (*J. Iron Steel Inst.*, 1947, 156, (3), 380–398).—F. describes the results of measurements of roll torque made during the strip rolling, at various speeds up to 300 ft./min., of two mild steels, containing 0.2 and 0.07% carbon respectively, and of H.C. copper. With pass reductions up to 60%, the roll pressure required for first passes was independent of the speed of rolling, thus confirming the results of previous researches. When the material was thin and strongly work-hardened, a marked dependence of roll pressure on speed was found, the pressure required being least at high speeds and apparently approaching a limiting value at 300 ft./min. This effect first appears, in material which does not work-harden rapidly, at a thickness of about 0.017 in. using 10 in.-dia. rolls (i.e. dia. : thickness ratio = 590) and a pass reduction of 30%. With greater pass reduction, the critical thickness is greater and *vice versa*. A high rate of strain-hardening causes the effect to appear at greater thicknesses. In the case of the H.C. copper, some anomalies were found, the pressure/speed curve showing a hump at about 100 ft./min.; a theoretical explanation is given for this. Energy consumption also depended upon speed, but to a less extent and in a more complex manner; the energy required was usually least at medium speeds. Variation of speed during rolling, the setting of the rolls being unchanged, caused considerable variations in the thickness of the resulting strip, the thickness varying inversely with rolling speed; this effect was most marked with work-hardened thin strip. It is apparent from the experimental results that it is possible to roll thinnest at high speeds. F. concludes by discussing the results of his experiments from the point of view of deformation theory, suggesting as possible causes, dependence of yield stress on rate of deformation, temp. rise due to work of deformation, roll flattening,



and frictional variations. These factors are not regarded as providing a complete explanation.—R. W. R.

**The Rolling of Metals, Theory and Experiment. XIV.—Methods Used in Practice for the Calculation of Rolling Load and Horse-Power.** L. R. Underwood (*Sheet Metal Ind.*, 1947, 24, (243), 1352–1360, 1366).—Cf. *Met. Abs.*, 1947, 14, 406. U. explains the method of calculating the rolling load and horse-power of a non-reversing cold breaking-down mill fitted with a fly-wheel between the motor and the stand. Examples of mills frequently fitted with a fly-wheel on the drive are brass and copper ingot cold breaking-down mills, the roughing stands of rod and bar mills, and any non-reversing mill in which the length of material rolled is short and the energy required for rolling relatively great. The methods of calculating roll loads and rolling horse-powers described are capable of giving satisfactory results in practice provided curves are used which refer to conditions closely resembling those of the calculation. Otherwise, the success of the methods is dependent on judgment gained from experience.—R. Gr.

**\*Fluctuations of the Distribution of Torque Between Rolling-Mill Spindles.** E. A. W. Hoff (*J. Iron Steel Inst.*, 1947, 155, (1), 51–54; and *Iron and Steel*, 1947, 20, (6), 216–217).—H. describes the results of strain-gauge measurements of the variations in the torques acting on the connecting spindles of a two-high mill, during the rolling of mild steel, H.C. copper, aluminium, and tellurium-lead strip. Two kinds of fluctuation were observed: (1) a periodic fluctuation, in step with the roll revolutions, which is ascribed to mechanical imperfections of the driving gear, and (2) irregular variations of shorter period, thought to be due to variations in the surface condition of the material being rolled. It is shown, in an Appendix, that none of the fluctuations could have been caused by the universal joints.—R. W. R.

**Synthetic-Resin Bearings [for Rolling Mills].** F. W. Jones (*J. Iron Steel Inst.*, 1947, 155, (4), 602–606).—J. describes the use of synthetic-resin bearings for rolling mills, and discusses various engineering considerations. The use of synthetic-resin bearings in place of bronze bearings resulted in a power saving of 19%.—R. W. R.

**B.C.H. Bearings.** — (*Trans. Inst. Marine Eng.*, 1945–46, 57, 66–67).—B.C.H. bearing material was used originally for roll-neck bearings in rolling mills. It now has uses in marine engineering for stern-tube bearings, “A” bracket bearings, rudder-post bearings, davit bearings, pump bearings, and eye rings, and for the surfacing of slides for cross-head slippers. It can be machined in a similar manner to aluminium.—J. L. T.

**Carbide Drawing Dies [for Aluminium].** Daniel Mapes (*Steel*, 1946, 119, (5), 84, 86).—A brief account of the advantages of changing from steel to “Carboly” cemented-carbide dies for deep drawing steel and aluminium alloys.—M. A. V.

**Drawing, Stretching, Stamping of Aluminium.** Harry L. Smith, Jr. (*Steel*, 1946, 119, (4), 88–90, 92, 130).—The technique of drawing, stretch-forming, and stamping aluminium alloys and Alclad is described generally. A table of tensile properties and hardness of the alloys is included.—M. A. V.

**Panel-Beating Aluminium.** — (*Modern Metals*, 1947, 3, (3), 24–25).—A description of the process, reprinted from *Aluminium News Bull. (Australia)*. —N. B. V.

**Fabricating Aluminium Radiators.** — (*Steel*, 1946, 119, (25), 102).—A brief description of three German shaping machines.—M. A. V.

**Some Facts About Spinning Aluminium.** — (*Modern Metals*, 1947, 3, (5), 16–17).—N. B. V.

**Press Forms 4-Part Magnesium Canoe.** Chester S. Ricker (*Machinist (Eur. Edn.)*, 1947, 91, (15), 480–481).—The manufacture of the canoe from sheets, extrusions, and castings is briefly described.—J. H. W.

**Finishing Aluminium Pistons on Heald Boremetics.** — (*Machine Tool Rev.*, 1947, **35**, (209), 67–68).—Heald Boremetics are ideal machines for turning pistons, either cylindrical or oval, or for boring the gudgeon-pin holes, as they possess the desirable characteristics of smooth running and uniform traverse. The cutting should be done dry, but the model should be smeared with vaseline or lanoline. The required smooth wall surface can be obtained in many ways, but the two-way boring process is generally recommended.

—H. V.

**Special Machine Tools for the Machining of Light Alloys.** G. Laval (*Machines et Métaux*, 1947, **31**, (344), 115–120).—English and American machine tools are described.—M. E.

**Free-Machining Copper.** — (*Indian Eng.*, 1946, **120**, (4), 225–226).—Reprinted from *Distribution of Electricity*.—W. G. A.

**Machinability, Tool Life, and the Machine Tool.** G. Schlesinger (*Machinery* (Lond.), 1946, **69**, (1774), 463–467; correspondence, 1947, **70**, (1795), 296).—Cf. *Met. Abs.*, 1947, **14**, 29.—J. L. T.

**Cutting Action of Reamers.** T. F. Githens (*Trans. Amer. Soc. Mech. Eng.*, 1946, **68**, (8), 867–876; and (summary) *Machinery*, 1946, **69**, (1779), 624).

**Chatter and Its Causes.** G. Holman (*Amer. Machinist*, 1946, **90**, 100–101; and (abridged) *Mécanique*, 1946, **30**, (340), 296).

**Materials Used in America for the Cutting Edge of Milling Tools.** J. Doumenach (*Machines et Métaux*, 1947, **31**, (344), 121–124).—A review.

—M. E.

**Grinding Carbide Milling Cutters.** E. T. Larson (*Grits and Grinds*, 1946, **37**, (3), 1–7; (4), 1–7).—L. describes recommended procedures for grinding carbide-tipped milling cutters for machining ferrous and non-ferrous materials.

—R. W. R.

**Limitation of Sintered Carbide [for Machining].** R. B. Scheffer (*Indust. Diamond Rev.*, 1946, [N.S.], **6**, (73), 372).—A brief discussion of the uses of carbide tools in the machining of metals.—R. W. R.

**Wet-Belt Machining.** William F. Schleicher (*Steel*, 1946, **119**, (2), 94–95, 114, 117).—Wet-belt machining, which is applicable to non-ferrous metals, is a method of grinding, surfacing, and stock removal by an abrasive belt passing at high speed over a hardened steel platen. The abrasive is bonded to the belt with a plastic impervious to the liquid. The method avoids generation of heat and consequent probable weakening of structure.—M. A. V.

**Notes on the Hand Engraving of Metals with Diamond Tools.** — (*Indust. Diamond Rev.*, 1947, **7**, (81), 229–234).—The various techniques are discussed, and the relative merits of diamond and steel tools are compared.—R. W. R.

**Finishing with Diamond Tools.** Paul Grodzinski (*Mech. World*, 1947, **121**, (3154), 615–616).—A brief discussion of the use of single-point diamond tools for the production of fine-turned finishes on metal surfaces.—R. W. R.

## XX.—CLEANING AND FINISHING

**Surface-Treating Aluminium with Alodine.** — (*Modern Metals*, 1947, **3**, (2), 23).—Cf. *Iron Age*, 1946, **158**, (23), 64; see *Met. Abs.*, 1947, **14**, 106.

—N. B. V.

**Protective and Decorative Finishes for Cast Aluminium.** John J. Stobie, Jr. (*Modern Metals*, 1947, **3**, (4), 14–19).—S. reviews the mechanical, chemical, electrochemical, and organic finishes available for cast aluminium. 27 references are given.—N. B. V.

**Pre-Welding Treatment for Aluminium [Diversey Process].** (Button). See p. 69.

**Finishing Copper by Oxidation with Sodium Chlorite.** Walter R. Meyer and G. P. Vincent (*Metal Finishing*, 1947, 45, (3), 61–63, 71).—A procedure, patented under U.S. Patent No. 2,364,993, for copper and copper alloys is described. It is applicable to pure copper, either cast, rolled, or electro-deposited, and to alloys containing more than 60% copper. For alloys with less than 90% copper, a pre-treatment is needed. Details of cleaning procedure and acid dipping are given, but the composition of the salts used is not given. The finish is claimed to improve the corrosion-resistance of the metal and to form an excellent basis for paints, lacquers, and enamels. Coloured finishes can also be obtained by carefully controlling the time of immersion. The temp. of operation is between 210° and 220° F. (99°–105° C.). Care is needed to prevent the solution touching the skin, and there is risk of fire if the salts come into contact with organic materials.—G. T. C.

**Preparation of Magnesium for Painting.** R. E. Gwyther (*Products Finishing*, 1947, 11, (5), 56, 58).—A report of a paper read at the second annual symposium on "Modern Metal Protection", held in Cleveland, Ohio.—J. L. T.

**Shot Peening.** R. King (*Mass Prod.*, 1946, 22, (9), 442–443).—An elementary account of the technique of shot peening, and of its effectiveness in increasing the fatigue strength of metal parts.—R. W. R.

**Soft Grit Blasting.** E. C. Lathrop and S. I. Aronovsky (*Steel*, 1946, 119, (4), 102, 104, 107–108).—A description of a method of blasting with corncob or rice hull grit, under 80–90 lb./in.<sup>2</sup> pressure, for cleaning metals or removing paint or surface finishes.—M. A. V.

**Vapour Blasting.** — (*Mass Prod.*, 1946, 22, (12), 602–603).—A short description of a new (American) process for the production of fine finishes on metal surfaces. An abrasive emulsion (containing Novaculite as abrasive) is blown by compressed air on to the surface at a speed of 3000 ft./sec. The process is useful in preparing metal surfaces for painting or plating, removing machining marks, reducing friction between surfaces, and honing machined surfaces.—R. W. R.

**Precision Tumbling of Metal Parts.** R. M. Lord (*Grits and Grinds*, 1946, 37, (6), 1–5).—L. describes the uses of precision tumbling, using Alundum Tumbling Abrasive, for deburring, descaling, and for the production of uniform radii on small metal parts.—R. W. R.

**Barrel Finishing of Metal Products. VI.—Continuation of the Discussion on the Tubbing Machine.** H. Leroy Beaver (*Products Finishing*, 1947, 11, (5), 74–76, 78, 80, 82, 84).—The importance of renewing the burnishing liquid after each run is emphasized as being the only way to ensure satisfactory results. B. says diagonal-polishing steel slugs in tubbing machines are more effective than round balls.—G. T. C.

**Barrel Finishing of Metal Products. VII.—Research in the Development of an Abrasive Bond Barrel Grinding Procedure.** H. Leroy Beaver (*Products Finishing*, 1947, 11, (6), 80, 82, 84, 86, 88, 90, 92).—Cf. preceding abstract. A discussion in very general terms of the properties required in liquids used in barrel grinding. High viscosity and rinsability are particularly important. It is suggested that glucose solutions and glycerine have the desired properties. No actual results are given.—G. T. C.

**Barrel Finishing of Metal Products. VIII.—Some Things You Can Do to Help Yourself.** H. Leroy Beaver (*Products Finishing*, 1947, 11, (7), 62, 64, 66, 68, 70, 74, 76).—Cf. preceding abstract. In view of the current shortage of burnishing materials, the possibility of burnishing articles without the addition of such materials is worth considering. Whether or not parts are self-burnishing will depend largely on their shape and nature. A number of cases are mentioned where self-burnishing has been successfully carried out. Slight modifications in design (e.g. the avoidance of unnecessarily deep recesses) will often ensure that components are self-burnishing.—G. T. C.



**Finishing Operations at Chrysler's Dodge Division.** Bryant W. Pocock (*Products Finishing*, 1947, **11**, (7), 30-32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58).—A description of the methods and equipment used for finishing motor cars. The specifications and operating details for the plating of brass, cadmium, bright zinc, copper (acid and cyanide), nickel (Watts' bath and hard nickel), chromium, and tin are given.—G. T. C.

**Current Status of Protective and Decorative Coatings, and Future Possibilities.** S. P. Wilson (*Products Finishing*, 1947, **11**, (5), 50-52, 54, 56).—A report of a paper read at the second annual symposium on "Modern Metal Protection".—J. L. T.

**A Surface-Active Agent for the Cleaning of Metals [Nacconol NR].** O. M. Morgan (*Monthly Rev. Amer. Electroplaters' Soc.*, 1947, **34**, (4), 430-441).—M. describes the use of an alkyl aryl sodium sulphonate, marketed as "Nacconol NR", which improves the cleaning efficiency of both acids and alkalis. Treatment time, operating temp., and concentration can be reduced if this material is used. It is unaffected by hard water. A new method of evaluating metal-cleaning compounds is also described, based on the fact that mineral oil fluoresces brightly under ultra-violet radiation. The fluorescence is capable of being photographed, giving a convenient method of detecting and recording oil residues on metal surfaces. The article includes a large number of photographs illustrating the effect of varying concentrations of the surface-active agent.—G. T. C.

**Water-Soluble Buffing Compound May Offer Advantages.** — (*Products Finishing*, 1947, **11**, (7), 92, 94, 96).—Buffing compounds have been developed which are water-soluble. They are easy to apply to the buffing wheel and adhere to it well. They can be removed from the work in many cases by a dip in hot water, though in general it is necessary to follow this water dip with a 2-3% sulphuric acid dip at room temp. The time in the water is, on the average, 2 min. and in the acid up to 30 sec. Unlike other buffing compounds, they do not "set-up" if there is an interval between application and removal.—G. T. C.

**Wheels and Compounds for Buffing and Polishing.** John E. Hyler (*Steel*, 1946, **119**, (25), 93-117).—H. enumerates recommended abrasives, buffing compounds, and types of wheels for various purposes, including the buffing and polishing of non-ferrous metals.—M. A. V.

**Supplementary Equipment for Buffing and Polishing.** John E. Hyler (*Steel*, 1946, **119**, (26), 62-63, 104).—Cf. preceding abstract. A discussion of wheels, other than set-up types, and electric motors.—M. A. V.

**Machines and Auxiliary Equipment for Buffing and Polishing.** John E. Hyler (*Steel*, 1946, **119**, (27), 68-69, 112).—Cf. preceding abstract. Buffing and polishing machines and dust-collecting systems are discussed.—M. A. V.

**Polishing and Grinding Goes Modern.** L. S. Sternal (*Metal Finishing*, 1947, **45**, (3), 51-54).—S. describes the advantages of using abrasive belts running over resilient contact wheels compared with the ordinary set-up polishing wheel and buff. Costs are considerably reduced, production is increased, and the finish obtained is more easily polished. Several types of contact wheel are described, including segmented cloth, segmented rubber, compressed canvas, and buff wheels. The importance of proper choice of wheel is stressed, and indications are given as to what each is suitable for.—G. T. C.

**Grinding of Chromium-Plated Parts.** F. J. Benn (*Grits and Grinds*, 1946, **37**, (5), 8-12).—Recommended procedures for the grinding of hard chromium plate are described.—R. W. R.

**Cleaning-Room Practice.** Milton P. Schemel (*Amer. Foundryman*, 1947, **11**, (2), 56-58).—A general review.—J. E. G.

**\*Note on a Convenient Method of Electropolishing Aluminium Alloys.** U. R. Evans and D. Whitwham (*J. Electrodepositors' Tech. Soc.*, 1947, **22**, 24–28).—An electrolytic-polishing bath, containing 144 c.c. ethyl alcohol, 10 g. anhydrous  $\text{AlCl}_3$ , 45 g. anhydrous  $\text{ZnCl}_2$ , 32 c.c. water, and 16 c.c. *n*-butyl alcohol, and operating at 20–24 V., is described. The method of polishing a small specimen is given in detail. After degreasing and etching, the specimen and cathode are fixed in a rigid frame, which is moved about in the solution during polishing. Polishing proceeds for about 1 min., after which the frame is exposed to the air, to break down the passivity, and then re-immersed. The cycle is repeated 6–12 times. The effect on the finish of departures from the optimum conditions is summarized in a table. Apart from aluminium alloys, zinc, tin, nickel, 18 : 8 stainless steel, cobalt, and chromium have been polished in the bath.—G. T. C.

**\*Electropolishing [Nickel] with Fluosulphonic Acid.** C. B. F. Young and Kenneth R. Hesse (*Metal Finishing*, 1947, **45**, (3), 64–67).—Solutions containing fluosulphonic acid 5–20, phosphoric acid 60–90, water 0–27, and chromic oxide 0.6–8.5% polished nickel, nickel silver, and 18 : 10 stainless steel fairly well. Additions of sulphuric acid produced no advantages over sulphuric-phosphoric acid mixtures. Fluosulphonic acid-acetic anhydride, fluosulphonic-perchloric acid, and fluosulphonic-sulphuric acid-water mixtures did not show promise. Several different anode materials were tried out in the various solutions.—G. T. C.

**Electropolishing Silver.** — (*Steel*, 1946, **119**, (25), 110).—The Westinghouse Electric Corp'n. have developed a process for electropolishing silver-plated articles in a silver cyanide bath.—M. A. V.

**\*Rapid Determination of Conditions for Electrolytic Polishing of a Metal.** François Bertein (*Métaux et Corrosion*, 1946, **21**, (247), 40–43).—Simple cells are described, in which the anode c.d. vary over a range of the order of 200 and which thus permit the rapid survey of the possibility of electrolytic polishing with a given metal with a series of electrolytes, temp., and times of treatment. The variation of c.d. over the anode surface is obtained by the interposition of an insulating screen, a plain or slotted cylinder, between the cylindrical anode and the annular cathode.—A. B. W.

**Electropolishing: What Is Its Status To-Day?** Charles L. Faust (*J. Electrodepositors' Tech. Soc.*, 1946, **21**, 181–194; discussion, 286–288; also (summaries) *Metal Ind.*, 1946, **69**, (25), 512–513; and *Product Eng.*, 1946, **17**, 449–451).—Industrial applications of electropolishing have been retarded by misconceptions and extravagant claims on the one hand and the complex patent situation on the other. F. lists pertinent patents in four pages of tables. The process can be used : (1) for finishing for appearance, e.g. usually as a final operation, though sometimes it may be preferable to combine electropolishing with a final loose buffing operation—an attractive satin appearance is obtained by electropolishing after abrasive blasting; (2) as a precision machining operation, e.g. for polishing screws, which are afterwards plated back to dimensions; (3) before deposition of iron, nickel, or chromium; and (4) before dyeing of aluminium or electro-colouring of copper. A variety of products are now electropolished commercially. The metals for which commercial methods are available are : stainless steels, carbon steels, low-alloy steels, high-speed steels, nickel-chromium-iron, nickel, nickel silver, Monel metal, Nichrome, Chromel, copper, brass, bronze, zinc, magnesium, and aluminium. The baths used on a significant industrial scale are limited to sulphuric-phosphoric, phosphoric alone, and sulphuric-citric acids. Baths may be divided into two classes from the maintenance viewpoint : (i) those of infinite life, in which plating or precipitation of salts prevents build-up of metal concentration, and (ii) those which have to be discarded when metal concentration reaches a definite limit. Typical D.C. requirements are :

12-14 V. and 100-300 amp./ft.<sup>2</sup>, and 5-10 or 20 amp./gal. bath vol. Temp. are generally in the range 115°-150° F. (46°-65° C.) and times of treatment 8-30 min., with metal-removal equivalent to 0.0001-0.003 in. Electro-polishing requires work-racking analogous to electroplating, and the same types of automatic, semi-automatic, or manual equipment can be used. Agitation is essential when the anodic efficiency is less than 100%, to avoid gas furrowing, and generally increases the rate and uniformity of polishing. It is considered that applications of electropolishing will increase, but the prospective user must be willing to design for electropolishing.—A. B. W.

**The Possibilities and Limitations of Electrolytic Polishing.** A. F. Brockington (*Sheet Metal Ind.*, 1947, **24**, (243), 1414-1416).—A brief review of the present position. Mop-polishing and electropolishing are compared.—R. Gr.

**\*Lime Treatment of Waste Pickle Liquor.** Richard D. Hoak, Clifford J. Lewis, Charles J. Sindlinger, and Bernice Klein (*Indust. and Eng. Chem.*, 1947, **39**, (2), 131-135).—The authors deal with the use of dolomitic lime for the treatment of acidic wastes. The lower rate of reaction of dolomitic limes as compared with high-calcium limes is illustrated graphically and the causes discussed, together with methods of increasing this rate. The lower reaction rate of dolomitic lime is balanced by its lower cost.—D. P. M.

## XXI.—JOINING

**Soft Soldering as a Production Process.** R. G. Harper and R. S. Strauss (*Sheet Metal Ind.*, 1947, **24**, (238), 345-354; discussion, (240), 784-786).—Presented to the Sheet and Strip Metal Users' Technical Association. H. and S. discuss the soldering of components fabricated from sheet and strip from the point of view of efficient quantity production. Factors influencing the selection of a solder are dealt with and individual processes considered.

—R. Gr.

**Continuous Soldering of Small Motor Rotors Using High-Frequency Heat.** W. L. Tesch and Paul A. Greenmeyer (*Materials and Methods*, 1947, **25**, (6), 94-96).—An illustrated description of equipment developed by R.C.A.-Victor of Camden, N.J., U.S.A., for the rapid soldering of conductors to the end rings of small squirrel-cage motor rotors. The rotors are 1 in. dia.,  $\frac{3}{4}$  in. long and are soldered at the rate of 600 per hr. The high-frequency generator used has an output of 2 kW. at 400 kc./s.—D. M. L.

[Discussion on R. H. Atkinson and G. P. Gladis's Paper:] "A Study of the Behaviour of Ruthenium-Palladium in Torch Flames, with the Object of Improving Soldering Technique". F. E. Carter (*Metals Technol.*, 1947, **14**, (1); *A.I.M.M.E. Tech. Publ.* No. 2039, pp. 15-16).—Cf. *Met. Abs.*, 1946, **13**, 341. C. states that, in commercial practice, annealing in helium is unnecessary, and R. H. A. and G. P. G. agree.—W. H.-R.

**Lead Welding.** Robert L. Ziegfeld and David M. Borcina (*Steel*, 1946, **119**, (6), 120-122, 162, 165-166, 168).—The history of welding lead to lead is briefly reviewed and the latest techniques described. A comprehensive list of corrosive chemicals and their effects on lead is appended.—M. A. V.

**Fastening and Fastening Methods.**—IV. J. R. Fawcett (*Mech. World*, 1947, **121**, (3154), 622-624).—F. discusses the joining of metal parts, (1) with low-m.p. fusible alloys of the bismuth-cadmium-lead-tin type, (2) by interference fits, (3) by swaging, (4) by rubber bonding, and (5) by plastic cementing.—R. W. R.

**Copper-Brazing Intricate Parts.** — (*Steel*, 1946, **119**, (19), 108, 110).—Assembly-line technique for copper-brazing small parts of precision machinery is described. A G.E. brazing furnace is used with a Drycolene atmosphere generator.—M. A. V.



**Silver Alloy Brazing.** Adolph Bregman (*Steel*, 1946, **118**, (23), 94–95, 143).—Examples are given of the silver brazing of steel in army ordnance.

—M. A. V.

**Silver Alloy Brazing of Copper Tubing.** J. C. Powers, Jr., and H. DeM. Lucas (*Steel*, 1946, **118**, (11), 112–114, 116, 118).—An illustrated description of technique. The brazing alloys recommended are "Easy-Flo" (50% silver) and "Sil-Fos" (15% silver).—M. A. V.

**Induction Brazing.** R. Baubie (*Metallurgia*, 1947, **36**, (213), 159).—Abridged from *Materials and Methods*, 1946, **23**, (4), 1007–1010; see *Met. Abs.*, 1947, **14**, 230.—J. L. T.

**Brazing Tool Tips by Induction Heating.** — (*Steel*, 1946, **119**, (8), 101, 154).—A brief description of the technique of brazing tungsten carbide tips to cutting tools by induction heating.—M. A. V.

**Brazed Sheet-Metal Automobile Engine.** — (*Sheet Metal Ind.*, 1946, **23**, (227), 533, 536).—Cf. *Met. Abs.*, 1946, **13**, 339.—W. G. A.

**Braze Welding Damper Windings.** Glenn Stangland (*Steel*, 1946, **119**, (13), 104–105, 170, 172).—Groups of non-ferrous bars in each pole piece of the amortisseur winding of a synchronous motor have their ends brazed to a copper ring. The welding alloy is copper–6% phosphorus, which flows at 1400° F. (760° C.) and is self-fluxing on copper, but requires a flux with some copper alloys. An oxy-acetylene torch is used.—M. A. V.

**Use of Bronze Welding in Repairing a Draw-Bench Cylinder.** — (*Steel*, 1946, **119**, (14), 82, 105).—M. A. V.

**Pre-Welding Treatment for Aluminium [Diversey Process].** B. B. Button (*Steel*, 1946, **118**, (11), 132, 137–138).—Methods of removal of oxide film from aluminium alloys preparatory to spot welding are discussed. The "Diversey" process is recommended, but compositions of the cleaning baths are not stated. —M. A. V.

**Metallic Joining of Light Alloys.—I, —II.** — (*Light Metals*, 1947, **10**, (108), 20–32; (109), 103–108).—(I.—) The author surveys the available methods of joining thin-gauge light-alloy materials and considers in detail the metallurgical aspects of the problem of soft-soldering light alloys. (II.—) A detailed review of the many soft solders which have been suggested for aluminium. The lack of co-ordinated investigation and field-test results is stressed.—E. C. E.

**Metallic Joining of Light Alloys.—III, —IV.** — (*Light Metals*, 1947, **10**, (110), 111–120; (111), 203–209).—Cf. preceding abstract. (III.—) Fluxes for soldering aluminium are briefly discussed and types of composition stated. Friction soldering without the use of flux shows the flux to give a much superior product as judged by a durability test according to W.T. Specification K110. Solders of the tin–zinc–lead and tin–zinc–silicon types are discussed and some test results quoted. For friction soldering, the 70 : 30 tin–zinc alloy solder is recommended. The use of resistance methods of heat supply for the soldering operation is described. Hard soldering is discussed generally and compositions given. The corrosion danger introduced by electrode p.d. between aluminium and the solder is considered; the potentials are no greater than exist between heavy metals and traditional solders, and consequently they do not rule out the use of solder with aluminium. (IV.—) A lengthy account is given of papers by E. C. Hartmann, G. O. Hoglund, and M. A. Miller (see *Met. Abs.*, 1945, **12**, 234) and A. E. Thiemann (see *Met. Abs.*, 1945, **12**, 19). A short digest of other literature is also given.—F. A. F.

**The Welding of Non-Ferrous Metals. VIII.—The Welding of Copper and Its Alloys.** E. G. West (*Sheet Metal Ind.*, 1947, **24**, (239), 618–622, 624; (241), 1017–1023, 1027; (243), 1425–1429, 1435).—Cf. *Met. Abs.*, 1947, **14**, 285. Various methods of arc welding of copper discussed include the metallic- and carbon-arc methods, with a reference to the Lessel multi-coated electrode.

The use of atomic hydrogen for welding has not as yet proved entirely satisfactory. The restricted uses of spot and seam welding and of butt and flash welding are referred to. Problems involved in the welding of copper-rich alloys are discussed and are stated to be less difficult than in welding copper itself. Copper alloy welding is not widely practised. The gas, arc, and resistance welding of copper-tin, silicon-bronze, and copper-aluminium alloys are considered.—R. GR.

**Multiple-Tip Torches Speed Stainless-Steel Welding.** William P. Brotherton (*Iron Age*, 1946, **157**, (25), 70-73).—A description of the use of torches possessing two or three tips. In one application, one tip performs a cutting operation, the other subsequently welding the material. In another application, three tips are employed, the first preheating the metal, the second welding, and the third post-heating.—R. W. R.

**\*Observations on the Arc Welding of Aluminium and Its Alloys.** A. Schaerer (*Promotionsarbeit von der E.T.H. in Zürich zur Erlangung der Würde eines Doktors der Techn. Wiss. Genehmigte*, 1946, 72 pp.).—The theoretical principles involved in arc-welding aluminium and its alloys are briefly reviewed, and a comprehensive series of experiments on the subject reported, with particular reference to flux-coated electrodes. The welding behaviour of pure aluminium, Peraluman, Anticorodal, and Avional sheets, using different welding-rod alloys, was examined, and the corrosion-resistance and mechanical properties of the resulting welds investigated. Results are tabulated and illustrated graphically, and many photographs of the types of welds obtained under various conditions are given.—G. V. R.

**Arc-Welding Equipment in War-Time Germany.** F. W. Myers, Jr. (*Iron Age*, 1946, **157**, (17), 46-50).—M. describes a number of arc- and spot-welding machines, mostly of the automatic or semi-automatic type.—R. W. R.

**Arc Welding Electrode Coatings.** H. P. Zade (*Welding*, 1946, **14**, (3), 127-131; and *Iron Age*, 1946, **157**, (15), 46-49).—R. W. R.

**Inert-Arc Welding.** D. W. Puffer (*Steel*, 1946, **119**, (21), 80-82, 116, 118).—The advantages and technique of arc welding in inert atmospheres are outlined. Special reference is made to aluminium and magnesium and their alloys, copper, and nickel-chromium alloys.—M. A. V.

**Production Applications for Inert Gas-Shielded Arc Welding.** H. T. Herbst (*Weld. J. (J. Amer. Weld. Soc.)*, 1947, **26**, (5), 410-418; and *Modern Metals*, 1947, **2**, (12), 26-28).—H. describes the Heliarc process, explains its development, and outlines various production applications for light metals.—N. B. V.

**Automatic Welding.** — (*Mass Prodn.*, 1946, **22**, (8), 367).—A brief description of a new automatic shielded-arc process developed by the American Lincoln Electric Company.—R. W. R.

**British Welding Research Association Symposium on the Welding of Light Alloys.** — (*Metallurgia*, 1946, **34**, (204), 321-324; *Sheet Metal Ind.*, 1946, **23**, (235), 2189-2191, 2198; and *Metal Ind.*, 1946, **69**, (18), 361-363; (19), 381-383).—Reports of the proceedings at the symposium (see abstracts below).

—W. G. A.

**The British Welding Research Association Symposium on the Welding of Light Alloys.** — (*Sheet Metal Ind.*, 1947, **24**, (240), 823-824).—A report of the introductory speeches to the symposium.—J. L. T.

**Industrial Practice for Spot-Welding Light Alloys.** — (*Sheet Metal Ind.*, 1947, **24**, (240), 824-828, 830; discussion, (244), 1650-1654, 1656).—A paper prepared by the L.R.4 Committee of the British Welding Research Association and presented at the symposium.—J. L. T.

**Spot Welding of Light Alloys: Present Trends in American Machine Design.** T. M. Roberts (*Sheet Metal Ind.*, 1947, **24**, (241), 1028-1032, 1034; discussion, (244), 1650-1654, 1656).—Read at the British Welding Research Association Symposium on the Welding of Light Alloys.—R. GR.

**Methods of Surface Preparation of Light Alloys for Spot Welding.** F. C. Dowding (*Sheet Metal Ind.*, 1947, **24**, (242), 1232–1236, 1238; discussion, (244), 1650–1654, 1656).—First progress report of the L.R.3 Committee of the British Welding Research Association and presented at the symposium.—R. GR.

**Spot Welding of Some Aluminium and Magnesium Alloys.** H. Brooks (*Sheet Metal Ind.*, 1947, **24**, (243), 1436–1440, 1442; discussion, (244), 1650–1654, 1656).—Read at the British Welding Research Association Symposium on the Welding of Light Alloys. MG 5, MG 7 (D.T.D. 182A), Alclad (D.T.D. 390), D.T.D. 118, and D.T.D. 120A are considered.—R. GR.

**Resistance Welding of Light Alloys.** R. Bushell (*Machine Shop Mag.*, 1947, **8**, (7), 66–71).—B. deals with the fundamental technical differences between the spot welding of aluminium alloys and the spot welding of ferrous materials. He also discusses the best equipment for spot welding, seam welding, and butt welding.—H. V.

**Some Fundamental Principles for the Resistance Welding of Sheet Metal.** H. E. Dixon (*Sheet Metal Ind.*, 1947, **24**, (239), 607–617, 624; (240), 813–820; (242), 1221–1226, 1230).—Presented to the Sheet and Strip Metal Users' Technical Association. Spot, flash, and butt welding of aluminium-base alloys are discussed.—R. GR.

**Sciaky Resistance-Welding Machines.** — (*Mass Prod.*, 1947, **23**, (4), 58–65).—A description of the principles, development, operating technique, and applications of the Sciaky welding machine.—R. W. R.

**\*The Development and Improvement of Spot-Welding Electrodes.** G. F. James (*Sheet Metal Ind.*, 1947, **24**, (238), 392–398; (242), 1227–1230).—Cf. *Met. Abs.*, 1947, **14**, 284. Experiments were carried out to determine the increase in tip dia. of some copper alloys under various welding conditions. The effect of temp. on the properties is discussed. Recommendations are made on the choice of suitable materials and conditions for the tips.—R. GR.

**Spray Welding [Hard-Facing Alloys].** — (*Steel*, 1946, **119**, (26), 74, 77).—Hard-facing alloys are spray welded using 150-mesh powder and oxy-acetylene fuel gas, the deposited metal being bonded with an acetylene torch, or by induction heating, or in a controlled-atmosphere furnace at 1980° F. (1082° C.). The max. final thickness by this method is 0.06 in., i.e. 0.075 in. of deposited metal before bonding.—M. A. V.

**Pressure Welding of Aluminium.** H. Herrmann (*Metal Progress*, 1947, **51**, (6), 1004, 1008).—See *Met. Abs.*, 1946, **13**, 443.—J. L. T.

**Welding Glass to Metal.** — (*Indian Eng.*, 1946, **120**, (3), 168).—Reprinted from *J. Council Sci. Indust. Research, India*.—W. G. A.

**Metal-Rubber Assemblies.** F. Sumner (*Mécanique*, 1946, **30**, (329), 9–11).—Translated from *Diesel Railway Traction*.—W. G. A.

**Plastic Adhesive [Cycleweld].** — (*Steel*, 1946, **119**, (27), 90).—Tests on 24S-T aluminium alloy plates bonded with "Cycleweld" plastic adhesive showed the adhesive to be stronger under bending stresses than the metal.—M. A. V.

**The Selection of Welding Processes.** W. J. Campbell (*Weld. J. (J. Amer. Weld. Soc.)*, 1946, **25**, (8), 704–706; and *Australasian Eng.*, 1946, (Nov.), 76–78).—N. B. V.

## XXII.—INDUSTRIAL USES AND APPLICATIONS

**Air Transport and Light Metal.** Hedley S. Crabtree (*Light Metals*, 1947, **10**, (109), 78–86).—A review of trends in the use of aluminium and magnesium alloys in aircraft.—E. C. E.

**Aluminium Aircraft Skis.** — (*Modern Metals*, 1947, **3**, (4), 20–21).

—N. B. V.

**The Seventeenth [French] Aircraft Show.** Maurice Victor, Jean Blanchot, and Lucien Alf (*Rev. Aluminium*, 1946, (127), 363–369).—E. C. E.



**Cable Sheathing in Aluminium.** — (*Light Metals*, 1946, 9, (104), 474-498).—Based on accounts by W. Deisinger (*Z. Metallkunde*, 1939, 31, (9), 305-310; and *Metallwirtschaft*, 1939, 18, (48), 963-968; see *Met. Abs.*, 1940, 7, 136, 180), P. Hanff, G. Hosse, and W. Deisinger (*Siemens Z.*, 1939, 19, (8), 357-368; see *Met. Abs.*, 1940, 7, 136), and A. Czempiel and C. Hasse (*Aluminium*, 1939, 21, 17; see *Met. Abs.*, 1939, 6, 383). The possibility of replacing lead by aluminium is examined critically in the light of economic and technical considerations.—E. C. E.

**†Insulated Cables and Wire in Aluminium.** — (*Light Metals*, 1946, 9, (107), 648-684).—A very comprehensive survey and summary of modern practice, in which particular attention is paid to the joining of aluminium cables.—E. C. E.

**Nomographs for Calculating the Benefits of Reducing the Weight of Commercial-Vehicle Bodies [by Use of Light Alloys].** H. Colombier and Pierre de Lapeyrière (*Rev. Aluminium*, 1947, (129), 18-28).—The three types of nomograph described give: (1) the initial expense of the use of light alloys, (2) the decrease in daily load, and (3) the annual benefit.—M. E.

**Coach Baggage Car Constructed of Aluminium Alloys.** — (*Product Eng.*, 1947, 18, (7), 104-105).—A weight saving of 34%, as compared with conventional steel construction, is obtained in the car.—H. V.

**Aluminium Ducts and Pipes [2S and 3S].** — (*Modern Metals*, 1947, 3, (3), 16-17).—Reprinted from *Amer. Artisan*. The practice of an American firm in fabricating ducts and pipes is described. The materials principally used are 2S ( $\frac{1}{4}$ ,  $\frac{1}{2}$ , or  $\frac{3}{4}$ H) and 3S.—N. B. V.

**Light Metals for Electronic Equipment.** L. A. Hammarlund (*Modern Metals*, 1947, 3, (5), 14-15).—N. B. V.

**Light-Weight Gasoline Engines Made from [Aluminium] Die-Castings.** R. P. McCulloch (*Iron Age*, 1947, 159, (20), 52-57).—M. discusses the factors influencing the choice of die-castings in the design of a light-weight engine. Such factors are a substantial reduction in machining operations, lower scrap losses, use of light and inexpensive machine tools, and greater flexibility of design. He describes the major manufacture and assembly operations in the mass production of light motors largely of aluminium alloy.—J. H. W.

**New Operation Builds Die-Cast [Aluminium] Engine in Mass-Production Style.** — (*Modern Metals*, 1947, 3, (4), 26-27).—In the range of  $2\frac{1}{2}$ -4 h.p. petrol engines described, all the main parts are high-pressure aluminium alloy die-castings with the exception of rods, crankshafts, and cylinder sleeves.

—N. B. V.

**Gas Turbines and Jet-Propelled Engines.** Maurice Victor (*Rev. Aluminium*, 1946, (128), 391-398).—An account of British and American jet-propelled engines and gas turbines.—M. E.

**Four-Stroke Engines Have Won the War.** Léonce Keuleyan, Jean Blanchot, and Lucien Alf (*Rev. Aluminium*, 1946, (128), 399-405).—M. E.

**The Martin [Aluminium] Outboard Motor.** G. E. Buske (*Modern Metals*, 1947, 3, (2), 15-17).—Aluminium alloys in the form of stampings and die-castings are used to the max. possible extent in this American outboard motor, the construction of which is described in some detail.—N. B. V.

**Four New Extrusions for Unit Furniture [Use of Light Metals].** George Fejer (*Light Metals*, 1947, 10, (111), 184-188).—A discussion of the uses of specially developed extruded light-metal sections in the making of furniture (mainly wooden); the applications are in the form of door handles, sliding door channels, and drawer handles.—F. A. F.

**[Use of Aluminium in] The Pinel "Hémo-Étaleur" for Counting Polynuclear White Blood Corpuscles.** Emile Pinel and Marcel Lapoire (*Rev. Aluminium*, 1947, (129), 12-14).—An illustrated account of the apparatus, which is made of aluminium.—M. E.

**The Light-Metal Home.** — (*Light Metals*, 1946, 9, (105), 539–561).—A survey of the use of light alloys (principally aluminium) in the home.

—E. C. E.

**Aluminium Houses.** — (*Mass Prodn.*, 1947, 23, (3), 52–57).—An account of the production of the “Airoh” House at the Bristol Aeroplane Company’s works.—R. W. R.

**Packaged [Aluminium] Houses.** — (*Steel*, 1946, 119, (7), 86, 88).—A brief description of aluminium and steel prefabricated houses.—M. A. V.

**Aluminium Roofing for Cincinnati’s Union Terminal.** — (*Steel*, 1946, 119, (6), 132, 149).—Details are given of the rebuilding of a dome-shaped roof, using preformed 14-gauge aluminium alloy sheet.—M. A. V.

**[Aluminium] Roofs in Vercors.** — (*Rev. Aluminium*, 1947, (130), 41–43).—In Vercors, roofs of houses burnt by the Germans have been reconstructed in aluminium.—M. E.

**How to Apply Aluminium Roofing and Siding.** J. S. Pollack (*Steel*, 1946, 119, (24), 107, 110).—Recommended erection methods are given.—M. A. V.

**Aluminium Milk Cases.** — (*Modern Metals*, 1947, 3, (2), 32).—N. B. V.

**Aluminium Pallet Increases Flexibility, Lowers Handling Cost.** T. O. Palmer (*Steel*, 1946, 119, (1), 125–126).—A description of an aluminium pallet for industrial fork trucks, showing a considerable saving in weight over wooden units.—M. A. V.

**Light-Weight Pallets for Easy Handling of Materials.** T. O. Palmer (*Mech. Handling*, 1947, 34, (2), 100–102).—Cf. preceding abstract. Reprinted from *Mill and Factory*.—J. L. T.

†**Light-Alloy Piston Materials.** A. Schofield and L. M. Wyatt (*J. Inst. Automobile Eng.*, 1947, 15, (7), 251–293).—A comprehensive review of the aluminium alloys used for pistons, their fabrication and heat-treatment, and the thermal and stress conditions to which they are subjected in service. The mechanical, physical, and bearing properties of the piston alloys are described.

—N. B. V.

**The Precipitron Utilizes Aluminium.** — (*Modern Metals*, 1947, 3, (4), 22–23).—The Precipitron, an electrostatic air-cleaning device, uses aluminium plates in the dust-collecting cell.—N. B. V.

**Printing Industry and Light Alloys.** — (*Light Metals*, 1947, 10, (109), 86–96).—A summary of current applications of aluminium alloys in printing plant and equipment and in printing processes. The theory and practice of the use of magnesium in photo-engraving are considered.—E. C. E.

**Rockets.** Maurice Victor (*Rev. Aluminium*, 1947, (130), 69–74).—An illustrated account of the manufacture of the V2 and of its performance.

—M. E.

**Aluminium and the Rubber Industry.** — (*Light Metals*, 1947, 10, (109), 57–68).—A review of the use of aluminium in the production and processing of rubber. Particular attention is paid to those applications where the metal has shown superiority over alternative materials.—E. C. E.

**Light Metals for Sculpturing.** Lawrence Tenney Stevens (*Modern Metals*, 1947, 3, (5), 18–20).—N. B. V.

**Light Metals in Ship Construction.** E. C. Goldsworthy (*Rev. Aluminium*, 1946, (127), 370–372).—Early experiences in the use of aluminium alloys for sea-going craft in Britain are reviewed. Between 1930 and 1934 many small craft were made from aluminium-magnesium alloy, and in 1944 one of these, the *Diana II*, was examined in detail with encouraging results. The Bristol Air-Sea Rescue launches are described, and the use of aluminium for the construction of containers for fish on fishing boats is mentioned.—E. C. E.

**Light-Alloy Ships.** — (*Indust. Australian*, 1946, 101, (2590), 906).—Reprinted from *Scope*.—W. G. A.

**Small Craft in Light Alloy.** — (*Light Metals*, 1946, 9, (103), 414-420).—An account of small rowing, sailing, and power-driven boats manufactured wholly or in part from light alloys.—E. C. E.

[Discussion on W. Muckle's Paper:] "**Application of Light Alloys to Superstructures of Ships**". — (*Trans. N.-E. Coast Inst. Eng. Ship.*, 1945-46, 62, D139-D154).—Cf. *Met. Abs.*, 1947, 14, 34.—E. C. E.

**Structural Uses of Aluminium Alloys.** H. K. Hardy and C. G. Watson (*Mass Prod'n.*, 1946, 22, (5), 219).—A summary of *Structural Eng.*, 1946, 24, (2), 65-112; see *Met. Abs.*, 1946, 13, 272.—R. W. R.

**Light Alloys in the Textile Industry.** — (*Light Metals*, 1947, 10, (108), 33-53).—A review of the applications of aluminium and magnesium in the cotton, woollen, synthetic-fibre, and associated industries.—E. C. E.

**New Toys in Aluminium.** — (*Rev. Aluminium*, 1947, (129), 15-17).

—M. E.

**Aluminium for Water-Works Structures.** John M. Perryman (*J. Amer. Water Works Assoc.*, 1946, 38, (12), 1327-1329).—It is pointed out that the reduced maintenance cost of aluminium equipment may more than off-set the greater initial cost of aluminium. A 500,000-gal. elevated water tank with an aluminium roof, ladders, and roof-supporting structure is described, and it is suggested that aluminium alloys could be considered as a substitute for steel filter gallery piping inside buildings and above the ground.—E. C. E.

**Aluminium in West Africa.** F. J. Erroll (*Light Metals*, 1947, 10, (111), 178-183).—A review of the Gold Coast as a source of raw material and as a market for the aluminium industry. West African bauxite is low in silica, and a new project will make hydro-electric power available for the conversion of the ore, which is estimated to exceed 80,000,000 tons. Aluminium alloys are to be used in the construction of tropical-type bungalows and for river lighters, as well as for kitchen utensils.—F. A. F.

**Aluminium Windows [63S].** — (*Modern Metals*, 1947, 3, (2), 18-19).—An American firm is mass-producing windows of the double-hung type in extrusions of 63S-5T alloy. The windows are transported to the site in the knocked-down state, and assembly, installation, and glazing take 23 min.

—N. B. V.

**Peace Demands for Aluminium Expand.** Daisy L. Schooley (*J. Chem. Education*, 1946, 23, (8), 399-401).—Reprinted from *Domestic Commerce*. A general review of some fields in which aluminium and its alloys may advantageously be used.—H. J. A.

**Aluminium Seeks Home Market.** — (*Scope*, 1946, (Sep.), 67-69).—An account of the changes which the war brought to the Swiss aluminium industry.—H. V.

**Developments in the Aluminium Industry.** E. G. West (*Metallurgia*, 1947, 36, (211), 39-43).—Recent progress in the development and applications of aluminium alloys is reviewed.—M. A. V.

**It's an Interesting Metal This Aluminium.** — (*Mass Prod'n.*, 1946, 22, (8), 403-404).—A brief account of the history and uses of aluminium.

—R. W. R.

**Beryllium Copper: Its Uses and Potentialities.** H. G. Williams (*Steel*, 1946, 118, (19), 88-91, 142, 144, 146).—Beryllium copper is non-magnetic, corrosion-resistant, and has high electrical conductivity; it can be formed in a soft, ductile state, and then hardened to high strength (200,000 lb./in.<sup>2</sup>) and a higher fatigue resistance than other copper alloys. The metallography, properties, and heat-treatment characteristics of the alloy are discussed.

—M. A. V.

[**Use of Brass in**] **Household Refrigerators.** — (*Non-Ferrous Forgings Digest*, 1947, 2, (2), 1-3).



**Diamond-Prepared Copper Tools in the Optical Industry.** — (*Indust. Diamond Rev.*, 1947, [N.S.], 7, (77), 117).—A brief description of the uses of copper tools, charged with diamond grit, for lens grinding.—R. W. R.

**\*The Production of [Gold] Film-Type Bolometers with Rapid Response,** C. B. Aiken, W. H. Carter, Jr., and F. S. Phillips (*Rev. Sci. Instruments*, 1947, 17, (10), 377–385).—In the type G bolometer, the sensitive element is constructed of a layer, 0.05–0.1  $\mu$  thick, of gold evaporated on a film of cellulose nitrate and covered by a layer of gold black to increase the absorption of radiation in the vicinity of 10  $\mu$ . Gold black, apparently a colloidal form of the metal, is produced by evaporation in an atmosphere of nitrogen, preferably in the presence of a small amount of tellurium. The resistivity of the gold black is dependent on the pressure of nitrogen, and by using a pressure of about 0.1 mm. it would probably be possible to deposit a conductive black strip directly on the cellulose film, omitting the first gold layer. The use of nickel, bismuth, antimony, cadmium, tin, tellurium, and selenium for bolometers has been briefly examined. None of these metals was so satisfactory as gold.—J. C. C.

**Magnesium, the Metal of To-Morrow.** T. R. B. Watson (*Canad. Metals*, 1947, 10, (4), 13–17, 32).—Presented to the Essex–Kent Section of the Chemical Institute of Canada. A review of the history, manufacture, properties, and applications of magnesium and its alloys.—H. J. A.

**The Alloys of Magnesium in Aeronautical Construction.** Jean Gris (*Rev. Aluminium*, 1946, (127), 355–362).—A review of the growth of the use of cast and wrought magnesium alloys in aircraft. The mechanical properties of typical magnesium alloys are given.—E. C. E.

**Photo-Engraving Plates in Magnesium.** H. E. Swayze (*Light Metals*, 1947, 10, (111), 188–192).—The magnesium alloy normally used for half-tone work contains aluminium 3, manganese 0.3, calcium 0.2, and zinc 1%, though for line work a special alloy (not specified) is used. Technical details, from the printer's point of view, are given, and the similarity to the processing of zinc is emphasized. Pictures indicating the clarity of reproduction from magnesium plates are given, together with further detailed comment on the peculiarities of magnesium alloys in processing as compared with zinc.—F. A. F.

**Magnesium in Photo-Engraving.** H. E. Swayze (*Modern Metals*, 1947, 3, (2), 20–22).—Reprinted from *Photo-Engravers' Bull.*, Nov. 1946. The advantages of magnesium over other metals used for photo-engraving are enumerated, and a description is given of the processing of magnesium plates.—N. B. V.

**\*Characteristics of the Silver Chloride–Magnesium Water-Activated Battery.** J. B. Mullen and P. L. Howard (*Electrochem. Soc. Preprint No. 90–33*, 1946, 411–422).—The positive electrode of each cell consists of silver foil 0.001–0.003 in. thick, coated with electrolytically formed silver chloride, electrochemically equivalent to 0.75–5.0 amp. min./in.<sup>2</sup> according to requirements. The negative electrode consists of commercially pure magnesium foil. In the cell, electrodes are assembled with dry absorbent paper interleaved. At the time of use, the battery is removed from the sealed container and activated by immersion in tap water or sea water. The working voltage of single cells is 1.3–1.5. A summary is given of the preparation of materials, methods of construction, electrolytes, and discharge characteristics. A comparison of Wh./lb. with other types of batteries gives these average figures: lead-acid 10.5, dry cell 2.0, and silver chloride–magnesium 19.4.—A. B. W.

**Pure Nickel Rupee.** — (*Sheet Metal Ind.*, 1947, 24, (243), 1419).—A note to the effect that pure-nickel coins are now beginning to circulate in India. An illustration of the obverse and reverse of a coin is given.—R. GR.

**The Nickel Industry in 1945.** Robert C. Stanley (*Queensland Gov. Min. J.*, 1946, 47, (539), 276).—Condensed from *Min. Congr. J.*—W. G. A.

**The Future of the High-Temperature Steam Piping Expansion Problem [Use of Inconel].** F. A. Scanlan (*J. Amer. Soc. Naval Eng.*, 1947, 59, (1), 48-56).—A type of bellows expansion fitting, fabricated in Inconel, is described. Such fittings at present on the market will withstand a pressure of 1000 lb./in.<sup>2</sup> at a temp. of 1600° F. (871° C.). It is suggested that these high-temp. expansion fittings will eliminate expansion loops and bends in high-temp. steam piping systems.—H. J. A.

**Some Aspects of Gas-Turbine Development for Aircraft Propulsion [Nimonic Alloys].** S. G. Hooker (*Trans. N.-E. Coast Inst. Eng. Ship.*, 1945-46, 62, 143-156; discussion, D47-D74).—A very brief account is given of some properties of modern materials for turbine blades, and the results of a number of tests on turbine discs are displayed. Turbine-blade stresses are designed up to the creep strength of Nimonic 80 at 700° C. for 300 hr. to fracture.

—E. C. E.

**Metallurgy and the Gas Turbine.** Frank T. Sisco (*Min. and Met.*, 1946, 27, (473), 276-277; and (condensed) *Indian Eng.*, 1946, 120, (3), 161-162).—A brief review.—W. G. A.

**The Nimonic Series of Alloys.** — (*Indust. Australian*, 1947, 102, (2603), 1097).—J. L. T.

**\*[Contact Materials for] Potentiometers [Palinoy No. 7].** L. A. Nettleton and Fred E. Dole (*Rev. Sci. Instruments*, 1946, 17, (10), 356-363).—Methods of improving the performance of potentiometers are discussed. The only type of contact material which consistently gave long operating life on nickel-chromium wires (in size down to 0.002 in. dia.) was an alloy of platinum, palladium, gold, silver, copper, and zinc (Palinoy No. 7), used as a wire brush with a pressure of 40 g.—J. C. C.

**The War Job of Tungsten and Molybdenum Products.** M. H. McClement (*Steel*, 1946, 118, (9), 141, 142, 144).—A brief account of the war-time production and applications of tungsten and molybdenum in the U.S.A.—M. A. V.

**Forecast on New Metals and Alloys.** Zay Jeffries (*Metals*, 1947, 17, (9), 8-10, 16).—An address to the American Institute of Mining and Metallurgical Engineers.—J. L. T.

**The Selection of Alloys for Use at Elevated Temperatures.** B. H. Garnsey (*Australasian Eng.*, 1946, (Nov.), 68-71; discussion, 71-72).—A lecture to the Australian Institute of Metals, Sydney Branch.—N. B. V.

**\*Marine Propeller-Blade Vibrations: Full-Scale Tests.** L. C. Burrill (*Trans. N.-E. Coast Inst. Eng. Ship.*, 1945-46, 62, 249-270; discussion, D119-D138).—B. describes some experiments carried out with full-size marine propellers with a view to determining the modes and frequencies of the natural vibrations of the blades. The blades are excited by a vibrator, controlled by means of a beat-frequency oscillator, and the nodal patterns mapped out with the aid of a piezo-electric pick-up, used in conjunction with a cathode-ray oscillograph. Some examples are given of the nodal patterns and natural frequencies obtained from propeller blades designed to give pure flexural and pure torsional movement, i.e. without coupling, and also for other blades not so designed. Records are given for a typical propeller known to "sing" in service which exhibit several interesting features.—E. C. E.

**The Use of Die-Castings in a Film Strip Projector.** N. Field (*Machinery (Lond.)*, 1947, 70, (1809), 689-692).—J. C. C.

**Collapsible Tubes.** Frank T. Sisco (*Min. and Met.*, 1946, 27, (475), 443; and *Indian Eng.*, 1947, 121, (1), 41).—A review.—W. G. A.

**Microscopic Electronic Parts by the Million.** — (*Steel*, 1946, 118, (25), 95, 120, 127).—Examples are given of mass-produced small stampings and formed-wire components of phosphor bronze, beryllium copper nickel, nickel alloys, tungsten, steel, and copper-clad steel.—M. A. V.

**New Methods of Radio Production [Use of Sprayed Metal].** J. A. Sargrove (*J. Brit. Inst. Radio Eng.*, 1947, [N.S.], 7, (1), 2-33).—A technique for the mass production of light-current electrical apparatus is described. The method depends partly on the use of metal films sprayed on to a special base-plate (instead of soldered wires) to form the electrical circuit. The insulating base-plate is designed with recesses corresponding to the positions of the conductors; the whole base-plate is sprayed with metal and is subsequently surface ground, leaving metal in the recesses only.—H. J. A.

**Future Trends in Instrument Bearing Design.** J. H. Goss (*Product Eng.*, 1947, 18, (2), 131-132).—Summary of a paper presented at the First National Instrumentation Conference of the Instrument Society of America.—W. G. A.

**Metal-Coated Plastics.** — (*Steel*, 1946, 118, (7), 92-95, 136, 138).—Applications of metal-coated plastics, e.g. as electrical conductors of intricate shape, or light reflectors, are becoming more numerous. Plating increases the heat resistance and tensile strength and decreases the water absorption of plastics; it is highly corrosion-resistant owing to the electrochemical inertia of the plastic base. Apart from electroplating, metal may be deposited by spraying, vacuum deposition, or chemical reduction. Special measures, e.g. roughening, must be taken to ensure good adhesion. Comparative tables of mechanical properties, corrosion-resistance, heat distortion, and water absorption of plated and unplated plastics are given.—M. A. V.

### XXIII.—MISCELLANEOUS

**[U.S.] Senate Small-Business Committee Report on the Future of Light Metals Industry.** — (*Modern Metals*, 1947, 3, (2), 28-30).—A summary of a U.S. Senate Committee Report entitled: "Future of Light Metals and Government Plant Disposals".—N. B. V.

**[Aluminium] 1939-1946.** Jean Gillemain (*Rev. Aluminium*, 1946, (127), 339-354).—A review of progress in aluminium technology in the war years, dealing in a general way with alloy development, continuous casting, continuous rolling on four-high mills, machines for the manipulation of sheet and tube, methods of joining including welding and riveting, foundry practice, and some novel uses of the metal.—E. C. E.

**Technical Organization of the "Aluminium Français" in the Service of Industry.** André Dumas (*Rev. Aluminium*, 1947, (130), 62-67).—An illustrated account of the history, organization, and laboratories of the "Aluminium Français".—M. E.

**Non-Ferrous Metals: Their Production and Properties (Other Than the Light Metals).** John L. Everhart (*Metals Rev.*, 1947, 20, (2), 5-7).—E. reviews the production of non-ferrous metals and their recovery from scrap, new developments in alloys for high-temp. service, new bearing metals, and progress in powder metallurgy.—J. L. T.

**New Metallurgical Developments.** Allen G. Gray (*Steel*, 1946, 118, (17), 108, 113-114, 116).—Notes are given on recent electrometallurgical developments, including new electric furnaces; the recovery of pure germanium from zinc-sintering plant Cottrell dust; the production of zirconium, beryllium, and chromium; and the plating of lead-tin alloy on steel.—M. A. V.

**Engineering Tools: Mental Processes, Materials, Mechanistic Skill, Money, and Men.** J. Eccles (*Trans. Liverpool Eng. Soc.*, 1946, 67, 35-60; discussion, 61-79).—A talk for young engineers.—H. J. A.

**Review of the Swiss Metal and Engineering Industries.** W. M. von Orelli (*J. Iron Steel Inst.*, 1947, 156, (2), 145-154).—A general account of the history and present position of the Swiss mining, metallurgical, and engineering industries.—R. W. R.



**Is the World Running Short of Metals and Fuels?** A. B. Parsons (*Min. J.*, 1946, **226**, (5773), 285-286; and *Queensland Gov. Min. J.*, 1946, **47**, (541), 328-329).—J. L. T.

**Metal Conservation: A National Problem.** C. Gerard Davidson (*Metals*, 1947, **17**, (7), 11-14).—An address to the Management Division of the American Society of Mechanical Engineers.—W. G. A.

**Aluminium and Alumina Against Silicosis.** H. Raymondau (*Usine Nouvelle*, 1947, **3**, (29), 11).—A brief review of treatment in the U.S.A. The results of the use of aluminium powder are still contradictory, and more investigation is needed.—J. L. T.

**\*Atmospheric Concentrations of Fluorides in Aluminium-Reduction Plants.** Charles D. Yaffe (*J. Indust. Hyg. Toxicol.*, 1946, **28**, (2), 29-31).—Total fluoride concentrations found, in the pot rooms of plants working the Hall-Héroult and Soederberg processes, ranged from 1.8 to 58.4 mg./10 m.<sup>3</sup>, an average figure of 16 mg./10 m.<sup>3</sup> being obtained.—R. W. R.

**Delayed Chemical Pneumonitis Occurring in Workers Exposed to Beryllium Compounds.** Harriet L. Hardy and Irving R. Tabershaw (*J. Indust. Hyg. Toxicol.*, 1946, **28**, (5), 197-211).—The authors describe the case histories of 17 patients working in a fluorescent-lamp manufacturing concern.—R. W. R.

**Lead Intoxication by Inhalation.** Lawrence H. Cotter (*J. Indust. Hyg. Toxicol.*, 1946, **28**, (2), 44-46).—C. describes the case histories of 10 patients engaged on burning painted steel. The use of positive-pressure respirators is recommended for such workers.—R. W. R.

**The Prevention of Accidents at Work and the Spirit of Security in Foundries.** Robert Couppel du Lude (*Fonderie*, 1946, **1**, (12), 469-471; discussion, 471).—M. E.

**Research Organizations.** W. L. Carter (*Mass Prodn.*, 1946, **22**, (6), 261-267).—C. reviews the work and organization of a number of British research associations, including the following establishments carrying out metallurgical research: The British Non-Ferrous Metals Research Association, The British Iron and Steel Research Association, and The British Cast Iron Research Association.—R. W. R.

**Engineering Research at the N.P.L.—II.** — (*Mech. World*, 1947, **121**, (3154), 634-635).—A description of recent developments in engineering and metallurgy at the National Physical Laboratory.—R. W. R.

**Physical Metallurgy in Australia.** A. F. Dunbar (*Australasian Eng.*, 1946, (May), 53-59).—Presidential address to the Australian Institute of Metals, Melbourne Branch, Physical Metallurgy Division. After giving an account of the history of the Division, D. describes metallurgical activities and investigations in Australia in recent years.—N. B. V.

**Metallurgical Research in Germany Since the War.** M. Hansen (*J. Iron Steel Inst.*, 1947, **156**, (3), 370).—A brief review of progress made with the recommencement of metallurgical research in Germany.—R. W. R.

**Physics in 1946.** Philip Morrison (*J. Appl. Physics*, 1947, **18**, (2), 133-152).—A general review of recent progress in physics, chiefly in America, particular reference being made to work arising out of war-time developments. Among the subjects discussed are the supraconductivity of sodium-ammonia systems, the development of sources of high-energy particles such as the synchrotron, developments in radiation theory as a result of radar work, artificial radio-active isotopes, the possibilities of the chain-reacting uranium pile as an instrument for nuclear physics research, the application of rockets to high-altitude measurements, and recent progress in the measurement of nuclear magnetic moments.—G. V. R.

**Present-Day Trends in Fundamental Research.** H. J. Bhabha (*Tisco Rev.*, 1946, **14**, (5), 255-259).—A lecture delivered at the inauguration of the Tata Institute of Fundamental Research at Bombay. The scope of the lecture is concerned entirely with physical research.—J. E. G.

**National Metallurgical Laboratory, Jamshedpur.** — (*Tisco Rev.*, 1946, 14, (5), 250–254, 259).—An account of the speeches delivered on the occasion of the laying of the foundation stone of the [Indian] National Metallurgical Laboratory at Jamshedpur.—J. E. G.

**Some Observations on Laboratory Planning.** G. B. Contractor (*Metallurgia*, 1947, 36, (212), 70–75).—Reprinted from *J. Council Sci. Indust. Research, India*.—M. A. V.

**The Battle of the Laboratories.** P. Swings and L. de Merre (*Rev. Univ. Mines*, 1947, [ix], 3, (5), 158–191).—A survey of recent physical, chemical, and biological researches carried out in French, British, and American laboratories. —M. E.

**Present-Day Problems in Obtaining Foreign Scientific Publications.** Verner W. Clapp (*J. Chem. Education*, 1947, 24, (2), 75–78).—An account of how the American Library of Congress is obtaining, classifying, and distributing foreign books and periodicals published during the war years.

—H. J. A.

## XXIV.—BIBLIOGRAPHY

(Publications marked \* have been received.)

**Allan, R. K.** *Rolling Bearings*. Second edition. Demy 8vo. Pp. xiv + 401. 1946. London: Sir Isaac Pitman and Sons, Ltd. (30s.)

\***American Metal Market.** *Metal Statistics*, 1947. 40th annual edition. Post 8vo. Pp. 816. 1947. New York: American Metal Market, 18 Cliff Street. (\$2.00.)

\***American Society for Testing Materials.** *1946 Book of A.S.T.M. Methods of Chemical Analysis of Metals*. Med. 8vo. Pp. x + 402. 1946. Philadelphia, Pa.: The Society, 1916 Race St. (\$4.50.)

**American Society for Testing Materials.** *1946 Book of A.S.T.M. Standards. Part IA.—Ferrous Metals. Part IB.—Non-Ferrous Metals. Part II.—Non-Metallic Materials—Constructional. Parts IIIA and IIIB.—Non-Metallic Materials*. Philadelphia, Pa.: The Society, 1916 Race St. (Parts IA, IB, IIIA, IIIB \$8.00; Part II \$12.00.)

**American Society for Testing Materials.** *Symposium on Testing of Bearings*. Demy 8vo. Pp. 65. Philadelphia, Pa.: The Society, 1916 Race St. (\$1.50.)

[The symposium was held in order to make available latest information on the tests which are used, the equipment that has been developed, and the correlation of laboratory tests with field service.]

**Association Française de Normalisation.** *Analyse Chimique des Bronzes*. (Norme française NF A06–627.) Pp. 20. 1946. Paris: The Association, Bureau de Vente, 19 rue du 4 Septembre. (115 francs.)

**Association Technique de Fonderie.** *Compte rendu du XIX<sup>e</sup> Congrès de l'Association Technique de Fonderie*. [1946.] Paris: Bureau d'Éditions. (300 francs.)

**Baritel, Aug.** *Corrosion des Chaudières par les Composés Oxygènes du Soufre*. Pp. 58. [1946.] Paris: 9 rue St.-Gilles.

\***Bastien, P.** *Recherches sur la Forgeabilité des Alliages Légers*. (Publications scientifiques et techniques du Ministère de l'Air, No. 197.) 27 × 18 cm. Pp. ix + 76, with 71 illustrations. 1946. Paris: Gauthier-Villars. (100 francs.)

**Batta, G., and Ed. Leclerc.** *La Chimie des Matériaux Techniques*. [1946.] Liège: H. Vaillant-Carmanne.

**Begeman, Myron L.** *Manufacturing Processes*. Second edition. Pp. 635. 1947. New York: John Wiley and Sons, 440 Fourth Ave. (\$5.00); London: Chapman and Hall (30s.).

**Bowerman, Elizabeth Gilbert.** Compiled by. *Union List of Technical Periodicals in Two Hundred Libraries of the Science-Technology Group of the Special Libraries Association*. [Plaoographed.] Third edition. Pp. 290. 1947. New York: Special Libraries Association, 31 East 10th St. (\$6.00.)

[Contains nearly 5000 titles of periodicals in representative special libraries (in the United States) in the fields of pure and applied science. In most instances the places of publication, years, and volume numbers are given.]

\***Boyles, Alfred.** *The Structure of Cast Iron*. A Series of Three Educational Lectures on the Structure of Cast Iron, Presented to Members of the A.S.M. During the Twenty-Eighth National Metal Congress and Exposition, Atlantic City, November 18-22, 1946. Med. 8vo. Pp. [viii] + 154, with 94 illustrations. 1947. Cleveland, O.: American Society for Metals, 7301 Euclid Ave. (\$3.25.)

**Brady, G. S.** *Materials Handbook*. Sixth edition. Demy 8vo. Pp. 831. 1947. New York: McGraw-Hill Book Co., Inc. (\$7.00); London: McGraw-Hill Publishing Co., Ltd. (35s.).

**Brillouin, Léon.** *Les Tenseurs en Mécanique et en Elasticité*. Med. 8vo. Pp. 370, with 109 illustrations. 1947. New York: Dover Publications, Inc., 1780 Broadway. (\$3.95.)

\***British Aluminium Company, Ltd.** *Aluminium and Aluminium Alloy Extruded Sections, Including Bars. Nominal Compositions, Related Specifications, and Mechanical Properties*. (Data Sheet W105.) Roy. 4to. 1947. London: The Company, Salisbury House, London Wall, E.C.2.

\***British Aluminium Company, Ltd.** *Aluminium and Aluminium Alloy Sheet and Coiled Strip. Nominal Compositions, Related Specifications, and Mechanical Properties*. (Data Sheet W104.) Roy. 4to. 1947. London: The Company, Salisbury House, London Wall, E.C.2.

\***British Aluminium Company, Ltd.** *Aluminium-Silicon-Copper Casting Alloy*. (Data Sheet No. 16: D.T.D. 424.) Roy. 4to. 1947. London: The Company, Salisbury House, London Wall, E.C.2.

\***British Aluminium Company, Ltd.** *Analysis of Aluminium and Its Alloys. Chemical, Colorimetric, and Photometric Methods*. 4to. Pp. 196, with 18 illustrations in the text, 2 plates, and 2 folding tables. 1947. London: The Company, Salisbury House, London Wall, E.C.2.

\***British Aluminium Company, Ltd.** *B.A. 21 Alloy Sheet and Coiled Strip*. (Data Sheet W103.) Roy. 4to. 1947. London: The Company, Salisbury House, London Wall, E.C.2.

\***British Intelligence Objectives Sub-Committee.** *A Metallurgical Examination of Four Japanese 47-mm. Armour-Piercing, High-Explosive Shells by L. H. Grenell, J. R. Cady, Anton Brasunas, and H. W. Gillett, Battelle Memorial Institute*. (Report No. B.I.O.S./J.A.P./P.R./1450.) [Mimeographed.] Cr. 4to. Pp. 15, with 10 illustrations. 1947. London: H.M. Stationery Office. (1s. 7d., post free.)

\***British Intelligence Objectives Sub-Committee.** *A Metallurgical Examination of Japanese 37-mm. Round-Nose A.P. Ammunition*. (Report No. B.I.O.S./J.A.P./P.R./1473.) [Mimeographed.] Cr. 4to. Pp. 26, with 21 illustrations. 1947. London: H.M. Stationery Office. (3s. 2d., post free.)



- \***British Intelligence Objectives Sub-Committee.** *A Metallurgical Examination of Miscellaneous Japanese Articles by H. W. Gillett, L. H. Grenell, A. S. Henderson, and J. R. Cady, Battelle Memorial Institute.* (Report No. B.I.O.S./J.A.P./P.R./1456.) [Mimeographed.] Cr. 4to. Pp. 7, with 6 illustrations. 1947. London: H.M. Stationery Office. (1s. 7d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Aspects of German Foundry Practice.* (Final Report No. 1354. Item No. 21.) [Mimeographed.] Cr. 4to. Pp. 32. 1947. London: H.M. Stationery Office. (3s. 8d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Cold Impact Extrusion of Aluminium, &c.* (Final Report No. 1409. Item No. 21.) [Mimeographed.] Cr. 4to. Pp. 33, with diagrams. 1947. London: H.M. Stationery Office. (3s. 8d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Developments in Magnesium Production and Fabrication.* (Report No. 1338. Item No. 21.) [Mimeographed.] Cr. 4to. Pp. 60, with supplementary tables, charts, and diagrams. 1947. London: H.M. Stationery Office. (7s. 9d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Equipment for Use with Oxygen and Fuel Gases for Welding and Cutting.* (F.I.A.T. Final Report No. 532.) [Mimeographed.] Cr. 4to. Pp. 80, illustrated. 1947. London: H.M. Stationery Office. (7s. 3d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Final Report on German Naval Boilers, with Particular Reference to Design, Corrosion, and Boiler Feed-Water Treatment.* (Final Report No. 1333. Item No. 29.) [Mimeographed.] Cr. 4to. Pp. 182, with supplementary tables, charts, and diagrams. 1947. London: H.M. Stationery Office. (25s. 6d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Flexible Pipes, Flexible Fuel Tanks, and Self-Sealing Fuel-Tank Coverings for Aircraft.* (Final Report No. 310. Item Nos. 21, 22, and 25.) [Mimeographed.] Cr. 4to. Pp. 36, with 10 illustrations. 1947. London: H.M. Stationery Office. (5s. 2d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Gas Containers and Pressure Vessels.* (Final Report No. 1238. Item Nos. 21 and 31.) [Mimeographed.] Cr. 4to. Pp. 82, with 55 illustrations and diagrams. 1947. London: H.M. Stationery Office. (7s. 8d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *German Light Chain and Wire-Forming Industry.* (Final Report No. 1346. Item Nos. 21 and 31.) [Mimeographed.] Cr. 4to. Pp. 51, with 12 illustrations. 1947. London: H.M. Stationery Office. (5s. 2d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *German Research in the Light Metals Industry.* (F.I.A.T. Final Report No. 997.) [Mimeographed.] Cr. 4to. Pp. 13. 1947. London: H.M. Stationery Office. (1s. 7d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *German Wire-Netting Manufacture.* (Final Report No. 1288. Item Nos. 21 and 31.) [Mimeographed.] Cr. 4to. Pp. 30, with diagrams. 1947. London: H.M. Stationery Office. (3s. 2d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Impact Extrusion: German Practice 1946.* (Final Report No. 1405. Item Nos. 21 and 31.) [Mimeographed.] Cr. 4to. Pp. 137, with 51 illustrations. 1947. London: H.M. Stationery Office. (12s. 4d., post free.)

- \***British Intelligence Objectives Sub-Committee.** *Japanese Ships: Miscellaneous Items.* (Report No. B.I.O.S./J.A.P./P.R./612.) [Mimeographed.] Cr. 4to. Pp. 5. 1947. London: H.M. Stationery Office. (7d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Melting and Casting of German-Silver Alloys.* (F.I.A.T. Final Report No. 878.) [Mimeographed.] Cr. 4to. Pp. 21. 1947. London: H.M. Stationery Office. (2s. 8d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Metallurgical and Chemical Examination of a Japanese Landing Gear and Wheel.* (Report No. B.I.O.S./J.A.P./P.R./1479.) [Mimeographed.] Cr. 4to. Pp. 13, with 2 illustrations. 1947. London: H.M. Stationery Office. (2s. 8d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Metallurgical Examination of a German and Japanese Aircraft Rate-of-Climb Indicator.* (Report No. B.I.O.S./J.A.P./P.R./1471.) [Mimeographed.] Cr. 4to. Pp. 19, with 6 illustrations. 1947. London: H.M. Stationery Office. (2s. 8d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Metallurgical Examination of Airframe Sections from "Zeke", "Val", "Lily", and "Dinah" Japanese Planes.* (Report No. B.I.O.S./J.A.P./P.R./1480.) [Mimeographed.] Cr. 4to. Pp. 15, with 8 illustrations. 1947. London: H.M. Stationery Office. (2s. 2d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Metallurgical Examination of a Japanese Army 105-mm. H.-E. Shell of 1938 by L. H. Grenell, J. R. Cady, Morse Hill, and H. W. Gillett, Battelle Memorial Institute.* (Report No. B.I.O.S./J.A.P./P.R./1440.) [Mimeographed.] Cr. 4to. Pp. 10, with 4 illustrations. 1947. London: H.M. Stationery Office. (1s. 1d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Metallurgical Examination of a Japanese 50-mm. Mortar-Grenade Smoke Shell and Fuse.* (Report No. B.I.O.S./J.A.P./P.R./1476.) [Mimeographed.] Cr. 4to. Pp. 7, with 1 illustration. 1947. London: H.M. Stationery Office. (1s. 1d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Metallurgical Examination of a Japanese "Zeke" Aircraft Volt Box.* (Report No. B.I.O.S./J.A.P./P.R./1469.) [Mimeographed.] Cr. 4to. Pp. 7, with 2 illustrations. 1947. London: H.M. Stationery Office. (1s. 7d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Metallurgical Investigation of an 8-cm. Japanese Anti-Aircraft Gun by E. L. Bartholomew, Jr., M. S. Burton, and F. R. Evans, Massachusetts Institute of Technology.* (Report No. B.I.O.S./J.A.P./P.R./1448.) [Mimeographed.] Cr. 4to. Pp. 39, with 16 illustrations. 1947. London: H.M. Stationery Office. (4s. 2d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Metallurgical Examination of 5-inch Japanese Naval Projectile by L. H. Grenell, J. R. Cady, F. M. Stephens, Jr., and H. W. Gillett, Battelle Memorial Institute.* (Report No. B.I.O.S./J.A.P./P.R./1453.) [Mimeographed.] Cr. 4to. Pp. 6, with 1 illustration. 1947. London: H.M. Stationery Office. (7d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Metallurgical Examination of Fuel Tank from Japanese Aircraft "Oscar".* (Report No. B.I.O.S./J.A.P./P.R./1481.) [Mimeographed.] Cr. 4to. Pp. 8, with 1 illustration. 1947. London: H.M. Stationery Office. (1s. 7d., post free.)

- \***British Intelligence Objectives Sub-Committee.** *Metallurgical Examination of Japanese Army 47-mm. H.-E. Projectiles* by L. H. Grenell, J. R. Cady, J. R. Keeler, and H. W. Gillett, Battelle Memorial Institute. (Report No. B.I.O.S./J.A.P./P.R./1454.) [Mimeographed.] Cr. 4to. Pp. 8, with 1 illustration. 1947. London: H.M. Stationery Office. (1s. 1d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Metallurgical Examination of Japanese 63-Kilogram Bombs, Fuses, and Gages* by L. H. Grenell, J. R. Cady, J. G. Dunleavy, and H. W. Gillett, Battelle Memorial Institute. (Report No. B.I.O.S./J.A.P./P.R./1442.) [Mimeographed.] Cr. 4to. Pp. 19, with 17 illustrations. 1947. London: H.M. Stationery Office. (2s. 2d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Metallurgical Examination of Oil Cooler from Japanese Aircraft "Betty"*. (Report No. B.I.O.S./J.A.P./P.R./1492.) [Mimeographed.] Cr. 4to. Pp. 7, with 1 illustration. 1947. London: H.M. Stationery Office. (1s. 7d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Metallurgical Examination of Two Japanese 140-mm. Naval Projectiles* by L. H. Grenell, J. R. Cady, D. O. Leeser, and H. W. Gillett, Battelle Memorial Institute. (Report No. B.I.O.S./J.A.P./P.R./1452.) [Mimeographed.] Cr. 4to. Pp. 12, with 3 illustrations. 1947. London: H.M. Stationery Office. (1s. 7d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Molten Salt-Bath Practice and Salt-Bath Design*. (Final Report No. 1281. Item Nos. 21 and 22.) [Mimeographed.] Cr. 4to. Pp. 21, with 4 diagrams. 1947. London: H.M. Stationery Office. (2s. 8d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *New High-Permeability Magnetic Material Developed in Japan*. (Report No. B.I.O.S./J.A.P./P.R./241.) [Mimeographed.] Cr. 4to. Pp. 9, with 1 diagram. 1947. London: H.M. Stationery Office. (1s. 1d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Notes on the Peeling of Nickel Deposits*. (F.I.A.T. Final Report No. 879.) [Mimeographed.] Cr. 4to. Pp. 28. 1947. London: H.M. Stationery Office. (3s. 2d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Production of Tantalum in Japan*. (Report No. B.I.O.S./J.A.P./P.R./847.) [Mimeographed.] Cr. 4to. Pp. 7, with 2 graphs and one diagram. 1947. London: H.M. Stationery Office. (1s. 1d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Research on the Mechanical Working of Metals. Interrogation of Dr.-Ing. Werner Lueg of the Kaiser-Wilhelm Institut, Düsseldorf*. (Final Report No. 1177. (Interrogation Report No. 424.) Item Nos. 21 and 31.) [Mimeographed.] Cr. 4to. Pp. 15. 1947. London: H.M. Stationery Office. (1s. 7d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Rock-Drilling Bits Tungsten Carbide Tipped*. (Final Report No. 1091. Item Nos. 21 and 31.) [Mimeographed.] Cr. 4to. Pp. 10, with 5 diagrams. 1947. London: H.M. Stationery Office. (1s. 7d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Some Aspects of German Powder Metallurgy (Preliminary Assessment)*. (Final Report No. 78. Item No. 21.) [Mimeographed.] Cr. 4to. Pp. 22. 1947. London: H.M. Stationery Office. (2s. 7d., post free.)



- \***British Intelligence Objectives Sub-Committee.** *Some Developments in Infra-Red and Raman Spectroscopy in Germany.* (Final Report No. 1345. Item No. 9.) [Mimeographed.] Cr. 4to. Pp. 7. 1947. London: H.M. Stationery Office. (1s. 7d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Special Mechanical Features of Linde-Frankl Oxygen Plants.* (F.I.A.T. Final Report No. 955.) [Mimeographed.] Cr. 4to. Pp. 43, with 14 figures. 1947. London: H.M. Stationery Office. (4s. 8d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Structural Work at Focke-Wulf, Bad Eilson.* (Final Report No. 285. Item No. 25.) [Mimeographed.] Cr. 4to. Pp. 12, with 3 figures. 1947. London: H.M. Stationery Office. (1s. 7d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *The Aluminium-Reduction Industry in Germany.* (F.I.A.T. Final Report No. 993.) [Mimeographed.] Cr. 4to. Pp. 26. 1947. London: H.M. Stationery Office. (2s. 8d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *The Copper Industry of Japan.* (Report No. B.I.O.S./J.A.P./P.R./900.) [Mimeographed.] Cr. 4to. Pp. 37. 1947. London: H.M. Stationery Office. (3s. 8d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *The Electrochemical Industry, Germany.* (Final Report No. 1301. Item No. 22.) [Mimeographed.] Cr. 4to. Pp. 39, with 27 illustrations. 1947. London: H.M. Stationery Office. (5s. 8d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *The Electron Emission of Crystalline Metal Surfaces and Its Relation to the Laws of Crystal Structure.* Parts I and II. (F.I.A.T. Final Report Nos. 1030 and 1031.) [In German.] [Mimeographed.] Cr. 4to. Pp. 14, illustrated. 1947. London: H.M. Stationery Office. (3s. 2d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *The Electrothermal Production of Aluminium-Silicon Alloy.* (F.I.A.T. Final Report No. 992.) [Mimeographed.] Cr. 4to. Pp. 10. 1947. London: H.M. Stationery Office. (1s. 1d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *The German Hard-Metal Industry.* (Final Report No. 1385. Item No. 21.) [Mimeographed.] Cr. 4to. Pp. 453, illustrated. 1947. London: H.M. Stationery Office. (38s. 2d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *The Production in Germany of Extruded Sections and Tubes in Aluminium and Magnesium Alloys.* (Final Report No. 1366. Item No. 21.) [Mimeographed.] Cr. 4to. Pp. 128, illustrated. 1947. London: H.M. Stationery Office. (12s. 3d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *The Production of Certain Types of Phosphor-Bronze, Brass, and Light-Alloy Castings in Germany. Composite Report of Interrogations of Dr. Heinrich Bauer, Dürener Metallwerke, Düren.* (Final Report No. 1295. (Interrogation Report No. 449.) Item Nos. 21 and 31.) [Mimeographed.] Cr. 4to. Pp. 10, with 3 diagrams. 1947. London: H.M. Stationery Office. (1s. 1d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *The Production of Ply Metals and Similar Materials in Germany.* (Final Report No. 1353. Item No. 21.) [Mimeographed.] Cr. 4to. Pp. 44, with 12 illustrations. 1947. London: H.M. Stationery Office. (4s. 8d., post free.)

- \***British Intelligence Objectives Sub-Committee.** *Thermostatic Bimetal Production in Germany.* (F.I.A.T. Final Report No. 974.) [Mimeographed.] Cr. 4to. Pp. 20, with diagrams. 1947. London: H.M. Stationery Office. (2s. 2d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *The Use of Cellulose Derivatives as Core Binders in German Foundries.* (Final Report No. 1219. Item Nos. 21 and 22.) [Mimeographed.] Cr. 4to. Pp. 7. 1947. London: H.M. Stationery Office. (1s. 1d., post free.)
- \***British Intelligence Objectives Sub-Committee.** *Tungsten Carbide Research in Germany.* (Final Report No. 925. Item Nos. 21 and 22.) [Mimeographed.] Cr. 4to. Pp. 66, with 8 diagrams. 1947. London: H.M. Stationery Office. (9s. 3d., post free.)
- \***British Standards Institution.** *Aluminium Alloy Bars and Sections.* (Emergency Standard No. (E) 2D. 649.) 4to. Pp. 5. 1946. London: The Institution, 28 Victoria St., S.W.1. (1s. 2d., post free.)
- \***British Standards Institution.** *Metal Lavatory Basins.* (No. 1329.) Demy 8vo. Pp. 8, with 1 diagram. 1946. London: The Institution, 28 Victoria St., S.W.1. (2s., post free.)
- \***Carslaw, H. S., and J. C. Jaeger.** *Conduction of Heat in Solids.* Roy. 8vo. Pp. viii + 386, with 51 illustrations. 1947. London: Oxford University Press. (30s. net.)
- Christen, Hermann.** *Werkstoffbegriffe.* Third edition. Pp. 197, with 164 illustrations in the text and 28 plates. 1947. Frauenfeld, Switzerland: Verlag Huber and Company. (7.50 Swiss francs.)
- \***Commission Technique des États et Propriétés de Surface des Métaux.** *Journées des États de Surface, Paris, 23-26 octobre 1945.* Demy 4to. Pp. [viii] + 273, with numerous illustrations. 1946. Paris (VIII<sup>e</sup>): Office professionnel général de la Transformation des Métaux, 16 avenue Hoche. (1050 francs, post free.)

[The papers published in this volume are: Gaston Dupouy, "Le microscope électronique et son emploi pour l'étude des états de surface" (*Met. Abs.*, 1947, 14, 161); A. Grumbach, "Étude des surfaces métalliques par voie électrolytique rôle de la couche de Beilby" (*Met. Abs.*, 1947, 14, 160); F. J. Taboury, "Couche de Beilby: comparaison des preuves électrostatiques et électroniques de son existence" (*Met. Abs.*, 1947, 14, 161); P. Lacombe et L. Beaujard: "L'oxydation anodique envisagée comme moyen d'étude de l'état de surface de l'aluminium et de ses alliages" (*Met. Abs.*, 1947, 14, 160); P.-A. Jacquet, "Quelques nouveautés sur le polissage électrolytique" (*Met. Abs.*, 1947, 14, 181); M. Mondon, "Le polissage électrolytique: méthode de super finition" (*Met. Abs.*, 1947, 14, 181); S. Wernick, "Développement du polissage électrolytique en Grande-Bretagne" (*Met. Abs.*, 1947, 14, 181); J. Benard, P. Lacombe, et G. Chaudron, "L'écroutissage superficiel de l'aluminium et du fer par abrasion, emploi des rayons-X en retour pour l'étude des états de surface" (*Met. Abs.*, 1947, 14, 160); Marie L. V. Gayler, "Note sur les phénomènes observés après traitement à haute température sur l'aluminium de haute pureté et sur un alliage à 4% de cuivre polis électrolytiquement" (*Met. Abs.*, 1947, 14, 153); A. Glazunov et L. Jenicek, "L'état de surface et les propriétés des dépôts électrolytiques" (*Met. Abs.*, 1947, 14, 167); Georges-A. Homes et Marcel Maquestiau, "L'épitaixie dans les dépôts électrolytiques" (*Met. Abs.*, 1947, 14, 371); G. I. Finch, "Structure des surfaces de glissement" (*Met. Abs.*, 1947, 14, 162); Pierre Nicolau, "Microgéométrie et étude des formes des surfaces. Position de la question. Définitions" (*Met. Abs.*, 1947, 14, 374); R. E. Reason, "Quelques problèmes relatifs à la conception des instruments pour l'étude des surfaces" (*Met. Abs.*, 1947, 14, 374); A. Arnulf, "Généralités sur les méthodes optiques d'examen des surfaces. Méthodes mises en œuvre à l'Institut d'Optique" (*Met. Abs.*, 1947, 14, 374); F. Flamant et A. Arnulf, "Détermination des profils de rugosité par les méthodes de pointés longitudinaux et par interférences" (*Met. Abs.*, 1947, 14, 375); C. Timms, "Vue d'ensemble sur les récents travaux concernant la mesure de la rugosité des surfaces" (*Met. Abs.*, 1947, 14, 375); G. Michalet, "Comparaison des principales méthodes de contrôle microgéométrique" (*Met. Abs.*, 1947, 14, 375); J. R. Womersley et M. R. Hopkins, "Suggestions

concernant l'emploi du correlogramme pour l'interprétation des enregistrements du fini de surface" (*Met. Abs.*, 1947, 14, 375); M. A. Mauzin, "Détermination de l'état de surface d'une pièce usinée par vision stéréoscopique et mesure d'un coefficient relatif à l'usage industriel de cette pièce" (*Met. Abs.*, 1947, 14, 375); Karl Wessel, "État actuel de la normalisation et des méthodes de contrôle des états de surface en Suède" (*Met. Abs.*, 1947, 14, 376); F. Canac, "Étude optique de l'état de surfaces sablées et création de tests" (*Met. Abs.*, 1947, 14, 376); J. Misset et P. Revel, "La superfinition" (*Met. Abs.*, 1947, 14, 409); Henri Bruck et Pierre Grivet, "Le microscope électronique. Application au microscope électrostatique de la Compagnie Générale de Télégraphie sans fil" (*Met. Abs.*, 1947, 14, 170); A. Marcelin, "Relation entre le coefficient de frottement et l'état de surface" (*Met. Abs.*, 1947, 14, 397); P. Bastien et A. Popoff, "Le rôle de l'état de surface dans les mesures de dureté" (*Met. Abs.*, 1947, 14, 397); M. Ros, "Influence de la surface sur la fatigue des métaux" (*Met. Abs.*, 1947, 14, 360); Robert Morlock, "L'étalement des liquides sur les métaux en fonction de leur état de surface" (*Met. Abs.*, 1947, 14, 360); P. de La Gorce, "Influence de l'état de surface sur la conductibilité des contacts" (*Met. Abs.*, 1947, 14, 361); A.-G. Clavier, "Recherches sur l'influence du degré de polissage sur les coefficients de surtension en ondes centimétriques" (*Met. Abs.*, 1947, 14, 376); U. R. Evans, "Résistance des métaux et des alliages à la corrosion" (*Met. Abs.*, 1947, 14, 382); C. H. Desch, "Le rôle des réactions chimiques dans les phénomènes de frottement et d'usure" (*Met. Abs.*, 1947, 14, 383); P. Chevenard et X. Waché, "Influence de l'état de surface sur l'oxydation sèche des austénites au nickel-chrome et du mode de finition des éprouvettes sur l'hystérésis mécanique des aciers"; P. Morize, P. Lacombe, et G. Chaudron, "Étude de l'état de surface chimique de l'aluminium par la mesure du potentiel de dissolution" (*Met. Abs.*, 1947, 14, 383); M. Capdecorme, "L'épitaixie dans les phénomènes de corrosion" (*Met. Abs.*, 1947, 14, 383); M. Pourbaix, "Corrosion, passivité, et passivation au point de vue thermodynamique" (*Met. Abs.*, 1947, 14, 383); Eva Palmær, "De la surtension de l'hydrogène, en particulier sur le nickel, le tantale, et le niobium" (*Met. Abs.*, 1947, 14, 384); Eva Palmær, "Recherches sur la corrosion effectuées en Suède pendant la guerre" (*Met. Abs.*, 1947, 14, 384)].

\***Council of Industrial Design.** *What is a Design Centre?* Foolscap 4to. Pp. 15, illustrated. 1947. London: H.M. Stationery Office. (n.p.)

\***Council of Ironfoundry Associations.** Costing Committee of the. *Cost-Ascertainment Methods for the Ironfoundry Industry, based on Uniform Principles.* 9 × 7 in. Pp. 30. [1947.] London: The Council, Derbyshire House, Belgrove St., W.C.1. (42s.)

\***Cussett, Francis.** *Vocabulaire Technique Anglais-Français et Français-Anglais.* Second edition. Foolscap 8vo. Pp. 591. 1947. Paris: Éditions Berger-Levrault, 5 rue Auguste-Comte. London: H. K. Lewis and Co., 136 Gower St., W.C.1. (12s. 6d.)

**Department of Scientific and Industrial Research.** *Classified List of Industrialists' Reports on Germany.* 13½ × 8½ in. Pp. 45. 1946. London: H.M. Stationery Office.

\***Die-Casting.** *A Bibliography on Die-Casting, 1910-1946.* Compiled by the Editors of *Die-Castings* and Reviewed by Mrs. Clair Kissam. [Loose-Leaf.] 4to. Pp. [iii] + 74. 1947. Cleveland, O.: Technical Publishing Co., 1240 Ontario St. (\$7.50.)

**Dietert, Harry W.** *Modern Core Practices and Theories.* Med. 8vo. Pp. xii + 532, with 294 illustrations. 1942. Chicago, Ill.: American Foundrymen's Association. (\$5.00.)

\***Directory.** *Standard Metal Directory.* Tenth edition. Pp. 852. 1946. New York: Standard Metal Directory, 425 Wall St. (\$10.00.)

**Dudley, John W., Jr.** *Examination of Industrial Measurements.* Demy 8vo. Pp. 113. 1946. New York: McGraw-Hill Book Co., Inc. (\$2.00); London: McGraw-Hill Publishing Co., Ltd. (10s.)

\***Dudley, L.** *Light Metals in Structural Engineering.* Demy 8vo. Pp. x + 216, with numerous illustrations. 1947. London: English Universities Press, Ltd. (30s. net.)

**Dunkley, G. T.** *Controlled Atmospheres in Heat-Treatment.* Demy 8vo. Pp. 70. 1947. London: Sir Isaac Pitman and Sons, Ltd. (7s. 8d., post free.)



- Dunsheath, Percy.** (Advisory Editor.) *Industrial Research 1947*. Demy 8vo. Pp. 536. 1947. London: Todd Publishing Group, 49 Park Lane, W.1. (25s.)
- Duport, J.** *Les Piqures dans les Alliages Légers*. [1946.] Paris: Bureau d'Éditions. (55 francs.)
- \***Federal Standard Stock Catalogue.** Section IV, Part 5. *Federal Specification for Aluminium (Al-2) Plate and Sheet*. (Federal Specification QQ-A-561a.) Cr. 8vo. Pp. 9. 1946. Washington, D.C.: Superintendent of Documents. (5 cents.)
- Federation of British Industries.** *Industry and Research*. Demy 8vo. Pp. 136. 1947. London: Sir Isaac Pitman and Sons, Ltd. (10s. 6d.)  
[A full report of a two-day conference arranged by the Federation of British Industries in March 1946.]
- Ferry, A.** *La Recherche Scientifique et les Économies de Matières*. [1946.] Paris: Gauthier-Villars. (350 francs.)
- Fridman, Ya. B.** *Mechanical Properties of Metals*. [In Russian.] Pp. 424. 1946. Moscow: All-Union Institute of Aviation Materials. (32 roubles.)
- Galibourg, M.** *Alliages Divers Anti-Frictions*. [1946.] Paris: Syndicat des constructeurs français de machines-outils.
- \***Gloag, John.** *Good Design, Good Business*. Cr. 8vo. Pp. 80, illustrated. 1947. Edinburgh: H.M. Stationery Office. (1s. 6d.)  
[Published for the Scottish Committee of the Council of Industrial Design.]
- Gorbunov, N. S., and I. D. Yudin.** *Diffusible Chromium Coatings*. Pp. 51, illustrated. 1946. Moscow.
- \***Gourley, Vincent C.** *Welding Symbols*. Demy 8vo. Pp. ix + 115, illustrated. 1947. Milwaukee, Wis.: Bruce Publishing Co. (\$2.50.)
- Gramm, H.** *Die Lösungsmittel und Weichmachungsmittel*. Fifth edition, enlarged and rewritten. Pp. 562, with 43 illustrations. 1946. Stuttgart: Wissenschaftliche Verlagsanstalt.
- \***Haim, G., and H. P. Zade.** *Welding of Plastics*. With a foreword by J. H. Paterson. Demy 8vo. Pp. xv + 206, with 88 illustrations. 1947. London: Crosby Lockwood and Son, Ltd. (21s.)
- \***Hamburg, H. F., J. L. Saunderson, R. S. Segsworth, E. O. Dixon, C. M. Lichy, C. S. Barrett, and H. T. Clark.** *Electronic Methods of Inspection of Metals*. A Series of Seven Educational Lectures on Electronic Methods of Inspection of Metals, Presented to Members of the A.S.M. During the Twenty-Eighth National Metal Congress and Exposition, Atlantic City, November 18–22, 1946. Med. 8vo. Pp. iii + 189, illustrated. 1947. Cleveland, O.: American Society for Metals, 7301 Euclid Ave. (\$3.50.)  
[Contents: H. F. Hamburg, "Electronic Methods for the Measurement of Strain in Metals"; J. L. Saunderson, "Spectrochemical Analysis of Metals and Alloys by Direct Intensity Measurement Methods"; R. S. Segsworth, "Uses of the DuMont Cyclograph for Testing of Metals"; E. O. Dixon, "Supersonic Methods of Metal Inspection"; C. M. Lichy, "Determination of Seams in Steel by Magnetic-Analysis Equipment"; C. S. Barrett, "The Electron Microscope and its Application to Metals"; H. T. Clark, "Electronics in Liquid Steel".]
- \***"Heat-Treater".** *Fundamental Principles and Applications of Induction Heating*. Demy 8vo. Pp. 147, with 104 illustrations. 1947. London: Chapman and Hall, Ltd. (10s. 6d. net.)

- \***Hepburn, J. R. I.** *The Metallization of Plastics*. Cr. 8vo. Pp. 71, with 4 plates and 8 figures in the text. 1947. London: Cleaver-Hume Press, Ltd. (6s. net.)
- \***Hérenghuel, J., and G. Chaudron.** *Structural Hardening of Aluminium-Zinc Solid Solution*. (Le Durcissement Structural de la Solution Solide Aluminium-Zinc.) Translated by G. J. Metcalfe. (Royal Aircraft Establishment, Farnborough, Hants. Library Translation No. 162.) Med. 4to. Pp. 8, with 17 figures. 1947. London: Ministry of Supply, Thames House, Millbank, S.W.1.  
[A reprint of an article in *Rev. Met.*, 1944, **41**, (2), 33-41; see *Met. Abs.*, 1947, **14**, 363.]
- \***High Duty Alloys, Ltd.** *Hiduminium Technical Data*. Demy 8vo. Pp. 62. 1947. Slough: High Duty Alloys, Ltd. (n.p.)
- Hood-Pearson Publications, Ltd.** *Electroplating and Metal Finishing*. Cr. 8vo. Pp. 48. London: The Company. (3s. 6d.)
- Hood-Pearson Publications, Ltd.** *The Colouring of Metals, Parts 1 and 2*. Cr. 8vo. Part 1, pp. 76; Part 2, pp. 72. 1946. London: The Company. (Each part, 3s. 6d.)
- \***Howe, James Lewis, and Staff of Baker and Co., Inc.** *Bibliography of the Platinum Metals, 1918-1930*. Imp. 8vo. Pp. 138. 1947. Newark, N.J.: Baker and Co., Inc., 113 Astor St. (\$5.00.)
- \***Hughes, Thomas P.** *Metals and Plastics: Production and Processing*. Med. 8vo. Pp. xiii + 373, with numerous illustrations. 1947. Chicago, Ill.: Irwin Farnham Publishing Co., 332 South Michigan Ave. (\$4.50.)
- International Trade Office.** *Industrial Reference Service*. Part XI. *Metals and Minerals*. [1946.] Washington, D.C.: Superintendent of Documents, Government Printing Office. (\$2.00.)
- \***Jacquesson, R.** *Recherches Récentes sur la Texture et les Produits Physiques et Mécaniques des Métaux Écrouis*. (Publications scientifiques et techniques du Ministère de l'Air, No. 199.) 27 × 18.5 cm. Pp. 106, with 55 figures. 1946. Paris: Gauthier-Villars et Cie. (120 francs.)  
[See *Met. Abs.*, 1947, **14**, 308.]
- Jarvis, E. G., and H. O. Jarvis.** *Facts for Foundrymen*. Sixth edition. Foolscap 8vo. Pp. 80. 1946. Buffalo: Niagara Falls Smelting and Refining Corporation. (\$1.00.)
- \***Johnson, F.** *Metal-Working and Heat-Treatment Manual*. Volume II.—*Alloy Steels, Cast Iron, and Non-Ferrous Metals*. Demy 8vo. Pp. 226, with 74 illustrations. [1947.] London: Paul Elek Publishers, Ltd., Diamond House, 37-38 Hatton Garden, E.C.1. (17s. 6d.)
- \***Joint Committee on Practical Training in the Electrical Engineering Industry.** *The Practical Training of Professional Electrical Engineers*. Post 8vo. Pp. 42. 1947. London: The Institution of Electrical Engineers, Savoy Place, W.C.2. (1s., post free.)  
[This report deals with the training of apprentices for the electrical industry. A scheme is suggested, including lectures and practical training. Instruction in pattern making, foundry work, machining, fitting, metal fabrication, working of metals, plastic moulding, rolling and drawing of non-ferrous metals, and light assembly is to be provided.]
- \***Kurrein, Max, and F. C. Lea.** *Cutting Tools for Metal Machining*. Second, revised edition. Med. 8vo. Pp. xii + 312, with 375 illustrations and 33 tables. 1947. London: Charles Griffin and Co., Ltd. (28s. 6d., post free.)

- Lányi, Béla.** *Electrochemistry.—I.* Pp. 232. 1946. Budapest: Mérnökök Nyomdája.
- Laurson, P. G., and W. J. Cox.** Edited by. *Mechanics of Materials.* Second edition. Demy 8vo. 1947. New York: John Wiley and Sons, Inc. (\$4.00); London: Chapman and Hall (24s.).
- \***Levasseur, Albert.** *L'Électrochimie et l'Électrometallurgie.* Sixième édition, revue et augmentée. 25 × 16 cm. Tome I.—*Électrolyse.* Pp. viii + 176, with 48 illustrations. Tome II.—*Fours électriques.* Pp. iv + 204, with 127 illustrations. 1947. Paris: Dunod. (Tome I, 280 francs; Tome II, 330 francs.)
- Li, K. C., and Chung Yu Wang.** *Tungsten.* Second edition. (American Chemical Society Monograph No. 94.) 24 × 15 cm. Pp. 430, with tables and illustrations. 1947. New York: Reinhold Publishing Corporation. (\$8.50.)
- \***Masi, I. Bartoli F.** *Conoscere l'acciaio.* (Quaderni Civiltà della Tecnica, I.) 23.5 × 17 cm. Pp. 94, illustrated. 1945. Milano: Poligono Società Editrice, Via Cesare Battisti 1. (Lire 350.)
- May, Earl Chapin.** *A Century of Silver.* Post 8vo. Pp. 400. New York: Robt. M. McBride and Company, 200 East 37th St. (\$3.50.)
- \***Mellon Institute.** *Post-War Research in Mellon Institute.* Demy 4to. Pp. 38, illustrated. 1947. Pittsburgh, Pa.: The Institute, 4400 Fifth Avenue. (n.p.)
- [The Mellon Institute is an endowed non-profit corporate body for conducting investigations on important problems in the pure and applied natural sciences, for training research workers, and for providing technical information adaptable to professional, public, and industrial advantage. This book describes the recent activities of the Institute in all branches of natural sciences, including: thermal-insulating materials, powder metallurgy, uses for waste pickle liquor, metal-joining methods, protective coatings, nickel compounds and catalysts, and research on magnesium.]
- Mersereau, Samuel Foster.** *Materials of Industry: Their Distribution and Production.* Fourth edition. Revised by Professors Calvin G. Reen and Kenneth L. Holderman. New York: McGraw-Hill Book Co., Inc. (\$2.80); London: McGraw-Hill Publishing Co., Ltd. (14s.).
- Metal Information Bureau.** *Quin's Metal Handbook and Statistics, 1946.* Pp. 424. 1946. London: The Bureau, 30 Jermyn Street, W.1. (12s. 6d.)
- Metal Information Bureau.** *The British Non-Ferrous Metals Directory.* London: The Bureau, 30 Jermyn Street, W.1. (5s., post free.)
- \***Miller, J. L.** *Modern Assembly Processes: Their Development and Control.* With a foreword by E. A. Watson. Second edition, revised. Demy 8vo. Pp. xii + 199, with 170 illustrations. 1946. London: Chapman and Hall, Ltd. (18s. net.)
- \***Moore, H. F., W. M. Murray, J. O. Almen, O. J. Horger, and Peter R. Kisting.** *Surface Stressing of Metals.* A Series of Five Educational Lectures on Effect of Surface Stressing Metals on Endurance under Repeated Loadings, Presented to Members of the A.S.M. During the Twenty-Seventh National Metal Congress and Exposition, Cleveland, February 4, 1946. Med. 8vo. Pp. [iv] + 197, with 140 illustrations. 1947. Cleveland, O.: American Society for Metals, 7301 Euclid Avenue. (\$3.50.)
- Moritz, H.** *Die Chemische Analyse.* Vol. 43. *Spektrochemische Betriebsanalyse. Praktische Ratschläge für die Ausführung spektrochemischer Analysen im Betriebslaboratorium.* Pp. 170, with 46 illustrations. 1946. Stuttgart: F. Enke-Verlag. (17 R.M. in brochure form; 18.50 R.M. bound.)



- Newton, Joseph.** *An Introduction to Metallurgy.* Med. 8vo. Pp. 642. 1947. New York: John Wiley and Sons, Inc. (\$5.00); London: Chapman and Hall (27s.).
- \***Ollard, E. A., and E. B. Smith.** *Handbook of Industrial Electroplating.* Demy 8vo. Pp. 287, with 97 illustrations. 1947. London: Iliffe and Sons, Ltd. (15s. net.)
- \***Parker, W. C.** *Investigation into Corrosion Problems at the Fulham Power Station.* [Mimeographed.] 4to. Pp. 76, illustrated, and with charts and diagrams. 1946. London: Metropolitan Borough of Fulham, Electricity Department.
- Petermann, R.** *Zur Chemie und Morphologie der Deckschichten bei Korrosionsversuchen mit Zink.* Pp. vi + 81, illustrated. 1946. Berne: Thèse, Bienne.
- \***Philips Industrial (Philips Lamps, Ltd.).** *Philips Resistance-Welding Handbook.* Demy 8vo. Pp. iv + 210, with 184 illustrations. 1947. London: Philips Industrial (Philips Lamps, Ltd.), Century House, Shaftesbury Avenue, W.C.2. (10s. 6d.)
- \***Phillips, F. C.** *An Introduction to Crystallography.* Demy 8vo. Pp. ix + 302, with 500 illustrations. 1947. London, New York, and Toronto: Longmans, Green and Co. (25s. net.)
- \***Pitaval, Robert.** *Histoire de l'Aluminium, Métal de la Victoire.* Med. 8vo. Pp. 207. Paris: Publications Minières et Métallurgiques, 86 rue Cardinet (17<sup>e</sup>). (300 francs; foreign price, 325 francs.)
- Portier, Henri.** *Le Tracé des Pièces de Fonderie en Alliages Légers et Ultra-Légers.* (Bulletins des Services Techniques du Ministère de l'Air, No. 109.) 1947. Paris: Gauthier-Villars et Cie. (200 francs.)
- Prescott, John.** *Applied Elasticity.* Post 8vo. Pp. vi + 672. 1947. New York: Dover Publications, Inc., 1780 Broadway. (\$3.95.)
- Rowley, Frank B., Millard H. Lajoy, and Einar T. Erickson.** *Vapour-Resistant Coatings for Structural Insulating Board.* (Engineering Experiment Station Bulletin No. 25.) Minneapolis, Minn.: University of Minnesota.
- \***Royal Aircraft Establishment.** *Hardness Tests in Protracted Heat on Various Aluminium Alloys.* (Warmdauerhärteprüfungen an Verschiedenen Aluminium-Legierungen.) (R.A.E. Translation No. 184.) 4to. Pp. 9, with 3 tables and 20 illustrations. 1947. London: The Ministry of Supply, Thames House, Millbank, S.W.1.  
[An article by W. Muller, translated by M. Squires, from *Aluminium*, 1943, 25, (1), 20-26; see *Met. Abs.*, 1947, 14, 171.]
- Ruf, J.** *Die Berechnung der Schwere- und Temperaturseigerung bei Flüssigen Zweistofflegierungen.* 4to. Pp. 47. Stuttgart: Technische Hochschule.
- Schneider, Stanislas.** *Préliminaires à l'Étude Statique des Matériaux de Construction Intéressant l'Aéronautique.* (Notes Techniques du Ministère de l'Air, No. 24.) 1947. Paris: Gauthier-Villars et Cie. (60 francs.)
- \***Scribner, Bourdon F., and William F. Meggers.** *Index to the Literature on Spectrochemical Analysis, Part II, 1940-1945.* Med. 8vo. Pp. iii + 180. 1947. Philadelphia, Pa.: American Society for Testing Materials, 1916 Race Street. (\$3.00.)
- Seely, Fred B.** *Resistance of Materials.* Third edition. Demy 8vo. Pp. 486. 1947. New York: John Wiley and Sons, Inc. (\$4.00); London: Chapman and Hall, Ltd. (24s.).

- \***Simoni, G.** *Conoscere l'alluminio.* (Quaderni Civili della tecnica, 4.) 23.5 × 17 cm. Pp. 99, illustrated. 1947. Milano: Poligono Società Editrice, via Cesare Battisti 1. (Lire 380.)
- \***Snoek, J. L.** *New Developments in Ferromagnetic Materials, with Introductory Chapters on the Statics and Dynamics of Ferromagnetism.* Post-1900 Pp. viii + 136, with 52 illustrations. 1947. New York and Amsterdam: Elsevier Publishing Co., Inc.: London: Cleaver-Hume Press, Ltd., 42a South Audley St., W.1. (13s. 6d. net.)
- \***Society for Experimental Stress Analysis.** *Proceedings of the Society for Experimental Stress Analysis.* Volume III, Number 2. Edited by C. Lipson and W. M. Murray. 4to. Pp. xvii + 166, with numerous illustrations. 1946. Cambridge, Mass.: Addison-Wesley Press, Inc., Kendal Sq. (\$6.00.)  
[Contents: J. H. Meier, "Improvements in Rosette Computer"; M. E. Merchant and N. Zlatin, "New Methods of Analysis of Machining Processes"; F. H. Boor and E. O. Stitz, "Stress Distribution in Spur Gear Teeth"; H. R. Lissner and E. S. Gurdjian, "A Study of the Mechanical Behaviour of the Skull and its Contents when Subject to Injuring Blows"; G. P. Tschebotarioff, "Use of Electric Resistivity Strain Gauges Over Long Periods of Time"; E. L. Kimble, "A Method of Effecting SR-4 Strain Gauge Operation Under Water"; C. R. Smith, "Bicycle Spokes—Their Use in Testing Aircraft Structures"; S. W. Poole and R. J. Johnson, "A Review of Some Mechanical Failures of Steel Plant Machine Equipment"; W. V. Bassett, H. Cromwell, and W. E. Wooster, "Improved Techniques and Devices for Stress Analysis with Resistance Wire Gauges"; G. C. Noll and C. Lipson, "Allowable Working Stresses"; G. Gerard, "Photogrid Strain Analysis of Formed Parts".]
- \***Spectrographic Discussion Group, Glasgow.** *Suggested Definitions of Terms Used in Spectrographic Analysis.* Med. 8vo. Pp. 11. 1946. Aberdeen: The University Press. (Gratis.)
- Staub, M.** *Recherches sur la Corrosion des Métaux par le chloroforme et le tétrachlorure de carbone.* (Thèse d'ingénieur-docteur.) Pp. 55, illustrated. 1946. Paris: Université de Paris.
- \***Telford, Arthur C.** *Dictionary of Machine-Shop Terms.* 5½ × 3 in. Pp. [vi] + 292. 1946. Chicago, Ill.: American Technical Society; London: Technical Press, Ltd., Gloucester Rd., Kingston Hill, Surrey. (5s. net.)
- \***Temple, J. E.** *Handbook of Structural Design in the Aluminium Alloys.* Demy 8vo. Pp. 147, illustrated. 1947. Birmingham: James Booth and Company, Ltd. (21s.)
- \***Thorpe's Dictionary of Applied Chemistry.** Fourth edition (revised and enlarged). Vol. VIII.—*Metal—Oils, Essential.* With an index by J. N. Goldsmith. Med. 8vo. Pp. viii + 679, with numerous illustrations. 1947. London, New York, and Toronto: Longmans, Green and Co., Ltd. (80s. net.)
- \***Vivian, A. C.** *Essential Metallurgy for Engineers: the Causes and Control of Metallic Properties.* With an Introductory Preface by Professor R. S. Hutton. Second edition. Demy 8vo. Pp. xi + 155, with 33 illustrations. 1945. London: Sir Isaac Pitman and Sons, Ltd. (8s. 6d. net.)
- Wampler, Rollin H.** *Modern Organic Finishes.* Pp. 452, illustrated. 1946. New York: Chemical Publishing Co., Inc. (\$8.50.)
- Watford Building Research Station.** *Some References to the Structural Uses of Aluminium.* 1946. Watford: The Research Station.
- Werner, E.** *Metallische Überzüge auf Elektrolytischem und Chemischem Wege und das Färben der Metalle.* Third, enlarged edition. Pp. 187, with 85 illustrations. 1946. Munich: Carl Hanser-Verlag.

- \*Wredden, J. H. *The Microscope: its Theory and Applications*. With an Introduction by W. E. Watson-Baker. Roy. 8vo. Pp. 296, with 298 illustrations. 1947. London: J. and A. Churchill, Ltd. (21s.)
- Don M., Horace Russell, Jr., and Clifford S. Garner. *The Rare-Earth Elements and their Compounds*. Med. 8vo. Pp. ix + 92, with 9 illustrations. 1947. New York: John Wiley and Sons, Inc. (\$2.50); London: Chapman and Hall, Ltd. (15s. net).

### NEW JOURNALS

- Instrument Practice.** Covers the whole field of instrument technology and instrumentation. Published monthly by United Trades Press, Ltd., 24 Bride Lane, Fleet Street, London, E.C.4. First issue published in November 1946. (30s. per annum.)
- Metalen.** Published monthly [in Dutch]. Administrative Office, Scheepmakersstraat 1-3, Den Haag, Holland. First issue published 15 September 1946. (f. 10.50 per annum.)
- Metallforschung.** Contains original contributions on metallurgy, metallography, &c. Published monthly by Dr. Riederer Verlag, Stuttgart; edited by G. Masing, E. Scheil, and G. Wasserman. First issue published in July 1946. (9 R.M. per quarter.)

### XXV.—BOOK REVIEWS

**Practical Metallurgy, Applied Physical Metallurgy, and the Industrial Processing of Ferrous and Non-Ferrous Metals and Alloys.** By Georg Sachs and Kent R. Van Horn. Med. 8vo. Fifth printing. Pp. [xii] + 567, with 335 figures in the text and numerous constitutional diagrams. 1946. Cleveland, O.: American Society for Metals. (\$5.00.)

There was a time, perhaps as recent as the later years of the eighteenth century, when a man might aspire to take all knowledge as his province; and if he had received a good education and was of a studious habit, he might justly expect to succeed. But those days are gone; and in these times nobody could even attempt to know everything, though he were to restrict himself to a single subject. As with men, so with books. When knowledge was scantier than it is to-day, a single book might set out to embrace a whole subject, and in the attempt might present all that could reasonably be expected. None, at the time of its appearance, could have quarrelled with "De Re Metallica" on the score of inadequacy; or, three hundred years later, with Percy's "Metallurgy". Coming still nearer our day, the standard work on "Metallography", when first it appeared in 1908, could cover, in an adequate manner, the field of knowledge as it then existed. In the 1940's it is doubtful whether any single book can be expected to deal satisfactorily with "metallurgy".

The degree by which metallurgical science has expanded; the extent to which it has inspired research and publication; the use it has made of physical and chemical discoveries; have brought metallurgy, as a subject, to dimensions that are almost frightening. Such advances have only been achieved by dividing the subject into a number of parts, none of them necessarily tied to any particular metal, on each of which many specialists have laboured. Metallographic studies have advanced in their own manner; mechanical metallurgy and production metallurgy have advanced with giant's strides, none proceeding independently, but all concurrently. In each branch of the subject, the process of probing and delving has gone on at a furious pace; and sufficient knowledge has emerged to justify a library of books, each written by a specialist dealing with one or other part of the enormous territory that has been cultivated. So considerable is the accumulation of results and discoveries that the regular appearance of monographs on separate topics seems the only way in which metallurgical knowledge can now be effectively presented.

Such are some of the thoughts engendered by a consideration of the latest printing of "Practical Metallurgy" by Drs. Sachs and Van Horn. Given the task of covering such a title, it is doubtful whether any would be likely to do better than these gifted compilers. Nevertheless, the result is an exasperating book; and the reader is constantly torn between



admiration of the enormous amount of information provided, a disappointment at what is not to be found. Doubtless, this is the consequence of covering such a large syllabus, resulting occasionally in a treatment of some or other topic that is almost apologetic in its brevity, though not in its illumination. There is a wealth of good things in this volume and no student of metallurgy should ignore it. Preferably he will have it available for ready reference and will find himself consulting it time after time. Occasionally he may be misled by one, and reads if he leaves the matter as he finds it in this book; but more probably he will be stimulated to look further into the topic that interests him, and will be helped to do so by the voluminous references to original work provided page by page. Regarded as an introduction, this book can be of immense help in guiding the enquirer towards metallurgical truth. If it turns the seeking mind towards more specialized, detailed, or complete treatments, it will have justified itself.

That this book is to be commended goes without saying, but the appearance of a further reprinting calls for at least two particular comments. The first is that in certain respects the book is now almost out of date; or perhaps it would be fairer to say that gaps in the information provided are rather noticeable because of the numerous developments that have occurred since the book was written. This work, in its particular subject, is encyclopædic in outlook; and few things date so rapidly as an encyclopædia. The time seems ripe for something more than a reprinting, and it is earnestly suggested that a revision is now appropriate. If such were undertaken, the second point calling for comment, and which has always been noticeable about this book, might receive the attention it warrants. The illustrations are numerous and in many respects admirable, but many of them are too small, and some of them are virtually useless in consequence. This comment is particularly applicable to photographs of processes and plant; in fact one almost feels that some of them were originally made with the specific intention of hiding anything that might yield information. Surely the authors, with their obviously wide contacts, could have provided something better. Another matter on the illustrations that calls for remark is the frequent absence of dimensions, or of a human figure to act as a standard of reference. To the initiated, such aids may be unnecessary; but surely the book is not intended to be read only by those already well informed. This same assumption of prior knowledge could be urged against some of the diagrams intended to illustrate processes; and it cannot be pressed too strongly that, in any new edition of this book, the whole subject of illustration should receive particular attention.—LESLIE AITCHISON.

**Cutting Tools for Metal Machining.** Second, revised edition. By Max Kurrein and F. C. Lea. Med. 8vo. Pp. xii + 312, with 375 illustrations and 33 tables. 1947. London: Charles Griffin and Co., Ltd. (28s. 6d., post free.)

The first edition of this book appeared in 1940. The objects remain the same as originally, namely to gather together in one volume the most important information regarding cutting speeds and the forces on modern tools; to provide those responsible for workshop practice, as well as designers, with an appreciation of the measurable quantitative values involved, to give guidance on the best methods of tooling for production; and to meet the need for a text book for teachers and students of the science and practice of the workshop.

The subject is dealt with in sixteen chapters. The first chapter, "Elements of the Tool", gives definitions and describes the measurement of tool angles, cutting forces and speeds, cooling, and lubrication. Succeeding chapters deal with "Materials for Tools", "Classification of Cutting Tools", and there is a series of chapters each devoted to a single type of tool, e.g. turning and boring tools, drills, reamers, and milling cutters. Chapters XII, XIII, and XIV are concerned with tool grinding, grinding wheels and grinding machines, lapping, and honing. Chapter XV, of only five pages, deals sketchily with surface finish and its measurement, but an appendix, "Finishing Cutting Tools", takes the subject further with an account of recent original work on a broad finishing tool. The final chapter, XVI, is entitled "Tool Hardening".

The chapter headings show that a surprising range has been covered within the 312-pages compass of the book. Inevitably, some of the sections suffer from the limitation of space, and it might have been more useful to expand the more advanced sections, e.g. on thread-grinding tools, at the expense of the rather full treatment of elementary points on angle measurements and the like, with which most of the readers of this book will be already acquainted.

The book is clearly a text book for mechanical engineers, and a metallurgist reviewing it has different interests from the majority of those for whom it is intended. The present reviewer looked without success for any systematic account of the influence of the material being cut upon the selection of the form of tool. Where reference is made to non-ferrous materials the identification is of the vaguest description: "aluminium" is used indifferently for the pure metal and its alloys. The reproductions of photomicrographs as half-tone illustrations on ordinary paper are unsatisfactory in many cases.

The chapter entitled "Tool Hardening" is weak. The authors wisely refer the student to "standard text books on metallurgy", and it would have been better to leave it at that and not to embark on an explanation of "certain points that are fundamental to the subject". In the course of this section the terms "phase" and "solution" are used in senses which could

only confuse the student seeking to understand the metallurgical aspects of tool steel. Examples are: "the structure of . . ."; "Pearlite is the eutectoid solution, composed of  $\alpha$ -iron and diagram) is called a *whole* phase is composed of cementite and pearlite. . . ."

These are fair to over-emphasize their importance in relation to the book as a whole. As it would on the mechanics of cutting processes and modern practice in the application of a *mag* tools, the book should be valuable to those teachers and students who have felt the need for a more comprehensive treatise than has hitherto been available.—A. J. MURPHY.

**Metallic Corrosion, Passivity, and Protection.** Second edition. By Ulick R. Evans. With an Appendix by A. B. Winterbottom. Med. 8vo. Pp. xxxiv + 863, with 144 illustrations. 1946. London: Edward Arnold and Co. (50s.)

No one who is interested in the production, fabrication, or uses of metals will need to be reminded of the economic importance of corrosion. It has increasingly come to be realized that the subject is amenable to scientific study, and that this can lead to advances not only in the field of pure science but in the efficient use of metals. Research on corrosion can yield large dividends in the economic as well as in the academic sphere.

Dr. Evans, who has made great contributions to advances in our knowledge of corrosion, continues in the second edition of his well known book the task of presenting and interpreting the accumulated contributions of many workers. The increasing number of these is illustrated by the inclusion in the new edition of references to the work of 1155 new authors! The general treatment adopted has naturally been influenced by Dr. Evans's own work, but a critical survey is given of researches in other laboratories. The Introduction, dealing with "Principles of Electrochemistry", presents a readable and lucid summary of the electrochemical concepts necessary for a proper study of corrosion. An Appendix by Mr. A. B. Winterbottom gives an authoritative account of optical methods for the determination of films on metals, based on polarization and interference phenomena.

The book includes fourteen chapters with these titles: simple examples of corrosion and passivity; study of thin films; oxidation at high temperatures; corrosion in moist or polluted atmospheres; corrosion not involving the absorption of oxygen; corrosion of ferrous materials involving the absorption of oxygen; corrosion of non-ferrous metals involving the absorption of oxygen; influence of stress, strain, and structure; influence of contacts and crevices; protection by inhibitive treatment of water; protection by chemical and electrochemical treatment; protection by paints and enamels; protection by metallic coatings; and testing. Each chapter is divided into sections (A), (B), and (C) as in the earlier edition, dealing respectively with "The Scientific Basis", "Practical Problems", and "Quantitative Treatment".

The advantages of segregating in section (B) an account of the more practical aspects of a topic are illustrated by the excellent review (pp. 375-384) of the corrosion of condenser tubes. In Chapter VIII a most readable account is given of the phenomena of intergranular corrosion and of corrosion fatigue.

Since the subject matter of the book is arranged according to the type of corrosive environment or to the methods of protection, the treatment of individual metals is distributed throughout all the chapters. A summary of the behaviour of typical non-ferrous metals in water and aqueous solutions is, however, given in Chapter VII, including a comprehensive account of "Non-Ferrous Metals in Contact with Water and Food" (pp. 388-410). The underlying principles and the practical application of protective methods are clearly and authoritatively discussed in Chapters X-XIII. The final chapter gives a brief survey of methods of testing, including in section (C) a stimulating and welcome account of the principles of statistics as applied to corrosion testing.

Although the text is considerably longer than the previous edition (xxxiv + 863 pp., compared with xxiii + 720 pp.), the book is easier to handle owing to the use of thinner paper. The author and the publishers are to be congratulated on the production of this valuable text book and work of reference.—F. WORMWELL.

**The Electron Microscope. An Introduction to its Fundamental Principles and Applications.** Second, revised and enlarged edition. By E. F. Burton and W. H. Kohl. 23 × 16 cm. Pp. 325. 1946. New York: Reinhold Publishing Corporation. (\$4.00.)

The possibilities offered by electron microscopy are very great, and have undoubtedly not yet been fully appreciated in this country. The present reviewer is, therefore, most glad to welcome a second edition of this book, which offers an easy and elementary approach to the underlying principles of the new methods. In the first 250 pages of the book, the reader is led gradually from the most elementary optics, electricity, and magnetism to the principles underlying the electrostatic and magnetic electron microscopes. The description is elementary, and should be followed by a schoolboy of Higher Certificate standard. The presentation is

extremely clear, and the authors are to be congratulated on the way in which the elementary reader is led from the simplest concepts to an understanding of what is involved by electron microscopy. This part of the book can be whole-heartedly welcomed for those readers who require a really elementary approach to the subject.

The last 46 pages of the book deal with applications of the method, and are less satisfactory. Many photographs—only two refer to metals—are reproduced, and are described briefly, and often with quotations from the original papers of others. This results in the introduction of many technical terms which will be meaningless to the reader for whom the earlier pages are intended. The authors seem in fact to have changed suddenly from a book intended for the general elementary reader to one addressed to specialists in different branches of science. The book concludes with a very comprehensive *bibliography* of several hundred books and papers dealing with electron microscopy in one form or another. This will be of great value, but it is to be hoped that in the next edition the authors will indicate which papers are suitable for the elementary reader to whom their earlier pages are addressed.—W. HUME-ROTHERY.

**Metals and Plastics: Production and Processing.** By Thomas P. Hughes. Med. 8vo. Pp. xiv + 373, with numerous illustrations. 1947. Chicago, Ill.: Irwin Farnham Publishing Co., 332 South Michigan Ave. (\$4.50.)

This is a well produced and well illustrated volume written for engineering students, with the professed aim of giving them a knowledge of the characteristics of the raw materials—metals and plastics—which they will need to use in the practice of their vocation. In its title and aim the book is, however, more ambitious than in its achievement. Essentially, the author has followed the pattern of many conventional elementary text books on "metallurgy for engineers" and has included, almost as an afterthought, just 20 pages on plastics. It would be pleasing to be able to report that the volume is a well balanced, freshly written account of ferrous and non-ferrous process and physical metallurgy; but in fact the matter is, in general, poorly selected, and the treatment is dull, often slipshod, and sometimes obscure and misleading. The chapters on equilibrium diagrams and the iron-iron carbide diagram are so clumsily set out that any uninstructed reader would undoubtedly be in a state of complete bewilderment after reading them; and there are a number of serious mistakes. Thus, the illustration of a typical solid-solution diagram with superimposed cooling curves is fundamentally in error, and is calculated to mislead the most painstaking student. The best parts of the book are those dealing with mechanical working and welding; these include some good photographs of modern equipment.—J. C. CHASTON.

**The Metallization of Plastics.** By J. R. I. Hepburn. Cr. 8vo. Pp. 71, with 4 plates and 8 figures in the text. 1947. London: Cleaver-Hume Press, Ltd. (6s. net.)

This monograph contains a very brief account of the processes—deposition from solution, metal spraying, sputtering, and evaporation—which are said to have been employed for applying metal deposits to the surface of plastics. Unfortunately, the details of equipment or of operation which are given are extremely meagre and far from up to date, and are likely to be more misleading than helpful. A surprising omission is the absence of any account of the application of these methods for metallizing plastics. The normal methods of applying coatings to metals or glass are alone described; and the reader will look in vain for guidance on the choice of method for any given plastic or for advice on special precautions which may be necessary in operation.—J. C. CHASTON.

**The Microscope: Its Theory and Applications.** By J. H. Wredden. With an Historical Introduction by W. E. Watson-Baker. Roy. 8vo. Pp. xxiv + 296, with 298 illustrations. 1947. London: J. and A. Churchill, Ltd. (21s.)

This is a clearly written elementary introduction to the use of the microscope. After a short historical introduction, by W. E. Watson-Baker, there are two chapters on elementary optics and on the general construction of the compound microscope, after which the various components are considered in detail in separate chapters. The author is concerned with the use of the microscope in a works laboratory and includes in the last chapter notes on a few special techniques which he has developed for examining electrical insulating materials. The volume deals only with the standard forms of microscope using transmitted illumination; the metallurgical microscope is not considered.—J. C. CHASTON.

**Handbook of Structural Design in the Aluminium Alloys.** By J. E. Temple. Demy 8vo. Pp. 147, illustrated. 1947. Birmingham: James Booth and Co., Ltd., Argyle Street Works, Nechells. (21s.)

Quite frankly, your present reviewer does not feel altogether competent to comment in detail on the matter contained in this Handbook. As the publishers point out, it is intended for engineers and architects, and the metallurgy is quite incidental. However, designer



colleagues are enthusiastic, and welcome the Handbook as a blessing to those involved in designing in light alloys.

The contents include a short introductory section on alloys available, their properties, and methods of fabrication. This is followed by the main part of the book, which covers structures, from simple bending and torsion through design of sections, struts, plates, and riveted joints to compound structures. The material is treated on the assumption that the reader is familiar with the design of steel structures, special emphasis being placed on the difference between these and light-alloy structures. It is interesting to note that Mr. Temple's theoretical deductions have recently been confirmed by Professor Baker's experimental work at Cambridge, results of which are included in the Handbook.

There is little doubt that the publication of this Handbook is most timely and should assist those engaged in applying light alloys to this very wide branch of engineering.

Designer friends consider the lay-out to be refreshingly straightforward and information readily accessible, despite the absence of an index.—W. K. B. MARSHALL.

**Heat-Treating Aluminium Alloys.** [Loose Leaf.] Demy 8vo. Pp. 144, illustrated. 1946. Louisville, Ky.: Reynolds Metal Co., Inc. (\$1.00); **Finishes for Aluminium (Section One).** [Loose Leaf.] Demy 8vo. Pp. 108, illustrated. 1947. Louisville, Ky.: Reynolds Metal Co., Inc. (\$2.00); **Finishes for Aluminium (Section Two).** [Loose Leaf.] Demy 8vo. Pp. 125. 1946. Louisville, Ky.: Reynolds Metal Co., Inc. (\$1.00); **Welding Aluminium and its Alloys.** [Loose Leaf.] Demy 8vo. Pp. 90, illustrated. 1946. Louisville, Ky.: Reynolds Metal Co., Inc. (\$1.00.)

The publishers have considered, quite correctly, that some knowledge of metallurgy is desirable for a proper appreciation of the various heat-treatment processes applied to aluminium alloys. In the initial part of their book on this subject they have, therefore, attempted to impart to the reader this essential metallurgy. The present reviewer finds it difficult to say definitely whether or not this attempt has been successful; whether or not in this case the process has been taken too far. However, allowing for necessary "popularization" of the presentation, the metallurgy is sound, and in any case the authors are to be congratulated on making a move in the right direction. The remainder of the booklet deals with the practice of heat-treatment, including, principally, annealing, solution and precipitation treatments, and the various types of equipment required. A defect is perhaps the constant reference to specification and proprietary alloys without giving compositions. Altogether, however, the booklet is a useful addition to those on this subject.

The booklets on "Finishes for Aluminium" are likely to be of interest to those engaged in using aluminium and its alloys in the multitude of new applications which have arisen since the end of the war. A bewildering number of treatments—including straight cleaning, mechanical, chemical, electrolytic, electroplated, organic, and inorganic finishes—are described, but, owing to somewhat uncritical presentation, the reader might find difficulty in choosing that most suited to his particular application. Section I describes the processes in a general way, while Section II gives comprehensive practical details. There is extensive reference to proprietary materials, but this does not detract seriously from the usefulness of the manuals.

The booklet on "Welding Aluminium and Aluminium Alloys" is perhaps a little more comprehensive than the average trade publication on aluminium welding in that it includes references to inert-gas-shielded arc welding, flash welding, and furnace brazing in addition to the more usual gas and metallic-arc, carbon-arc, and spot welding. It is strange, however, to find such praise for notched edges as a preparation for gas welding. This method of preparation is now no longer considered necessary in this country. Some confusion is caused by the failure to associate odd illustrations with the text in their immediate vicinity, but otherwise the subject is quite well presented.—W. K. B. MARSHALL.

**Philips Resistance-Welding Handbook.** Demy 8vo. Pp. iv + 210, with 184 figures. [1946.] London: Philips Industrial (Philips Lamps, Ltd.), Century House, Shaftesbury Ave., W.C.2. (10s. 6d.)

This book has been written to help the user of resistance-welding processes. It is essentially practical, although there is a useful proportion of supporting theory. The scope of the book covers the construction and principles of spot-, projection-, seam-, flash-, and butt-welding machines; applications of the processes (with special emphasis, of course, on steel and light metals); and certain specialist sections on subjects such as the metallurgy of resistance welding, timers, electron-tube control, electrodes, and production planning. Much of the text is anonymous, but there are some useful contributions from well known authorities, including Sinclair, Simmie, Hipperson, Higgins, and Tucker. In certain sections there are faint suspicions of special pleading, but these never obtrude: rival equipment and processes are given a fair hearing. Altogether the book serves a useful function in gathering together the various aspects of resistance welding. It is, incidentally, very well produced, although an index would have improved its usefulness.—W. K. B. MARSHALL.

