# METALLURGICAL ABSTRACTS

(GENERAL AND NON-FERROUS)

# Volume 1

L

190

1h

and y

dia i

11

「日日の

Ŀ

107

-

÷.

3

sð,

٥.

.

# FEBRUARY 1934

Part 2

# I.-PROPERTIES OF METALS

(Continued from pp. 2-6.)

Aluminium: Resistance to Corrosion and Use of the Metal in the Chemical Industry. Am. Matagrin (*Rev. Chim. Ind.*, 1933, 42, 66-72, 99-102, 128-132).—A review, discussing corrosion-resistance, foundry practice, rolling, soldering, drawing, uses in the dairy, brewing, rubber and chemical industries, and protection by anodic oxidation.—E. S. H.

**†Has Aluminium a Transformation Point?** O. Tiedemann (Metallwirtschaft, 1933, 12, 669–671).—T. has previously described (see J. Inst. Metals, 1926, 35, 540) phenomena in aluminium which point to the existence of a transformation point; up to the present no satisfactory explanation of these has been advanced, nor have they been contradicted. The fact that the temperature curve for a number of properties shows no inflection is no indication of the absence of a transformation. The literature on transformations in zine and cadmium is discussed...-v. G.

**†On Investigations of the Alleged Allotropy of Aluminium.** A. Schulze (*Metallwirtschaft*, 1933, 12, 667-669).—A review of articles published on this subject to date leads to the conclusion that aluminium has no transformation point and that observed irregularities in the temperature curves of various properties are due to the effects of impurities.—v. G.

Amorphous-Crystalline Transformation of Arsenic and Antimony. G. R. Levi and D. Ghiron (Atti R. Accad. Lincei Rend., 1933, [vi], 17, 565-569; Chem. Zentr., 1933, 104, II, 3082).—The conversion of amorphous antimony into the crystalline form is accelerated by such catalysts as hydrochloric acid and hydriodic acid; there is no definite transformation temperature, but the change can occur at 180° C., although 270° C. was previously thought to be the minimum temperature. Reduction of antimony chloride to metal invariably yields the amorphous form, whereas reduction of other salts in the absence of chlorides yields the crystalline form. Rapid heating of the amorphous form causes the change to occur explosively, but explosion may be avoided by prolonged heating at low temperatures.—A. R. P.

\*On a Polymorphic Transformation of Calcium. A. Schulze and H. Schulte-Overberg (*Metallwirtschaft*, 1933, 12, 633-635).—Thermal, electrical, and dilatometric tests on calcium containing 4.6% of impurities, including carbon, oxygen, a trace of iron, and 1.7% nitrogen, indicate the existence of a transformation at  $430^{\circ}-450^{\circ}$  C. accompanied by a heat evolution of  $2.3 \pm 0.3$ cal./grm.—v. G.

\*X-Ray Investigations on Calcium at High Temperatures. L. Graf (Metallwirtschaft, 1933, 12, 649–653).—X-ray examination of the calcium used by Schulze and Schulte-Overberg (cf. preceding abstract) showed that the metal is face-centred cubic at low temperatures (a = 5.56 A. at 20° C.) and body-centred cubic above 450° C. (a = 4.43 A. at 480° C.). The recrystallization temperature of cold-worked calcium is about 350° C.—v. G.

\*Measurements on Contact Potential Difference between Different Faces of Copper Single Crystals. Bernhard A. Rose (*Phys. Rev.*, 1933, [ii], 44, 585– 588) Cf. J. Inst. Metals, 1933, 53, 482. The contact p.d. between (111)

F

<sup>\*</sup> Denotes a paper describing the results of original research.

<sup>†</sup> Denotes a first-class critical review.

and (100) faces of single crystals of copper has been measured at different stages of a thorough outgassing treatment. The first effect of outgassing is to reduce the surface gas layer to a thickness at which it has a definite crystal structure related to that of the underlying copper. Although further treatment removes the residual gas, it also produces new crystal facets by evaporation of copper, so that a true final state cannot be obtained. The results indicate that the contact p.d. between the above two faces is at least 0.384 v., and is probably greater than 0.463 v. These values are much greater than was expected for a symmetrical cubic crystal. For polycrystalline copper the contact p.d. between the plates falls to only 0.01 v. after outgassing.

-W. H.-R.

The Formation of Oxide Films on Gold and Iron. William James Shutt and Arthur Walton (Trans. Faraday Soc., 1933, 29, 1209-1216) .- The passivation of gold by treatment with alkalis is explained, on the basis of the oxide film theory of passivity, by the interaction of the gold with the solution to form a layer of gold oxide which can be rendered fully passive by subsequent anodic treatment. The chemical reaction by which the oxide film is formed results in the liberation of hydrogen which is adsorbed on the gold; when the passivated metal is treated with dilute hydrochloric acid, the oxide film dissolves, but the hydrogen remains adsorbed and, if sufficient is present, prevents further action of alkalis. If oxidizing agents, such as hypochlorite, are added to solutions in which the oxide film is formed, no hydrogen is adsorbed, and the loss in weight on treating the passive metal with hydrochloric acid corresponds closely with that expected by the formation of a monomolecular layer of gold oxide. No film can be detected in solutions of low hydroxyl-ion concentration containing oxidizing agents, such as concentrated nitric acid or acidified permanganate solution, probably owing to the removal of adsorbed hydrogen and the slowness of the formation of gold oxide. In acid solutions the potential of an electrode containing adsorbed hydrogen falls with increasing  $p_{\rm H}$  more rapidly than that of an electrode from which the hydrogen has been removed by chlorine, but in alkaline solution the potentials are the same, since more adsorbed hydrogen is readily produced.—A. R. P.

\*Study of the Electrical Properties of Thin Films of Platinum Obtained by Cathodic Pulverization in Simple Gases. André Féry (J. Phys. Radium, 1933, [vii], 4, 301-315).—Films of platinum formed by cathodic discharge in helium, oxygen, nitrogen, and hydrogen are not characterized by definite properties. They absorb the gas present in the discharge tube. At room temperature the electrical resistance of the films diminishes after their formation; it decreases further on heating, and gas is evolved simultaneously. Ordinary platinum is not obtained even after heating at  $500^{\circ}$  C.—E. S. H.

\*On the Nature of the Spontaneous Separation of Polonium on Silver in Various Acids. Otto Erbacher (Z. physikal. Chem., 1933, [A], 165, 421–426).— The phenomena associated with the spontaneous separation of polonium on silver can be explained by the following two assumptions: (a) an electrochemical exchange of the silver atoms with the more noble polonium ions, (b) formation of a solid solution of polonium in the silver peroxide film produced by the ozone formed by the action of the  $\alpha$ -rays emitted from the polonium.

-B. Bl.

Some Properties and Uses of Rhenium (Dvi-Manganese). J. G. F. Druce (Indust. Chemist, 1933, 9, 244).—A review of published work.—E. S. H.

The Atomic Mass of Sodium. II.—The Sodium Chloride-Silver Ratio. Clyde R. Johnson (*J. Phys. Chem.*, 1933, 37, 923–933).—Five determinations of the sodium chloride : silver chloride ratio gave the value 22.994 for the atomic mass of sodium.—J. S. G. T. \*Mechanical Properties of Electrolytic Zinc Sheets. O. Bauer and J. Weerts [with F. Beck] (*Metallwirtschaft*, 1933, 12, 615-618).—Tensile and bending tests have been made on various types of zinc sheet at temperatures between  $-80^{\circ}$  C. and  $+220^{\circ}$  C. The sheets are anisotropic, the tensile strength in the direction of rolling being about  $10^{\circ}_{\circ}$  less, and the elongation and bending strength about  $30-50^{\circ}_{\circ}$  greater than in the transverse direction. The elongation falls rapidly below  $20^{\circ}$  C. and the bending strength below  $40^{\circ}$  C. Up to  $0.06^{\circ}_{\circ}$  of impurity (lead, iron, copper, cadmium) found in commercial electrolytic zinc have no appreciable effect on the mechanical properties of hot-rolled sheet. A grade of zinc with  $0.90^{\circ}_{\circ}$  lead showed a tensile strength about  $25^{\circ}_{\circ}$  greater than that of electrolytic zinc, but the elongation and bending strength were much lower; the effect of temperature on this material was similar to that on the other grades of zinc tested.—v. G.

†Impurities in Commercial Zinc. Werner Fröhlich (Met. Ind. (Lond.), 1933, 43, 559-560, 589-590).-The chief impurities in commercial brands of primary zinc are cadmium, lead, and iron, whilst tin, copper, antimony, arsenic, and aluminium may also be present in remelted zinc. Cadmium causes considerable increase in hardness, brittleness, and hot shortness; the maximum permissible amount is 0.25% for rolling and 0.1-0.75% for galvanizing, according to whether much or little bending is to be imposed. Cadmium is sometimes added to improve the fluidity of the bath. Lead is relatively harmless, and tends to increase the softness and ductility of coatings and to neutralize the effect of cadmium; rolling zinc may contain 1.25 and galvanizing zinc 0.3-0.5%. It also increases the weathering resistance of zinc. More than 0.015% of iron makes zinc too hard and brittle for rolling; large amounts increase the amount of dross and ashes in the galvanizing bath and lower the acid corrosion-resistance of zinc. Tin is rarely present, but up to 0.75% tends to produce brighter and smoother coatings. Rolling zinc should not contain more than 0.15% of copper and galvanizing zinc not more than 0.2%, larger amounts in the latter causing a yellow sheen. All kinds of zinc should contain as little arsenic and antimony as possible (not more than 0.1%), and galvanizing zinc not more than 0.01% of aluminium.—J. H. W.

**Creep of Metals.** J. Neill Greenwood (*Modern Eng.*, 1933, 7, 322–324).— A brief survey of creep phenomena and their investigation.—H. W. G. H.

Modern Researches on the Properties of Engineering Materials. J. Neill Greenwood (*Modern Eng.*, 1933, 7, 243-248 and 277-281).—A review of present knowledge of the fatigue, corrosion-fatigue, and creep properties of materials, steels in particular, is followed by a discussion of its application to the problem of design. Reference is made principally to the work of Gough, Haigh, and McAdam.—H. W. G. H.

**Thermal Effects in Elastic and Plastic Deformation.** M. F. Sayre (*Proc. Amer. Soc. Test. Mat.*, 1932, 32, (11), 584-592; discussion, 593-606).—See J. Inst. Metals, 1932, 50, 468. The discussion, in which A. Nadai, L. B. Tuckerman, and M. F. Sayre took part, deals chiefly with the testing of steel proving rings for thermal creep.—A. R. P.

Elasticity, Plasticity, Toughness, Brittleness, and Hardness. M. Ros and A. Eichinger (Assoc. Internat. Essai Mat., Congres de Zürich, 1932, (II), 530-543).—[In German.] See J. Inst. Metals, 1931, 47, 473.—S. G.

Relations between Elasticity and Plasticity, Toughness and Brittleness. Practical Means of Characterizing Them. P. Regnauld (Assoc. Internat. Essai Mat., Congres de Zürich, 1932, (II), 544–547).—[In French.] See J. Inst. Metals, 1931, 47, 473.—S. G.

Elasticity and Plasticity, Tenacity and Fragility. G. Sachs (Assoc. Internat. Essai Mat., Congres de Zürich, 1932, (II), 548–554).—[In German.] See J. Inst. Metals, 1931, 47, 473.—S. G.

-

March 1

inite -

tal for

Terra .

CES No

ER -

「日日

1

121

in a

匾

10

1

110

1

1

0

2

ME

2

14

-

2

ġ,

ġ,

Į,

Ideal and Practical (Test) Relation between Elasticity, Plasticity, Tenacity, and Brittleness. F. B. Seely (Assoc. Internat. Essai Mat., Congrès de Zürich, 1932, (II), 555-559).—[In English.] See J. Inst. Metals, 1931, 47, 474.—S. G.

Fundamental and Practical (Test) Connection between Elasticity and Flasticity, Tenacity and Brittleness. A. Schob (Assoc. Internat. Essai Mat., Congrès de Zürich, 1932, (II), 560-566).—[In German.] See J. Inst. Metals, 1931, 47, 474.—S. G.

On the Relation Existing between Elasticity, Plasticity, Tenacity, and Brittleness. Suggestion in Regard to a Measurement for Tenacity under a Static Load. Ph. Theodorides (Assoc. Internat. Essai Mat., Congrès de Zurich, 1932, (II), 567-570).—[In German.] Standard definitions of the terms elasticity, plasticity, tenacity, and brittleness are suggested and discussed. It is proposed that the determination of elastic limit be replaced by the determination of the lower limit of plasticity. Tenacity should be defined as the capacity of a material for plastic deformation under increasing forces and should be measured by determining the ratio of two work-values under a static load. ——A. R. P.

**Discussion** [on Elasticity, Plasticity, &c.] M. Spindel. W. Rutgers. J. Basta. M. Ros. P. Santo Rini. W. Rosenhain. H. Fromm. H. Rabozée. A. Mesnager. W. Tafel (Assoc. Internat. Essai Mat., Congrès de Zurich, 1932, (11), 574-584).—[In English, French, or German.] The discussion deals with the necessity of standardizing the methods of determining the various plastic and elastic properties of metals and with the need for internationally accepted definitions of these properties.—A. R. P.

Remarks on a Theorem of Conservation in the Theory of Metals. F. Bloch (J. Phys. Radium, 1933, [vii], 4, 486–491).—Theoretical.—E. S. H.

<sup>†</sup>Metallurgical Problems in Handling Hydrogen under High Pressures and Temperatures. John L. Cox (*Trans. Amer. Inst. Chem. Eng.*, 1933, 29, 43-87).—The first part of the paper discusses published work on creep, particularly in respect of alloy steels. Reference is made to the active effect of chromium in raising creep strength. A bibliography, containing references to 220 papers on creep, including non-ferrous metals and alloys, is given. The second part reviews published work on the corrosion and embrittling of metals and alloys (mainly alloy steels) at high temperatures by hydrogen.

—E. S. H.

\*Researches on Metal Electric Arcs. T. Toniszewski and T. Maciejewski (Acta Phys. Polon., 1933, 2, 67-74).—The static characteristics of arcs between plane and hemispherical metal electrodes are given for all possible combinations of iron, copper, molybdenum, tungsten, and brass. The Ayrton constants of the systems copper-copper, molybdenum-molybdenum, and tungsten-tungsten have been determined; with the second pair these constants are the same for all current densities, whereas with the other pairs there are two current-density ranges wherein these constants vary.—A. R. P.

\*Theory of the Dependence of the Electrical Conductivity of Metals on Pressure. Wolfgang Kroll (Z. Physik, 1933, 85, 398-402).—The effect of pressure on the electrical conductivity of metals is discussed along the lines of Bloch's theory. The effect is correctly interpreted if Fermi's expression for the potential at a lattice point is used in the theory.—J. S. G. T.

\*Magnetic Interaction of Metallic Electrons. Criticism of Frenkel's Theory of Super-Conductivity. H. Bethe and H. Fröhlich (Z. Physik, 1933, 85, 389-397).—Frenkel's theory of super-conduction, attributing the phenomenon to magnetic forces called into play between the electrons, is considered to be untenable. Such forces, it is shown, can in no way affect the value of the conductivity, and are revealed, macroscopically only, in the phenomenon of self-induction. The work is entirely mathematical in character.—J. S. G. T.

### **II.**—**PROPERTIES OF ALLOYS**

#### (Continued from pp. 7-11.)

\*Studies of the Ternary System Aluminium-Antimony-Magnesium. W. Guertler and A. Bergmann (Light Metals Research, 1933, 2, (39), 1-14).— A full, illustrated translation from Z. Metallkunde, 1933, 25, 81, 111. See J. Inst. Metals, 1933, 53, 343.—J. C. C.

\*Thermal Measurements on Hardenable Aluminium Alloys. W. Fraenkel (*Metallwirtschaft*, 1933, 12, 583-585).—Heating curves have been taken by a sensitive differential method on aluminium alloys with (a) 4% copper, (b) 4% copper and 0.5% magnesium, and (c) 4% copper, 0.5% magnesium, and magnesium, and

\*Heat Evolution and Mechanism of Transformation of Hardenable Aluminium Alloys. H. Röhrig (*Metallwirtschaft*, 1933, 12, 671).—Cf. preceding abstract. In this connection attention is directed to the work of Kokubo and Honda (J. Inst. Metals, 1931, 47, 266) in which similar results were obtained.—v. G.

On the Mechanical and Chemical Properties of Alloys of Aluminium with Cr. Fe, Mg, Mn, Ti, V. H. Bohner (*Light Metals Research*, 1933, 2, (29), 1-23; and *Met. Ind.* (*Lond.*), 1933, 43, 27-30, 56-58).—Translated in full from *Metallwirtschaft*, 1933, 12, 251-255, 265-267. See J. Inst. Metals, 1933, 53, 694.—J. C. C.

\*The "Precipitation Heat-Treatment" Effects in Copper-Aluminium Alloys. W. Stenzel and J. Weerts (*Light Metals Research*, 1933, 2, (37), 2-25).—A full translation, illustrated by sketches, from *Metallwirtschaft*, 1933, 12, 353, 369. See J. Inst. Metals, 1933, 53, 694.—J. C. C.

†Nickel in the Light Alloys. J. Cournot (*Rev. Nickel*, 1933, 4, 137–142).— Of these alloys Duralumin is the oldest and the modern process of precipitationhardening has brought its use to a better understanding. It is, however, corrodible. Addition of 2% cadmium, and the juxtaposition of aluminium and Duralumin sheets have been suggested as remedies in certain special alloys. Usually, however, these materials require delicate handling. Increasing the quantity of nickel in this type of alloy gives a fine structure and better physical properties. Addition of small quantities of chromium reinforces the effect of nickel, giving material possessing homogeneity, stability, and inoxidizability.—W. A. C. N.

The Aluminium Alloy Anticorodal. A. I. A. G. (Schweiz. Tech. Z., 1933, 236–239).—Anticorodal is used exclusively for decorative work. Its physical properties are tabulated. Some of its many applications are illustrated.—W. N.

\*The System Iron-Cobalt-Aluminium. Werner Köster (Arch. Eisenhüttenwesen, 1933, 7, 263-264).—The space model of the solid state of ironcobalt-aluminium alloys differs from that of the corresponding metal system (see Koster, Met. Abs., this vol., p. 71) only in the size of the various fields; this is due to the similarity in the nickel-aluminium and cobalt-aluminium systems. Observations on the magnetic transformation have afforded similar, as yet unexplained, results to those observed in the nickel system.—J. W.

\*The System Iron-Cobalt Manganese. Werner Köster and Winfried Schmidt (Arch. Eisenhüttenwesen, 1933, 7, 121-126).—The  $\gamma$ - $\varepsilon$  boundary in the cobalt-manganese system has been established and the variation of the lattice constants of the two phases with the composition determined. The temperature of the  $\gamma$ - $\varepsilon$  transformation and of the magnetic transformation of cobalt are so quickly reduced by addition of manganese that they reach

A Sala

100

Em)

Inc. 1

and a

1

di l

-

11

「

리는

152

the

2.4

d's

-

Ø.

-

6

z)

2

1

8

2

room temperature at 30% and 38% manganese, respectively. The ternary system iron-cobalt-manganese up to 50% manganese has been studied by dilatometric, X-ray, and micrographic methods. Below 1400° C. homogeneous is formed which is converted at lower temperatures to a in alloys containing

dilatometric, X-ray, and micrographic hierhous. There to a in alloys containing  $\gamma$  is formed which is converted at lower temperatures to  $\alpha$  in alloys containing up to 18% manganese and 80% cobalt. The degree of hysteresis of this reaction increases with increase in the manganese content. Between 18 and 30% manganese the  $\gamma$ -phase is converted partly or wholly into  $\epsilon$ . The  $\gamma - \epsilon$  transformation in the iron-manganese system is completely analogous to the corresponding transformation in pure cobalt and in the ternary system these transformations are joined together by a plane of equilibrium. With a constant manganese content the lattice parameters of the ternary  $\gamma$ - and  $\epsilon$ -phases decrease, at first linearly, then more rapidly as the iron is replaced by cobalt; with a constant iron or cobalt content, however, they increase linearly with increasing manganese content. The change from the ferroto the para-magnetic state does not appreciably affect the dependence of the parameters on the concentration, but the lattice of the ferromagnetic phases are larger than those of the paramagnetic.—J. W.

A New Corrosion-Resistant Copper Alloy. [Corrix.] Anon. (Metallwirtschaft, 1933, 12, 622).—Corrix is an alloy of copper 86, aluminium 10, and iron 4% made from specially purified metals. It can be cast and worked readily, and towards many reagents is as resistant to corrosion as the austenitic chromium-nickel steels.—v. G.

Copper Alloys that Have the Strength of Steel. Anon. (Machinery (N.Y.), 1933, 40, 104–105).—The characteristics and uses of silicon-bronze and beryllium-copper alloys are briefly reviewed.—J. C. C.

<sup>†</sup>The Aluminium-" Bronzes." E. C. J. Marsh and E. Mills (*Aircraft Eng.*, 1933, 5, 251-255, 286-288).—A general survey of the subject with reference to the usual commercial forms, methods of manufacture, working properties, heat-treatment, micro-structure, corrosion-resistance, &c.—H. S.

Investigation on the Transformations in the Solid State in the System Copper-Gold. Günter Wehner (*Thesis*: Univ. Leipzig, 1931, 78 pp.).—See J. Inst. Metals, 1932, 50, 730.—I. M.

\*The Modulus of Elasticity of Annealed  $\alpha$ -Bronzes. Léon Guillet, Jr. (Compt. rend., 1933, 197, 1320-1321).—The kind of elastic deformation imposed on a body is important. Torsion and bending are heterogeneous deformations. On the other hand, if the test-piece is long relative to its cross-sectional area, the stress imposed by tension is the same in all parts of the section, *i.e.* the deformation is homogeneous; it is, however, relatively very small, and pure tension is difficult to apply. Elongations have been measured to  $\frac{1}{100}$  mm. with a Martens' elasticimeter, loads of about 30 grm./mm.<sup>2</sup> being applied with an Amsler machine with the help of wedges, at constant speed with increasing and decreasing loads. The values of Young's modulus are tabulated below, and will be seen to diminish as the tin content increases in an approximately linear relationship. This agrees perfectly with Chevenard and Portevin's results for the modulus of torsion of certain alloys (brass, cupro-nickel, copper, &c.);

Tin, %.	Copper, %.	Young's Modulus, Mean Value.		
$\frac{1\cdot92}{3\cdot81}$	97·97 96·10	12,600 12,300		
6:05 8:02	93·85 91·92	11,970		
9.90	90.05	11,260		

70

VOL. 1

-J. H. W.

Notes on Volvit Bronze. Anon. (*Metallwirtschaft*, 1933, 12, 674).—Volvit bronze contains 9% tin and considerable amounts of phosphorus. By careful supervision of the casting and working operations, cold-rolled tubes and rods can be made of this alloy. It has a Brinell hardness of 230 in the drawn state, whilst the annealed metal has a tensile strength of 40 kg./mm.<sup>2</sup> and an elongation of 70%. The alloy is suitable for making all types of bearing boxes.—v. G.

\*Influence of Temperature on the Mechanical Properties of Brasses. -- I.-II. W. Broniewski and K. Wesolowski (Rev. Met., 1933, 30, 396-401, 453-457).-[I.--] Tests included tensile tests on thin sheets (5 mm.) at elevated temperatures, thin sheets being chosen to obviate serious cooling of the test-length by conduction of heat to the testing-machine. Hardness tests were made at elevated temperatures, the ball and mounting used to determine the hardness being heated to temperature with the specimen. In making impact tests at elevated temperatures the test-piece was heated on the hammer itself. Three brasses were used containing: (1) zinc 33%; (2) zinc 40%; and (3) zinc 40, lead 1.3%. The results of tests made at temperatures in the range 200° to 700° C. are given as graphs and are compared by B. and W. with the results of tests published by other investigators. [II.---] In brasses containing 33% of zinc the effect of cold-work is no longer observed in the mechanical properties above  $400^{\circ}$  C. In pure brasses of 40% zinc the effect of cold-work is more persistent, and does not disappear from the diagram of notched-bar values until 600° C. is exceeded. The introduction of lead into brass seems to lower that limit to about 500° C. For the three brasses studied, the curves of tensile strength, elastic limit, and hardness are of similar form, having a rapid descent at a fairly low temperature in the zone of recrystallization with ranges of less rapid change on each side.—H. S.

**P.M.G. Alloy.** Anon. (*Machinery* (*Lond.*), 1933, 42, 770–771).—The properties in the cast and forged conditions of 18 copper alloys made up with P.M.G. hardener alloy in various proportions, with or without zinc, are tabulated. Some typical applications are quoted.—J. C. C.

**Tellurium-Lead.** W. Singleton (*Plumbing Trade J.*, 1934, 13, 242-243).— A lecture to the Institute of Plumbers on the properties of tellurium-lead and its applicability to plumbing.—E. S. H.

\*On Zinc in Lead Bearing Metals. K. L. Ackermann (Metallwirtschaft, 1933, 12, 618-619).—If there is sufficient antimony in lead-antimony-zinc alloys, the zinc forms a compound which crystallizes in long, brittle crystals which make the alloy hard but brittle. If tin is also present, it combines with part of the antimony, and some of the zinc is set free. Zinc produces difficulties in casting, especially when heavy metals such as copper, iron, and nickel, are also present, and must therefore be considered as an undesirable constituent of lead bearing metals.—v. G.

Mechanical Properties of White-Metal Bearing Alloys at Different Temperatures. H. K. Herschman and J. L. Basil (*Proc. Amer. Soc. Test. Mat.*, 1932, 32, (II), 536–555; discussion, 556–557).—See J. Inst. Metals, 1932, 50, 429.—S. G.

\*Study of the Ultra-Light Alloys of Magnesium, Aluminium, and Copper.—I. Paul Bastien (*Rev. Mét.*, 1933, 30, 478–501).—See J. Inst. Metals, 1933, 53, 623.—H. S.

\*The System Iron-Nickel-Aluminium. Werner Köster (Arch. Eisenhüttenwesen, 1933, 7, 257-262).—The system has been examined thermally and micrographically up to 30% aluminium. Since the compound NiAl forms a continuous series of solid solutions with  $\alpha$ -iron within the range tested, the alloys contain only the  $\alpha$ - and  $\gamma$ -phases. The ( $\alpha + \gamma$ )-field is divided into 2 parts, the first forms a narrow wedge extending out from the scythe-shaped ( $\alpha + \gamma$ )-field of the iron-aluminium system, and the second a broader wedge

-

1

-

101

10

ST-

=1

10

e)

extending to room temperature from the nickel-aluminium system down to a very low nickel content and broadening with decreasing temperature. The magnetic transformation point of iron-aluminium alloys is first raised by addition of nickel; for alloys with a high content of nickel and aluminium, however, it occurs at a considerably lower temperature after quenching from a high temperature than after cooling slowly from a medium temperature. The  $\alpha$ -phase is ferromagnetic up to a content of 70% nickel and about 20% aluminium.—J. W.

Stainless Nickel Chromium Alloy. [Inconel.] Anon. (Indust. Australian, 1933, 88, 269).—See J. Inst. Metals, 1933, 53, 437.—P. M. C. R.

†Chromium-Nickel as a Corrosion-Resistant Alloy. Robert J. McKay (Metals and Alloys, 1933, 4, 177–180, 202–204).—A review of the properties, uses, and resistance to corrosion of nickel-chromium alloys, cspecially Inconel (chromium 12–14, iron 5–6%, remainder nickel).—A. R. P.

Chromium-Nickel Resistance Alloys. Anon. (Arch. tech. Messen, 1933, 3, (29), r30).—An account of certain proprietary resistance alloys, including Megapyr. Their analyses and physical properties are tabulated, and permissible working temperatures and special applications are indicated.—P. R.

Symposium on Electric Resistance Alloys. Anon. (Japan Nickel Rev., 1933, 1, 376).—[In English and Japanese.] A very brief summary of the proceedings.—W. A. C. N.

Resistance Alloys for Heating, and Their Testing. W. Hessenbruch (Arch. tech. Messen, 1933, 3, (29), r155-r156).—The analyses, relevant physical properties, and approximate working ranges of a number of resistance alloys are tabulated, and comparative curves show the effect of temperature on the specific resistance of typical alloys. Mechanical properties at room temperature are quoted, and curves show the limits of creep of certain materials at high temperatures. Methods of durability testing are discussed, and the influence of temperature on durability is shown graphically. The importance of surface loading, frequency and duration of run, furnace atmosphere, and to certain constituents of specific alloys are briefly discussed, results being tabulated in some cases.—P. M. C. R.

\*An Investigation on the Nickel-Chromium Alloys. Yonosuke Matsunaga (Japan Nickel Rev., 1933, 1, 347-363).—[In English and Japanese.] Specimens were melted in an hydrogen atmosphere in an electric furnace. The specimens for thermal analysis were heated in hydrogen in thick-walled quartz tubes. For samples containing more than 70% chromium, however, interpolation methods had to be employed. Variations in solid solubility were traced by microscopic study. A new equilibrium diagram has been developed. A eutectic containing 51% chromium is formed at 1346° C. The  $\alpha$ -phase is soluble to the extent of 47% copper at 1346° C. and 44% copper at room temperature. The corresponding figures for the  $\beta$ -phase are 37 and 7% nickel respectively. Oxidation, hardness, and electric resistivity measurements indicate that alloys containing 15-35% copper are best for heat-resistivity purposes. In any case, the chromium should be less than 50% of the alloy.—W. A. C. N.

Equilibrium Diagram of Nickel and Chromium. S. Nishigori and M. Hamazumi (Japan Nickel Rev., 1933, 1, 391).—[In English and Japanese.] Abstracted from Sci. Rep. Tohoku Imp. Univ., 1929, [i], 18, 491-502. See J. Inst Metals, 1930, 43, 477.—W. A. C. N.

Study of the Life of Electric Heating Wires. M. Horioka (Japan Nickel Rev., 1933, 1, 292-310).—[In English and Japanese.] An investigation of various methods for conducting forced life tests on resistance wires for electric heating. In ideal tests of this nature the following factors would be altered simultaneously—oxidation, protection by oxide film, change of internal structure, heterogeneity of material, and strength at high tempera-

ture. As this, however, cannot be done easily the tests preferred wereforced oxidation test in oxygen, measurement of oxidation by thermo-balance, measurement of the weight of oxidized matter peeled off from the surface, brine test. microscopic study, measurement of cracking and peeling off sound in the cooling. The experimental results are given in tabular and graphical form. It is stated that there is a definite relation between the life of resistance wire and the absolute temperature at which the wire is put into service. The breakdown hrs. in air can be lengthened by 4 or 5 times when the running temp. is lowered by 100° C. in the range between 800° and 1300° C. The breakdown of wires tested in air frequently occurs before the temperature or watt consumption decreases to 80% of the initial values. The life of the wire can be regarded as approximately proportional to the diameter of the wire. Owing to the greater solubility of the chromium of the alloys than that of the other elements in brine solution, the brine test is of little use in determining the life of wires. The peeling-off of the oxidized film is useful only in the higher ranges of temperatures. The oxygen gas test shortens the time of testing by to or more of that of the air test. It is suggested that the cracking sound test is worthy of further study.-W. A. C. N.

Research on Electric Heating Elements. Isamu Asaki (Japan Nickel Rev., 1933, 1, 311-321).—[In English and Japanese.] The quality of a heating wire depends greatly on its chemical composition and the melting process used in producing the alloy. The deleterious effect of low-grade raw materials is emphasized. The compositions of the commercial alloys are given. The mechanical working—drawing—is receiving increasing attention at the present time, in order to attain still greater uniformity of the wires. With good-quality wires the oxide film formed on the surfaces of heating wires is principally  $Cr_2O_3$  which is difficult to scrape off. Forced heating is considered the most effective and practical method for the quality test. The causes affecting the life of heating wire are discussed. Photomicrographs show the growth of the intergranular oxide films.—W. A. C. N.

Forced Life Test of Heating Wires. Shinji Togo (Japan Nickel Rev., 1933, 1, 322-341).-[In English and Japanese.] A study of the physical properties of electric heating wires as applied to various heating utensils and for sundry purposes. As no single property is alone responsible for the differing lives of wires, a modified life test under stringent conditions is the only possible one for determining the comparative qualities of the elements. The useful life, *i.e.* when the filament becomes incapable of standard heating temperature and current consumption, is not an important consideration at low heating temperature ranges, but the breakdown life, *i.e.* the life before actual failure, is extremely important. The higher the temperature the more the useful life factor enters into the question. From the results of his tests T. concludes (1) the life of a wire is affected considerably by any non-uniformity in its diameter; (2) the stronger the adhesion of the oxide films the longer the life; (3) the life depends on the rate of oxidation and also on the uniformity of the inner physical structure. See also J. Illuminating Eng. Soc. Japan, 1928, 12, 386, and (abstracts) Japan Nickel Rev., 1933, 1, 380; J. Inst. Metals, 1933, 53, 347.-W. A. C. N.

Testing the Life of an Electric Heating Wire. Yasuyuki Toba (Japan Nickel Rev., 1933, 1, 342-346).—[In English and Japanese.] Two classes of wires are under consideration: (1) nickel 80, chromium 20%; (2) nickel 60, chromium 15, and iron 25%. The lives of the wires have been determined by the time which elapses up to the point of breakdown by heating to a high temperature and then cooling them alternately at a certain time interval. The apparatus and technique employed are described and discussed.—W. A. C. N.

2 4 2

N.N. M. H.

73

2

2

Design of Electric Heating Devices. Isamu Asaki (Japan Nickel Rev., 1933, 1, 364–373).—[In English and Japanese.] A discussion which embraces the mechanical and electrical properties of the materials for the heating elements, electric heaters, heating elements under service conditions, connecting parts, calculations in the design of electric heaters.—W. A. C. N.

Oxidation Tests of Heating Wires at High Temperatures. S. Togō (Japan Nickel Rev., 1933, 1, 379-380).—[In English and Japanese.] Summary from J. Illuminating Eng. Soc. Japan, 1928, 12, 354-362, which was published in Japanese. See J. Inst. Metals, 1933, 53, 347.—W. A. C. N.

Coefficient of Thermal Expansion of Heating Wires. S. Togō (Japan Nickel Rev., 1933, 1, 381-382).—[In English and Japanese.] Summary from J. Illuminating Eng. Soc. Japan, 1928, 12, 243, which was published in Japanese. See J. Inst. Metals, 1933, 53, 347.—W. A. C. N.

Electrical Resistance of Heating Wires. S. Togō (Japan Nickel Rev., 1933, 1, 383-385).—[In English and Japanese.] Summary from J. Illuminating Eng. Soc. Japan, 1928, 12, 590-605, which was published in Japanese. See J. Inst. Metals, 1933, 53, 347.—W. A. C. N.

Machinable Metal. P. W. Rauschert (Canning Age, 1933, 14, 447).— Describes the properties of "Illinois" nickel alloy and its use in handling foodstuffs in the canning and dairy industries.—E. S. H.

Catalogues [Nichrome]. Anon. (Japan Nickel Rev., 1933, 1, 392–394).—[In English and Japanese.] Particulars of physical, chemical, and electrical properties of the most important Nichrome alloys passing under proprietary names are given.—W. A. C. N.

\*Liquation or Segregation of the Constituents of Silver Coinage Alloys. S. W. Smith (Sixty-Third Rep. Royal Mint (Lond.), 1932, 55-57) .- It has already been shown (Sixty-First Rep. Royal Mint (Lond.), 1930, 55-60) that in the 50:50 silver-copper alloy the copper primaries which form at temperatures between the liquidus and the solidus are free to move in the molten matrix, and do so move under the influence of gravity if allowed sufficient time. In order to demonstrate micrographically the movements which occur in casting, copper primaries were concentrated under the influence of gravity at the top of a molten cylindrical specimen of this alloy by "soaking" at a suitable temperature, and sudden chilling was then applied in their vicinity. Both micrographic and analytical evidence showed that the copper primaries had been scattered by the chilling surface and had moved away from it in strict accordance with the well-known effect of casting alloys of this composition in chill moulds under ordinary conditions. These observations were extended to other silver coinage alloys both on the copperrich and on the silver-rich sides of the eutectic.-J. H. W.

Chemical Studies of Ancient Chinese Coins.—II. Tsurumatsu Dono (J. Chem. Soc. Japan, 1932, 53, 100–109; C. Abs., 1933, 27, 5).—[In Japanese.] Assay of ancient coins can be made with accuracy by means of combined chemical and microscopic tests. True ancient coins showed more lead than less ancient or imitation coins and the lead appeared in a more segregated black mass of metal under the microscope.—S. G.

Silver-Copper Alloys Containing Phosphorus.—III. K. W. Fröhlich (*Mitt.* Forschungsinst. Edelmetalle, 1933, 7, 91–96).—See J. Inst. Metals, 1933, 53, 696. With increasing phosphorus content the tensile strength of annealed 50:50 copper-silver alloy decreases to a minimum with 0.1% phosphorus and remains fairly steady up to 1% phosphorus after which it slowly increases reaching 30 kg./mm.<sup>2</sup> with 2.5% phosphorus; the elongation rises sharply to 0.1% phosphorus then more slowly to a maximum at 1%. Phosphorus increases the rate of grain-growth on annealing, hence alloys containing this element can be annealed at lower temperatures or for shorter periods than phosphorus.

free alloys. The hardness of the alloys is scarcely affected by the phosphorus content, but falls appreciably with increase in annealing temperature from  $520^{\circ}$  to  $700^{\circ}$  C.; the Erichsen value reaches a maximum with  $0.1^{\circ}$  phosphorus, the precipitation-hardening effects are unaltered, but the rate of corrosion in acetic acid is decreased slightly. Phosphorus has a similar effect on 80:20 and 83:17 silver-copper alloys.—A. R. P.

\*Structure of Silver Amalgam. A. Weryha (Z. Krist., 1933, 86, 335–339). Examination by the X-ray method of silver amalgam, produced by immersing a silver wire in mercury for some time, shows the presence of the compound Ag<sub>3</sub>Hg<sub>4</sub>-F. S. H.

\*Solidification Diagram of Alloys Formed by Two Alkali Metals : Solium-Rubidium Alloys. E. Rinck (Compt. rend., 1933, 197, 1404-1406).—The rubidium for these experiments was prepared partly from the chloride by the calcium reaction (Hackspill method) and partly aluminothermally from the carbonate, and then purified by fractional distillation. The solidification diagram does not resemble that of the sodium-potassium alloys, and no evidence of the compound Na<sub>2</sub>Rb was found. A eutectic occurs at 75 atomic-% of rubidium at  $-4.5^{\circ}$  C. The curve tends to become horizontal in the vicinity of the composition of a possible compound NaRb<sub>2</sub>, and it was supposed that for alloys of this composition the 2 metals would be mutually miscible at temperatures above the temperature of the beginning of crystallization. The alloys were shown experimentally to shibit on sign of segregation when soaked for 5 hrs. at temperatures between 80° and 200° C. inclusive. The results indicate that only the study of another property of the liquid alloys will explain the particular shape of the liquidus.—J. H. W.

Effect of Precipitation from Supersaturated Solid Solutions after Cold-Work in the Heat Expansion Diagram. Franz Bollenrath (Metallwirtschaft, 1933 12, 569-573).—The temperature at which precipitation commences in aged Elektron, Lautal, and especially Duralumin has been determined from dilatometric curves, as well as the effect of cold-work on the shape of the curves. The actual precipitation is preceded by a process of rearrangement of the atoms in the lattice which is characterized by a rise in the coeff. of expansion. This coeff. is  $22.8 \times 10^{-6}$  for unworked Duralumin at  $20^{\circ}$  C, and falls to  $21.9 \times 10^{-6}$  after a reduction of 20% by cold-rolling. The temperature of the beginning and ending of the precipitation is reduced 30° C. by a 20% reduction, and is only slightly more after a more severe reduction. The precipitation of CuAl<sub>2</sub> and of Mg<sub>2</sub>Si can be recognized as separate reactions.—v. G.

Influence of Recrystallization Temperature and Grain-Size on the Creep Characteristics of Non-Ferrous Alloys. C. L. Clark and A. E. White (Proc. Amer. Soc. Test. Mat., 1932, 32, (II), 492-506; discussion, 507-516).-See J Inst. Metals 1932, 50, 432. In the discussion Howard Scott pointed out, from a review of the work done by other investigators, that the recrystallization temperature of pure metals is a constant function of the relaxation temperature; thus the former is about 0.5 times and the latter about 0.47 times the melting point in ° abs. From C. and W. s work  $(T_1 + 273)/(T_2 + 1)$ (273) = 0.95 for Monel metal and various copper-zinc alloys where  $T_1$  is the temperature at which the creep rate is  $0.001^{0/2}_{.00}$  per hr. at a load of 10,000 lb. in.<sup>2</sup>, and  $T_2$  is the temperature of maximum softening rate on annealing alloys cold-rolled to 80-85% reduction for 15 minutes. From this relation it is suggested that more significant information on the strength of metals at high temperature will be obtained by making creep tests at the recrystallization temperature or some predetermined fraction thereof. Arthur McCutchan has subjected the curves (on a log-log basis) given in the paper to mathematical analysis, and points out that the parabola determined from these curves and plotted on ordinary paper gives a clearer picture of the relation of stress to creep and makes a fairly reliable distinction between the creep characteristics of material below and above the recrystallization temperature.—A. R. P.

\*Investigations on Segregation. G. Masing and E. Scheuer (Light Metals Research, 1933, 2, (35), 12–29).—A full translation, including sketches, from Z. Metallkunde, 1933, 25, 173. See J. Inst. Metals, 1933, 53, 698.—J. C. C.

\*Volume-Magnetostriction Exhibited by Poly- and Single-Crystals. O. v. Auwers (*Physikal. Z.*, 1933, **34**, 824–827).—Read at the IX Deutschen Physikertag, September, 1933. [*Note by Abstractor :* By volume-magneto-striction of a substance is to be understood the relative change of volume  $(\Delta V/V)$  accompanying the production of a magnetic field, H, in the region of a sample of material of initial volume V.] Investigation of the phenomenon in the case of single crystals of iron-nickel and iron-cobalt alloys shows that: (1) below technical saturation point the effect is, to a first approximation, negligible; (2) above saturation point the magnitude of the effect is directly proportional to the strength, (H) of the external magnetic field, and the law of proportionality is independent of the orientation of the crystal lattice with respect to the direction of the magnetic field; (3) the abscissa,  $H_0$ , on the H axis, corresponding with the point of intersection of the straight lines giving the relation of  $\Delta V/V$  to H is smaller in proportion as the direction of magnetization corresponds more exactly with the direction of easiest magnetization in the crystal lattice; (4) the inclination of these straight lines to the H axis depends on the composition of the crystal lattice. The effect in the case of Perminvar multi-crystalline alloys is small and there is considerable resemblance between the volume-magnetostriction composition diagram and the composition-structure diagrams.-J. S. G. T.

#### **III.**—STRUCTURE

(Metallography; Macrography; Crystal Structure.)

#### (Continued from pp. 12-14.)

Metallographic Grinding with Paraffin [Wax] Impregnated with Abrasives. R. L. Dowdell and M. J. Wahll (*Metals and Alloys*, 1933, 4, 181–182).—The use of French emery papers in preparing metallographic sections may be obviated by finishing the polishing, after the coarse emery treatment, on rotating steel discs coated with a mixture of paraffin wax and abrasive. Two discs are used, the first being coated with wax and 150-mesh Carborundum, and the second with wax and 400-mesh Alundum. The steel discs are rotated vertically, and the specimen is held by hand flat against the side; in this way no abrasive is worked into the surface of soft metals, the metals do not become hot, and no surface flow occurs, since the wax acts as lubricant. Aluminium, magnesium, and copper can be polished in the usual time with less residual scratch. An automatic apparatus for polishing 4 specimens simultaneously is described.—A. R. P.

Method of Preparation of Lead and Lead Alloy Cable Sheath for Microscopic Examination. W. H. Bassett, Jr., and C. J. Snyder (*Proc. Amer. Soc. Test. Mat.*, 1932, 32, (II), 558–568; discussion, 569–575).—See J. Inst. Metals, 1932, 50, 485. In the discussion E. E. Schumacher and G. M. Bouton detailed the procedure for preparing sections of lead alloys for micrographic work used in the Bell Telephone Labs. The section should be cut with a microtome from a specimen which is so clamped that the knife cuts diagonally. Rough grinding is done on a No. 1 French emery paper and the finishing on a "00" paper; finally the section is given a few strokes on a leather strip. Etching is done with 75% acetic acid containing hydrogen peroxide. Lead-antimony alloys are washed in strong sodium hydroxide solution, then rinsed in a dilute soap solution and dried in a current of air; in this way a transparent

film is formed which prevents tarnishing. Some characteristic micrographs of various lead alloys are shown.—A. R. P.

\*Etching Method for the Micrographic Examination of Platinum Metal Alloys. F. Beck (*Metallwirtschaft*, 1933, 12, 636-637).—Alloys of platinum with rhenium, rhodium, and iridium can be etched by immersion in a fused sodium chloride bath at 860° C. in a graphite crucible, a current of 3 amp./cm.<sup>3</sup> at 2.5 v. being passed between the alloy as anode and the crucible as cathode for 5-45 seconds. The specimens are then quenched in distilled water.—v. G.

\*Sub-Microscopic Differences between Cast and Recrystallization Conditions in Metals. U. Dehlinger (*Physikal. Z.*, 1933, 34, 836–838).—Read at IX Deutschen Physikertag, September, 1933. D. has already suggested that differences occurring in the cast and recrystallization conditions of certain alloys is probably attributable to the development of a mosaic structure in the latter. Tensile tests carried out on cast and recrystallized single crystals of aluminium (99:5–99.8% purity) show that the crystal grain in the case of the latter is characterized by a considerably more marked mosaic structure than is the case with the cast material.—J. S. G. 1.

\*The L X-Ray Spectrum of Solid Aluminium. T. H. Osgood (*Phys. Rev.*, 1933, [ii] 44, 517-519).—The L X-ray spectrum of solid aluminium shows a wide continuous band between approximately 170 and 200 A. This indicates that the conduction electrons are spread over a range of energy levels in agreement with the Sommerfeld theory.—W. H. R.

\*Crystal Structure and Electrical Properties. II.—Lattice Structure and [Electrical] Conductivity of Bismuth Single Crystals Subjected to Transverse Magnetization. O. Stierstadt (Z. Physik, 1933, 85, 310-331).—The crystal lattice structure of bismuth single crystals is revealed by measurements of the electrical resistance of the crystal oriented at various inclinations to the crystal axes.—J. S. G. T.

\*Soft X-Rays from (100) and (111) Faces of Single Copper Crystals. Morgan L. Williams (*Phys. Rev.*, 1933, [ii], 44, 610–617).—Between 90 and 220 v. 14 critical potentials have been found in the emission of soft X-rays from the (100) and (111) faces of single crystals of copper, the values for the two faces agreeing within 1.5 v. These may be explained by Kronig's theory (*Z. Physik*, 1932, 75, 191) which is based on Bloch's theory of metals.—W. H.-R.

On Lithium Alloys. II.—X-Ray Analysis of the System Lithium–Cadmium. A. Baroni (Atti R. Accad. Lincei Rend., 1933, [vi], 18, 41–44; Chem. Zentr., 1933, 104, II, 3526).—Cf. J. Inst. Metals, 1933, 53, 437. Thermal analysis of the lithium–cadmium system has confirmed the existence of LiCd, LiCd<sub>3</sub>, and Li<sub>2</sub>Cd. X-ray examination shows that LiCd has a lattice of the cæsium chloride type,  $a = 3\cdot32$  A., with 1 molecule in the unit cell; the calculated density is 5 336, the experimental 5·123. LiCd<sub>3</sub> has the same type of lattice with  $a = 8\cdot62$  and 8 molecules in the unit cell,  $d_{calc.} = 7\cdot136$ ,  $d_{actual}$  6 925. The compound Li<sub>3</sub>Cd could not be detected by X-rays.—A. R. P.

<sup>+</sup>Lattice Constants, 1933. M. C. Neuburger (Z. Krist., 1933, 86, 395-422).— Values for the atomic number, atomic weight, density (calculated from X-ray data), space lattice, space group, lattice type, lattice parameter, shortest distance between atoms, atomic radius, atomic space, packing density, volume of the elementary cell, volume per atom, and atomic volume are tabulated for a number of elements, including 43 metals.—E. S. H.

\*Magnetic Dipole Fields in Unsaturated Cubic Crystals. L. W. McKeehan (*Phys. Rev.*, 1933, [ii], 44, 582–584).—The mean values of the randomlydirected local magnetic field at a lattice point of body-centred and facecentred cubic arrays of equal magnetic dipoles have been calculated by assuming that (a) the orientation of neighbouring dipoles is independent, (b) the direction of each dipole axis is one of the directions of easy magnetization of iron and nickel which have the above lattice types, and (c) the mean magnetization in a large group (2000) of dipoles has definite fractions of the saturation value. The results indicate that, if local constraints prevent parallel alignment of adjacent magnetic elements, the high intensity of local magnetic fields may be an important cause of high coercive force.—W. H.-R.

\*A Contribution to the Theory of Heteropolar Crystals. H. M. Evjen (*Phys. Rev.*, 1933, [ii], 44, 501-509).—Although the details of this paper refer to salts, it should be noted as giving a development of the theory of the solid state, and a discussion of the evidence in favour of the existence of secondary structure of crystals.—W. H.-R.

\*Electron Diffraction and Structure of Thin Metallic Layers. J. A. Prins (Z. Krist., 1933, 86, 301-303).—Tin showed a diagram corresponding with the tetragonal modification. Calcium showed the presence of hydroxide, whilst magnesium did not give a hexagonal pattern corresponding with the metal, but the diagram resembled that of magnesium oxide.—E. S. H.

\*Experimental Determination of the Distribution of Conduction Electrons in Metals. H. M. O'Bryan and H. W. B. Skinner (*Phys. Rev.*, 1933, [ii], 44, 602-603).—A note. Measurements have been made of the intensity distribution in the X-ray bands from solid lithium, beryllium, carbon, sodium, magnesium, aluminium, and silicon. In contrast to the previous work of Houston (*Phys. Rev.*, 1931, [ii], 38, 1797), the results are in better agreement with the electron distribution predicted by the simple Sommerfeld electron theory of metals than with that expected from the more complex theories of the Bloch type.—W. H.-R.

### IV.-CORROSION

#### (Continued from pp. 15-18.)

\*On Corrosion of Welded Aluminium Cables. O. Scarpa (Alluminio, 1933, 2, 327-328).—In a short note, are discussed the results of some interesting experiments which show the very good resistance to corrosion of welds made with an alloy of the following composition : zinc 45, aluminium 35, tin 15%.—G. G.

\*Corrosion at Riveted Joints of Duralumin Structure. G. W. Akimov (Light Metals Research, 1933, 2, (36), 13-15).—Translated from Korrosion u. Metallschutz, 1932, 8, 309. See J. Inst. Metals, 1933, 53, 355.—J. C. C.

\*Corrosion of Light Alloys. G. Guzzoni (Alluminio, 1933, 2, 329-336).— In this first part of the article G. discusses the principal rules governing the mechanism of the corrosion of light alloys, and the methods of preventing it, especially the use of anodic polarization.—G. G. Copper in Architecture. W. H. J. Vernon (Plumbing Trade J., 1933, 13,

**Copper in Architecture.** W. H. J. Vernon (*Plumbing Trade J.*, 1933, 13, 176).—From a lecture delivered to the Association of Architects, Surveyors, and Technical Assistants. The paper refers especially to the green patina which forms on weathered copper and its reproduction by artificial methods.

-E. S. H.

On the Action of Acetylene of Petroleum Cracking Gas on Copper and Brass. J. S. Zalkind and B. A. Vovsi (Zhurnal Prikladnoi Khimii (Journal of Applied Chemistry), 1933, [B], **6**, (4), 677–680).—[In Russian, with German summary.] Since acetylene is present in products obtained by cracking petroleum its effect on copper and brass has been investigated. Two gases were examined: the primary gas, direct from the cracker, and the residual gas remaining after compression and cooling of the primary; they contained respectively 0.9-1% and 1.68% of acetylene. Since only traces of copper acetylide were produced in tests at  $20^\circ$ ,  $55^\circ$ , and  $80^\circ$  C., even under a pressure of 35 atmospheres, it is concluded that there is no danger in employing copper and brass plant under the above conditions.—M. Z. The Action of Corrosive Media on Admiralty Metal. Sydney Born and W. L. Nelson (*Nat. Petrol. News*, 1933, 25, 27-31; *Chem. Zentr.*, 1933, 104, II, 3750).—Copper alloys such as brass, bronze, nickel-brass, silicon-bronze, and especially Admiralty gun-metal are rapidly corroded by even very dilute solutions of ammonia and hydrochloric acid. Gun-metal is, however, only very slightly affected by hard water, dilute sodium hydroxide solution, and dilute hydrogen sulphide water or gas. Addition of sodium hydroxide as a neutralizer to acid liquors to be brought into contact with gun-metal is recommended.—A. R. P.

**Corrosion in Sulphonators.** Anon. (*Chem. and Met. Eng.*, 1933, **40**, 409).— The following results of corrosion tests of metals in sulphonators under actual operating conditions, were obtained at the plant of the Endicott Johnson Corporation in co-operation with the International Nickel Company.

				Corrosion-Rate, mg./dm.², per Batch.		
Metal.			Sulphonated Neatsfoot Oil.	Sulphonated Castor Oil.		
Lead 18–8 Chrome–nickel Nickel Monel metal Ni-Resist. Plain cast iron.	iron		• • • •	$     \begin{array}{r}       127 \\       425 \\       30 \\       34 \\       90 \\       10,000 \\       \end{array} $	$165 \\ 22 \\ 25 \\ 11 \\ 29 \\ 120$	

—F. J.

Increased Acidity Inhibits Corrosion. Application to Canning Prunes. E. F. Kohman and N. H. Sanborn (*Indust. and Eng. Chem.*, 1933, 25, 920–922).—It is shown that the addition of citric acid (obtained from lemon juice) in the canning of prunes lessens their corrosive action on the tinplate can. This is consistent with the principles of the electro-chemical theory of corrosion.—F. J.

Effect of Metals on the Colour of Raspberries and Strawberries. J. M. Bryan and T. N. Morris (Canning Trade J., 1933, 3, 252).—From the Report of the Food Investigation Board for 1932. Amounts up to 40 parts per million of aluminium, copper, nickel, chromium, zinc, lead, or silver had no immediate effect on the colour of the fruits. 10 parts per million of iron produced discolouration of raspberries, 2 parts were sufficient to discolour strawberries, but iron had no effect on black currants. Discolouration by tin was most marked with black currants, 2 parts per million being sufficient to impart a bluish tint, although after heating, the discolouration almost disappeared. Raspberries after heating are discoloured by 40 parts per million of tin, whilst black currants are not affected by 100 parts per million.—E. S. H.

Methods for Preventing Corrosion in Ice-Producing Plant. A. Freundlich (Z. ges. Kälte-Ind., 1933, 40, 147-148; Chem. Zentr., 1933, 104, II, 3612).— For parts which come into contact with brine, lead-coated steel should be used and for other parts lead-coated steel further coated with zinc.—A. R. P.

Corrosion in Gearing. J. R. Kammel (Commonwealth Eng., 1933, 21, 75-76).—Describes experiments carried out by W. Rosenhain at the National Physical Laboratory and discusses the conclusions that have been reached therefrom.—J. H. W.

The Stability of Trichlorethylene. Investigations of Its Corrosive Action on Metals. Anon. (Chem. Trade J., 1933, 93, 227-229).—Under the influence of actinic light (e.g. sunlight) trichlorethylene decomposes into carbonyl chloride and hydrogen chloride or into diacetyl chloride which

1

5

ė

ģ

5

2

\$

further decomposes into hydrogen chloride and dichloracetic acid; these acid decomposition products are liable to produce corrosion in degreasing plants, but experiments have shown that their development can be prevented by adding organic amines or diphenylguanidine to the trichlorethylene. After this treatment only zinc, cast iron, and mild steel are attacked by the degreaser, and then only very slightly. Carbon tetrachloride, on the other hand, is inert only to aluminium, Staybrite steel, and Monel metal.—A. R. P.

†On the Question of the Protection from Corrosion and Corrosion Stability of Binary Solid Solutions. L. Graf (*Metallwirtschaft*, 1933, 12, 585-587, 602-603).—A review of theoretical and practical work on Tammann's theory of resistance limits.—v. G.

<sup>†</sup>Corrosion and Protection of Metals. U. R. Evans (*Rev. Met.*, 1933, 30, 502-508; and (abstract) *Industrie chimique*, 1933, 20, 809-810).—A good survey of the subject with special reference to recent research work. Corrosion is discussed under the headings—direct oxidation, places susceptible to corrosion, electrochemical corrosion, corrosion by a drop on a horizontal surface, corrosion of a vertical plate. Protection against corrosion is dealt with under the headings—materials resistant to corrosion, treatment of water, metallic coatings, and paints. A *bibliography* is appended.—H. S.

\*Comparative Results of the Measurement of Corrosion. Jean Cournot and Henri Fournier (Compt. rend., 1933, 197, 1409–1411).—Siebel and Pomp's cupping test, the Persoz test, and the loss-of-weight method have been used to measure the effects of corrosion on a number of alloys, which were tested before and after 2 months' corrosion in a salt mist. If  $\sigma$  is the percentage loss in weight or diminution of the property measured, a factor  $\sigma'$  is used to show the sensitiveness of the measurement, so that in the loss of weight method,  $\sigma'$  is the quotient of  $\sigma$  by half the maximum variation of the results as a percentage of the mean value, and in the cupping tests,  $\sigma'$  is calculated as

Character of Corrosion.	Loss of Weight, %.	Siebel and Pomp Test.			Persoz Test.					
		Breaking Stress.	Elongation, %.	Deflection.	Load.	Deflection.				
Armco Iron.										
Diminution %, $\sigma$ Sensitivity, $\sigma'$ .	10 1·10	9·9 0 11	$\begin{array}{c} 25 \cdot 8 \\ 0 \cdot 28 \end{array}$	15 0·18	$\begin{array}{c} 18 \cdot 2 \\ 0 \ 17 \end{array}$	6 0·13				
18% Chromium, 8% Nickel Austenitic Steel.										
Diminution $\%, \sigma$ Sensitivity, $\sigma'$ .	0·07 0·00	$-0.5 \\ 0.00$	$-2.2 \\ 0.00$	$-\frac{1.10}{0.00}$	2·8 0·00	$-\frac{2.9}{0.00}$				
Austenitic Ferro-Nickel, containing 34% Nickel.										
Diminution $\%, \sigma$ Sensitivity, $\sigma'$ .	0·09 0·00	6 09 0·04	$-10.5 \\ 0.02$	$-\frac{1.4}{0.00}$	10 0.07	10·4 0 09				
Duralumin.										
Diminution $\%$ , $\sigma$ Sensitivity, $\sigma'$ .	0·06 0·001	$53 \cdot 2$ 1 18	54·9 0·79	$32.9 \\ 0.64$	$\begin{array}{c} 17.9 \\ 0.16 \end{array}$	16·9 0·19				
Monel Metal.										
Diminution $\%, \sigma$ Sensitivity, $\sigma$ .	0·09 0·008	$\frac{1\cdot 32}{0\cdot 00}$	11·8 0·05	4·7 0·02	$7.9 \\ 0.15$	9.5 0.23				
67 : 33 Brass.										
Diminution $\%$ , $\sigma$ Sensitivity, $\sigma'$ .	0.07 0.00	0.37 0.00	14·06 0 11	9·8 0·08	0·32 0·00	4·12 0·03				

the quotient of  $\sigma$  from the expression:  $\frac{d\sigma}{\sigma} = \frac{dI}{I} \cdot \frac{I}{I-F} + \frac{dF}{F} \cdot \frac{F}{I-F} + \frac{dI}{I}$ , where I = the initial and F = the final value. The results are tabulated as shown at foot of previous page.

For certain types of alloys, the Siebel and Pomp test is considered superior for the measurement of corrosion.—J. H. W.

\*Tests of a Method of Continuous Measurement of Slight Corrosion Accompanied by Evolution of Gas. A. Portevin, E. Pretet, and L. Guitton (*Rev. Met.*, 1933, 30, 362-365).—A method is developed for the study of slow corrosion of steels of the corrosion-resisting types in dilute acids, the specimen being suspended from the arm of a balance during immersion in the corroding medium. Gas bubbles which become detached are caught in a bell attached to the suspension above the specimen.—H. S.

Salt-Spray Tests. L. Richard (Galvano, 1933, (20), 15-16).—The construction of a suitable apparatus is described.—E. S. H.

Controlled Data from an Immersion Test. R. F. Passano (Proc. Amer. Soc. Test. Mat., 1932, 32, (II), 468-474; discussion, 475-476; and Amer. Soc. Mech. Eng. Preprint, 1932).—See J. Inst. Metals, 1932, 50, 480.—A. R. P.

The Problem of Corrosion-Fatigue of Metals. August Thum and Heinrich Ochs (Forschungen u. Fortschritte, 1933, 9, 478-479).—A short review of the problem of corrosion-fatigue.—J. W.

#### **V.**—**PROTECTION**

#### (Other than Electrodeposition.)

#### (Continued from pp. 18-20.)

†Electrolytic Oxidation of Aluminium. E. Herrmann (Schweiz. Tech. Z., 1933, (19), 285–291; and (translations in abstract) Light Metals Research, 1933, 2, (33), 13–20; Aluminium Broadcast, 1933, 4, (12), 13–20).—A general introductory review of the methods-chemical and electrolytic-that are used in forming the oxide protective layer on aluminium. The Alumilite process is particularly described. The others mentioned are the Bengough and the Eloxal processes. In the Alumilite process, the objects, after thorough cleansing in organic and alkali solvents, are immersed as anodes in a bath of dilute sulphuric acid to which small quantities of addition agents may be added. The cathode is of lead. The chemical nature, and the thickness, of the oxide layer produced under differing conditions are discussed. When the basis material is pure, clean aluminium the layer is colourless and transparent. With aluminium-silicon alloys it is grey. The oxide layer may be coloured in a great variety of tones by immersion in certain organic dyes. More recently, in order to obtain more permanent colouration under exposed conditions, the oxide layer is impregnated with inorganic electrolytes, which are then caused to absorb mineral colouring matters by the use of specific physical or chemical means. Iron and silver salts, sodium bichromate and potassium ferrocyanide solutions have been used in this connection.

#### -W. A. C. N.

**†Gas for Modern Calorizing.** Anon. (Gas World (Industrial Gas Suppl.), 1933, 5, (12), 11).—The art of calorizing, *i.e.* protecting iron and steel against corrosion by the application of a coating of aluminium, is described. Town's gas is the fuel used.—J. S. G. T.

The Manufacture of Tinplate. Wilhelm Kramer (Stahl u. Eisen, 1933, 53, 1237-1240).—A review.—J. W.

The Effect of Insufficient Pickling on Subsequent Galvanizing. V. A. Wardell (Indust. Chemist, 1933, 9, 233-234).—Pickling in sulphuric acid, using

1

1934

glue as an inhibitor, is affected by the grain size of the sheet. This is shown by simultaneous pickling of sheets of the same composition in the same cradle, differing in annealing treatment. The softer, fully annealed sheet gave a typical "skinned" coating when galvanized, whilst the harder sheet gave a good spangle and smooth surface. Pickling removes the scale from hard sheets with a minimum loss of iron, although soft annealed sheets lose a considerable quantity of iron before pickling is satisfactory.—E. S. H.

Embrittlement of Hot-Galvanized Structural Steel. Samuel Epstein (*Proc. Amer. Soc. Test. Mat.*, 1932, 32, (II), 293-374, discussion, 375-379).—The problem of embrittlement in galvanized structural steel angles for electrical transmission towers is discussed and methods of quantitative testing for such embrittlement are described. Data from a large number of tests on 170 heats of various steels in the rolled, pickled, and galvanized conditions with punched and drilled holes are tabulated; they show that in all cases embrittlement is confined to the largest-sized punched angles, and that punching is the principal factor in producing it, pickling, galvanizing, and the nature of the steel being of only minor importance. In the discussion V. L. Glover stated that his experience showed hydrogen absorption in pickling to be an important fact in producing embrittlement of galvanized wires; pickling in 0.5% nitric acid entirely eliminated the brittleness.—A. R. P.

Effect of Zinc Coatings on the Endurance Properties of Steel. W. H. Swanger and R. D. France (*Proc. Amer. Soc. Test. Mat.*, 1932, 32, (II), 430-448, discussion, 449-452; and *Amer. Soc. Mech. Eng. Preprint*, 1932).-See J. Inst. Metals, 1932, 50, 482. In the discussion Robert Job stated that the corrosion-fatigue strength of steel staybolts was not improved by cadmium plating, probably owing to the cracking of the deposit. H. S. Rawdon confirmed the superiority of zine-plated over hot-galvanized wires, but W. M. Peirce pointed out that if a thin coat is applied by hot-galvanizing immediately after drawing, so that pickling is reduced to a minimum, the endurance properties are as good as those of plated wires. W. H. Swanger was of opinion that hydrogen embrittlement caused by pickling played only a minor part in determining the endurance strength.-A. R. P.

Some Factors Affecting the Preece Test for Zinc Coatings. H. H. Walkup and E. C. Groesbeck (*Proc. Amer. Soc. Test. Mat.*, 1932, 32, (11), 453-463, discussion, 464-467; and *Amer. Soc. Mech. Eng. Preprint*, 1932).— See J. Inst. Metals, 1932, 50, 481. In the discussion A. R. Small stated that his work had shown that the Preece test was satisfactory for works routine; immersion for 1 minute was the equivalent of 0 1 oz./ft.<sup>2</sup>, and about the equivalent of exposure for 1 year in the Chicago atmosphere. W. H. *Finkeldey* said that the number of dips a given weight of coating would normally stand was frequently doubled by the presence of smooth, adherent zinc corrosion products. F. F. Farsworth considered that the test was satisfactory only for determining the uniformity of the coating, and H. S. Raudon considered that the test was not suitable for all types of zinc coating.—A R. P.

Neo-Sherardizing. Rustproofing by the Sherardizing Process. Anon. (Met. Ind. (Lond.), 1933, 43, 630).—An improved sherardizing process is said to produce a brighter and more uniform coating and to permit of thicker coats. Chrome sherardizing consists of directly plating chromium on to a polished sherardized article. Copper and brass sherardizing are used for decorative purposes. Sherardizing with aluminium powder instead of with zinc allows the metal to be used at a bright red heat without scaling, but it is more expensive, as a higher temperature and preferably a reducing atmosphere are required for the process.—J. H. W.

Protecting Underground Pipe Lines Against Soil Action. K. H. Logan (Chem. and Met. Eng., 1933, 40, 514-516).—Based on a paper read before the Electrochemical Society. See J. Inst. Metals, 1933, 53, 638.—F. J.

Metallic Coatings. Anon. (Commonwealth Eng., 1933, 21, 91–92).—Brief review of the various methods available for coating iron and steel with protective non-ferrous metals.—J. H. W.

Metallization. Anon. (Soudeur-Coupeur, 1933, 12, (10), 1-5).—Applications to steel structures, cisterns, coils, and vessels are described and illustrated. The advantages of the modern Schoop pistol, using wire, are explained.—H. W. G. H.

Rubber Coatings for Abrasion and Corrosion. Leonard Church (Chem. and Met. Eng., 1933, 40, 467-469).—Corrosion-resistance, wear, and abrasion resistance, and insulation against electricity, heat, sound, or vibration are all possible through the rubber coating of metallic parts by electro-deposition. Zinc can be used as readily as any other metal and, since zinc hydroxide and zinc oxide are not only not detrimental to the rubber, but are useful for cure, zinc is usually chosen, being readily and cheaply applied as a light coating to other metals. The process of depositing the rubber and the properties of the rubber coatings are described.—F. J.

Corrosion Protection and Ennoblement of Metals. Walter Savelsberg (Chem.-Zeit. 1933, 57, 883–884).—The mechanism of corrosion and protection is discussed and methods of protecting metals from corrosion by paints, enamels, and electrodeposits of other metals are briefly described.—A. R. P.

Permeability of Paint Films to Moisture. Robert I. Wray and A. R. Van Vorst (Indust. and Eng. Chem., 1933, 25, 842-846).—Various methods for determining permeability of paint films to moisture are discussed and results obtained by three methods given. In general, aluminium paint coatings show greater resistance to the passage of moisture than other pigments in the same vehicles. The aluminium powder concentration in the vehicle and the grade of powder used also have a marked effect on the permeability of the paint. Higher powder content, within limits, and finer grades of powder make more impermeable paint films.—F. J.

**Protective Painting is more than Surface Covering.** S. C. Britton and U. R. Evans (*Food Ind.*, 1933, 5, 392-393).—The general principles of protecting metal work by paint are reviewed.—E. S. H.

# VI -ELECTRODEPOSITION

(Continued from pp. 20-22.)

Some New Organic Addition Agents for Cadmium Electroplating. R. A. Claussen and H. L. Olin (Trans. Electrochem. Soc., 1933, 63, 87-94; discussion, 94-97) .- For abstract of the paper see J. Inst. Metals, 1933, 53, 249. In the discussion Gustaf Soderberg maintained that an ideal addition agent must not react chemically with the solution or be oxidized at the anode or reduced at the cathode to form ineffective compounds, must be equally effective over a wide range of concentrations, and must not be included in the deposit. On this basis he criticizes work on the effect of adding waste products as recommended by C. and O., since these products contain a wide variety of compounds only some of which may be effective; he also suggests that light may be thrown on the reason why some substances are active and others not by a study of cathode potentials. L. Addicks, on the other hand, states that an addition agent is destroyed as it is used up for the effect desired, and therefore recommends that these agents be added continuously drop by drop from a mechanical device. Leon R. Westbrook, in reply to questions by U. C. Tainton, said that small amounts of lead, tin, and arsenic in the bath darken the deposit, but their effect is overcome to some extent by adding a nickel salt as a brightener. Aqueous or alkali extracts of various organic substances, e.g. wood, or sulphonated castor oil, and some sulphonated

51

12

Con la

24

Sec.

1

20

the

100

1

Pin I

PR-

13

12

「日本

3.4

201

316 日前

12

112

20

(MEL

àsi

14

s b

戸田

1ZI

1

111

14

10

84

100

derivatives of naphthalene, can also be used as brighteners in cadmium plating baths. U. C. Tainton stated that colloidal silicic acid is used as an addition agent in zinc deposition from sulphate electrolytes in preference to organic compound; it is not included in the deposit, but travels towards the anode.

-A. R. P.

Cadmium Plating Instead of Galvanizing. Anon. (Z.V. d. Kupferschmied., 1933, 45, 181–182).—Cf. J. Inst. Metals, 1933, 53, 136, 445. Short note describing the electrodeposition of cadmium.—M. H.

Chromium Plating. Anon. (Automobile Eng., 1933, 23, 507).—See Met. Abs., this volume, p. 20. A description of a portable plating outfit which comprises two cases, one containing the electrical equipment necessary for plating, and the other the plating solutions, plating pads, and cleaning and polishing materials. A portable buffer also forms part of the outfit. It is stated that satisfactory and uniform deposits are obtained with this equipment, and that quicker deposition of both chromium and nickel is possible than in the vat process.—J. W. D.

Information for the User about Chromium Plate. Marvin J. Udy (Metal Progress, 1933, 24, (6), 24–27, 62).—Many failures of chromium-plating in practice are due to neglect of one or more of the following factors : appropriate thickness of coating for a given purpose, nature and quality of basis metal, nature and finish of undercoating. The significance of certain characteristic properties of chromium plate on industrial applications is discussed.—P. R.

A New Bath for the Direct Nickeling of Zinc. George W. Nichols (Met. Ind. (Lond.), 1933, 48, 566-568).—Paper read before the Electrochemical Society. See J. Inst. Metals, 1933, 53, 559.—J. H. W.

On the Platinizing of Noble and Base Metals. Edmund R. Thews and Ralph W. Harbison (*Chem.-Zeit.*, 1933, 57, 980–981).—The following are discussed : economics of the process, stability of the plate, old and new plating baths, their preparation, maintenance, and operation.—A. R. P.

Some Notes on Silver Plating. Anon. (Galvano, 1933, (20), 13-14).—A brief discussion of the process, in which it is claimed that the principal causes of failure are excess or insufficiency of cyanide, or excess of carbonate.

-E. S. H.

\*The Use of the Microscope in the Study and Control of Electrodeposits. A. Portevin and M. Cymboliste (*Rev. Mét.*, 1933, 30, 323-348).—A study of the technique of examining electrodeposits microscopically, of the qualities and defects of electrodeposits in relation to properties, and the factors affecting structure. Protection of electrodeposits by supplementary electrodeposits of other metals, *e.g.* copper or nickel, and chromium when the original deposit is a delicate one, before sections are cut for microscopical examination, is recommended. The protective or supplementary electrodeposit should not be one vigorously attacked by the etching medium. Attention is paid to thickness, inequalities, porosity, pin-holes, cracks, excrescences, colour, lustre, adhesion, flaking or peeling, corrosion-resistance, and structure of electrodeposits, and 74 photographs illustrating the structures of deposits are given.

-H. S.

Theories of Addition Agent Action. Robert Taft (*Trans. Electrochem.* Soc., 1933, 63, 75-82; discussion, 82-85).—For abstract of the paper see J. Inst. Metals, 1933, 53, 255. In the discussion, P. Jacquet gave details of tests made on the deposition of copper from sulphate solutions containing various colloids; gelatin and pure serum albumin modified the stress in the deposit considerably, gum arabic slightly, and dextrin not at all. With gelatin the stress of the deposit is closely connected with the method of preparation and age of the colloidal solution and with its "gold number," which appears to confirm the theory that some colloids are included in electrodeposits by adsorption. This theory is further confirmed by observa-

-

No.

24

2100

50

22

ich.

Part 1

E

前

al su

in.

1

200

御 二 二

1

1

120

122

100

線北

Sec.

山田

ib=

日本市日

a i P

100

日日

<u>Dete</u>

235

225

TIT

1 1 1

三日本

tions made on the adherence of electrodeposits to copper sheet which has first been dipped in colloidal solutions and washed before placing in the electrolytic bath; with solutions containing proteins or peptones, especially serum albumin, no adherence of the deposit is obtained, whereas with gum or dextrin solution good adherence is obtained. The colloid layer in the first case is produced in a few seconds, and cannot be removed by washing even in boiling water, hence it appears that colloids may stick to metals by adsorption independently of the electric current; with the current they are subject to cataphoresis, and are thus responsible for the variations of concentration in the neighbourhood of the cathode which modify the adsorption equilibria. Lawrence Addicks stated that in the early days of copper refining, smooth deposits were obtained by adding, to the electrolyte, oil or the solution obtained by boiling wood chips with water. Glue size was also used in nickel plating solutions to obtain smooth deposits. R. T., in reply, stated that at low temperatures gum arabic produces a profound effect on the form of electrodeposited copper.-A. R. P.

Control of Electrodeposits. Anon. (Galvano, 1933, (14), 23–25, (15), 23–26).—Translated from Machinery (Lond.), 1932, 39, 581–585. See J. Inst. Metals, 1932, 50, 683.—E. S. H.

# VII.-ELECTROMETALLURGY AND ELECTROCHEMISTRY

(Other than Electrodeposition and Electro-Refining.)

#### (Continued from pp. 23-24.)

\*The Electrolysis of Metallic Salt Solutions with a Cathode of Rarified Gas. N. Thon (Compt. rend., 1933, 197, 1114-1117).-Experiments were undertaken in depositing different metals using a rarified gas cathode and varying the distance between the cathode and the surface of the liquid. With a.c., the system electrolyte/rarified gas/platinum becomes a sensitive detector, the positive rectified current going to the surface of the liquid towards the metal. An applied potential difference of 1000 v. was used. It was established (1) that the electrolysis of salts of metals less noble than hydrogen (zinc, cadmium, lead, nickel) does not form a metallic deposit, but results only in an evolution of hydrogen; (2) that copper and mercury, although more noble than hydrogen do not form deposits from their salts, copper sulphate, and mercurous nitrate, respectively; (3) that a deposition of the metals is obtained with solutions of the simple salts, silver nitrate, gold chloride, and lead chloride. In the case of silver, a deposit is obtained even if the polarity of the electrodes is reversed. The statement relating to copper sulphate is in contradiction to Corbino's results, and a number of observations are made in support of that statement.-J. H. W.

The Hydrogen Overvoltages of Iron-Chromium Alloys in Potassium Hydroxide Solution. M. de Kay Thompson and D. M. Fleming (*Electrochem. Soc. Preprint*, 1934, April, 73-77).—The hydrogen overvoltage of ironchromium alloys in *M*-potassium hydroxide solution at 25° C. is constant between 0 and 60% chromium, after which it rises gradually to that of chromium in a concave curve.—A. R. P.

The Conductivity of Electrolytes Measured by the Resistance of Palladium Wire Containing Hydrogen. Notes on a Similarly Named Paper by C. A. Knorr and E. E. Schwartz. Donald P. Smith (Z. Elektrochem., 1933, 39, 743-744).—Both quantitative and qualitative arguments are raised against explanations put forward by K. and S. See J. Inst. Metals, 1933, 53, 363.

### IX.-ANALYSIS

#### (Continued from pp. 25-27.)

\*Analysis with Wedge Spectra : Its Recent Application to Zinc on a Quantitative Basis. Morris Slavin (Eng. and Min. J., 1933, 134, (12), 509-513).— The spectroscopic determination of Co, Fe, Cu, Cd, Tl, Ge, and Pb in ZnSO<sub>4</sub> solutions, and of Fe, Cu, Cd, and Pb in metallic Zn is described. A suggested improvement consists in separating the metals into groups as in qualitative analysis, adding prior to precipitation, a known amount of a metal which acts as a collector during the separation, and as the base material while spectrographing. From measurements of the comparative intensities of the lines of this metal and those of the unknown metal the percentage of the latter in the original sample can be calculated.—R. Gr.

\*Quantitative Rapid Micro-Analysis of Pure Aluminium. F. Pavelka and Hermine Morth (*Mikrochemie*, 1933, 13, 305-312).—The metal (0.1 grm.) is dissolved in 50% H<sub>2</sub>SO<sub>4</sub> and the solution is oxidized with 1 drop of H<sub>2</sub>O<sub>2</sub> and diluted to 10 c.c. in a graduated flask; 3 c.c. of the solution are used for the colorimetric determination of Fe with K<sub>4</sub>Fe(CN)<sub>8</sub>, a further 2 c.c. for the determination of Cu by measuring the time taken for the catalytic reduction of Fe(CNS)<sub>3</sub> with Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> under standardized conditions, and 2-3 c.c. for the determination of Mn by a modified persulphate method.

—A. R. P.

Methods of Analysis for Brass and Bronze. Anon. (Schweiz. Tech. Z., 1933, (24), 375-377).—The standard methods adopted by the U.S.M. Normal bureau are described.—W. A. C. N.

Method of Analyzing Antifiction Alloys. P. Foerster (Ann. Chim. Analyt., 1933, [ii], 15, 441–446).—Modifications of the usual procedure are recommended. The Sn and Sb oxides which remain insoluble after treatment of the alloy with HNO<sub>3</sub> are evaporated with Na<sub>2</sub>S,9H<sub>2</sub>O and a little S until a thick syrup is obtained. This is diluted and the insoluble PbS and CuS are collected, dissolved in HNO<sub>3</sub>, and added to the main filtrate. The solution containing SnS<sub>2</sub> and Sb<sub>2</sub>S<sub>3</sub> is divided and aliquot parts taken for Sn determination by I<sub>2</sub> titration, and Sb determination by KMnO<sub>4</sub> titration. Cu and Pb are determined by electrolysis of the HNO<sub>3</sub> solution and the spent electrolyte is used for determination of Zn and Fe.—A. R. P.

\*Detection of Alkaline Earth Metals. A. J. Scheinkmann and A. B. Politzschuck (Z. anal. Chem., 1933, 94, 192–193).—The carbonate precipitate obtained with  $(NH_4)_2CO_3$  in the usual way is dissolved by gentle warming with  $CH_3$ ·COONH<sub>4</sub> solution. To test for Ca, 10 drops of this solution are boiled with 3 drops of  $NH_4OH$ , a few crystals of  $NH_4Cl$ , and 10 drops of saturated  $K_4Fe(CN)_6$  solution; a white precipitate of  $Ca(NH_4)_2Fe(CN)_6$ , insoluble in  $CH_3$ ·COOH, indicates Ca. To test for Ba, a few drops of the accetate solution are treated with dilute  $H_2SO_4$ , when an immediate white precipitate indicates Ba; on boiling the filtrate a white precipitate indicates Sr.-A. R. P.

\*Picrolonic Acid as a Reagent for the Alkali Metals. Y. Volmar and M. Leber (J. Pharm. Chim., 1933, [viii], 17, 427-431; Chem. Zentr., 1933, 104, II, 2426-2427).—K is detected and separated by precipitation with (a) picric acid, (b)  $H_2PtCl_6$  and  $C_2H_5OH$ , or (c) Carnot's reagent (CaS<sub>2</sub>O<sub>3</sub> being substituted for Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>). In the filtrate from (a) Na gives an immediate precipitate with 0.02 N-picrolonic acid. To test for Na in the filtrate from (b) the  $C_2H_5OH$  must be removed and the Pt precipitated before applying the picrolonic acid test. Similarly, in method (c)  $C_2H_5OH$  must be boiled off. Bi precipitated with  $H_2S$  and Ca with  $(NH_4)_2CO_3$ , and  $NH_4$  salts expelled by evaporation and heating before testing for Na.—A. R. P.

On the Detection of Minute Amounts of Arsenic by the Gutzeit Method. G. Lockemann and B. Fr. von Bülow (Z. anal. Chem., 1933, 94, 322-330). Modifications of the method to improve its sensitivity are described in detail. A. P. P.

\*A New Way of Detecting Barium, Strontium, and Calcium in the Systematic Course of Analysis. Johanna Brintzinger and H. Brintzinger (Z. anal. Chem., 1933, 94, 166–170).—In microchemical analysis Ca may be identified as CaSO<sub>4</sub>,2H<sub>2</sub>O,Ba as BaSiF<sub>6</sub>, and Sr as  $Sr(IO_3)_2$  which give characteristic crystals on a microscope slide.—A. R. P.

\*Microchemical Identification of Sodium with the Aid of Picric Acid Georges Deniges (Bull. Trav. Soc. pharm. Bordeaux, 1933, 71, 191–195; Chem. Zentr., 1933, 104, II, 2427).—In spite of its relatively great solubility (10–12%) in H<sub>2</sub>O, Na picrate can serve for the identification of Na. The solution is evaporated and the dry residue (1 mg.) treated with 1 drop of 1% picric acid solution; in the presence of Na characteristic clusters of needles are formed. K, Rb, and Cs may be previously removed with HClO<sub>4</sub>.

\*On the Use of 5:7-dibromo-o-(8)-Hydroxyquinoline as a Specific Reagent for Vanadium. G. Gutzeit and R. Monnier (*Helv. Chim. Acta*, 1933, 16, 239-240).—Tervalent V may be detected by the brown precipitate (or colouration at high dilutions) given with 5:7-dibromo-o-(8)-hydroxyquinoline. Fe must first be removed by boiling with 3N-NaOH; the filtrate is acidified with HNO<sub>3</sub> and the reagent added.—E. S. H.

\*The Behaviour of Zirconium, Thorium, and Some Rare Earths Towards Quinalizarin. A. S. Komarowsky and I. M. Korenmann (Z. anal. Chem., 1933 94, 247-249).—On adding a few drops of alcoholic quinalizarin solution to a neutral chloride solution of Zr. Th, or the rare earths, and then making the solution feebly alkaline with NaOH, a blue colour, eventually flocculating to a blue precipitate, is obtained. The limits of sensitivity in p.p.m. are Nd 0-5. Pr 1-08, Ce 1-15, La 2-0, Zr 6-25, Th 6-67.—A. R. P.

On the Colorimetric Estimation of Antimony in Copper. A. A. Vassiliev and M. E. Schub (Zhurnal Prikladnoi Khimii (Journal of Applied Chemistry), 1933, [B], 6, (3), 560-462).—[In Russian, with German summary.] Clark's method is critically examined. A sharper comparison is obtained by extracting the coloured  $C_2H_5N-KI-Sb$  complex with an organic solvent,  $\epsilon.g. C_5H_{11}$ ·OH. Satisfactory results are obtained with 0.001-0.004% Sb, but certain difficulties exist which render further work desirable.—M. Z.

A Volumetric Method for the Determination of Barium and Sulphates. J. C. Giblin (Analyst, 1933, 58, 752–753).—The feebly HCl solution of Ba is titrated with  $H_2SO_4$  using Na rhodizonate paper as indicator, the til ation is finished when a drop of the solution no longer gives a red spot on the paper. —A. R. P.

On the Use of Rhodizonic Acid as an Indicator in the Volumetric Determination of Barium. A. Friedrich and S. Rapoport (*Mikrochemie*, 1933, 14, 41-48).—Tests under varying conditions failed to give good results, since Ba rhodizonate forms an almost insoluble colloidal suspension which reacts only slowly with sulphate ions (cf. preceding abstract).—A. K. P.

\*Colorimetric Determination of Bismuth. C. Mahr (Z. anal. Chem., 1933, 94, 161–166).—In 4–6% HNO<sub>3</sub> Bi produces a yellow colour with an excess of  $CS(NH_2)_2$ , whereas Cu and Pb are precipitated as crystalline compounds. The yellow colour of the filtered solution is compared in a Dubosq colorimeter with that produced by a standard Bi solution under similar conditions. In the presence of Sb, KF is added to prevent interference: Fe<sup>--</sup> must be reduced to Fe<sup>--</sup> by treatment with N<sub>2</sub>H<sub>4</sub> solution. The method gives good results with as little as 0·15 mg. of Bi in the presence of 1.5 grm. of Cu or 3 grm. of Pb.—A. R. P.

È.

ŧ

10

6.

0.

ż.

jį I

10

1

E.

P

23

10

and a

01

\*Determination of Chromium by the Mercurimetric Method. Al. Ionescu-Matiu and S. Herscovici (Bull. Soc. chim. France, 1933, 53, 1032–1038).— The solution containing the Cr as  $CrO_4$  and free from Cl and  $SO_4$  is treated with an excess of  $HgNO_3$  and the  $Hg_2CrO_4$  removed. The filtrate is oxidized with KMnO<sub>4</sub> and the resulting  $Hg(NO_3)_2$  titrated with NaCl after addition of Na nitroprusside until the turbidity disappears.—A. R. P.

The Application of the Mercurithiocyanate Precipitation of Copper to Its Colorimetric Determination. J. Golse (Bull. Trav. Soc. pharm. Bordeaux, 1933, 71, 16-24; Chem. Zentr., 1933, 104, II, 2427-2428).—The Cu is precipitated together with a known quantity of Zn by addition of an excess of  $(NH_4)_2$ Hg(SCN)<sub>4</sub>, and the colour of the precipitate is compared with that obtained in a series of standards containing the same amount of Zn but variable amounts of Cu. As little as 0.001 mg. of Cu is sufficient to impart a violet tint to the ZnHg(SCN)<sub>2</sub> precipitate.—A. R. P.

A Contribution to the Colorimetric Determination of Sodium. F. Alten and H. Weiland (Z. Pflanzenernährg. Dung. Bodenkunde, 1933, [A], 31, 252-255; Chem. Zentr., 1933, 104, II, 2427).—The method depends on the precipitation of the Na as the triple acetate of Na, UO<sub>2</sub>, and Mg and the colorimetric determination of the UO<sub>2</sub> with  $K_4$ Fe(CN)<sub>5</sub>.—A. R. P.

Nephelometric Determination of Small Quantities of Bismuth [in Copper]. Luigi Malossi (*Rend. Accad. Sci. fisich. mat. Napoli*, 1932, [iv], 2, 83–90; *Chem. Zentr.*, 1933, **104**, II, 2298).—The Bi is separated from the HNO<sub>3</sub> solution of the Cu by precipitation with  $(NH_4)_2CO_3$ , the precipitate dissolved in the minimum of HCl and the solution treated with a 0.5% suspension of agar-agar and with an alkaline solution of  $Na_2SnO_2$  whereby colloidal bismuth is formed the colour of which is compared with that produced similarly in a standard Bi solution.—A. R. P.

The Determination of Small Amounts of Bismuth in Copper. L. C. Nickolls (Analyst, 1933, 58, 684).—Cf. J. Inst. Metals (Monthly Issue), 1933, July, p. xevi. The method recommended by the Technical Sub-Committee of the Fiseal Policy Committee of the Brass and Copper Industries gives good results, but the use of  $SO_2$  for reducing the Fe<sup>\*\*</sup> to Fe<sup>\*\*</sup> is bad. A much better reducing agent is obtained by dissolving 10 grm. of Sn in 100 c.c. of 6N-H<sub>2</sub>SO<sub>4</sub>; a few drops of this SnSO<sub>4</sub> solution rapidly reduces the Fe and has no effect on the Bi colour, nor does it cause liberation of I<sub>2</sub> from the KI used.—A. R. P.

The Electrolytic Determination of Bismuth, Tin, Lead, and Antimony without Mechanical Stirring. Th. Grosset (Bull. Soc. chim. Belg., 1933, 42, 269-280).—Bi is deposited from a boiling HNO<sub>3</sub>-tartaric acid solution using 0·5 amp. at 1·32 v., Sb from a boiling HCl solution containing NH<sub>2</sub>OH·HCl and tartaric acid using 3·2 amp. at 2 v., Pb from a boiling nitrate solution using 3 amp. at 2·1-1·5 v., and Sn from a boiling HCl solution containing NaCl, KCl, NH<sub>4</sub>Cl, and (NH<sub>4</sub>)<sub>2</sub>S<sub>2</sub>O<sub>8</sub> using 3·2 amp. at 2·1 v. and a Ni-plated Pt cathode.—A. R. P.

\*The Determination of Cadmium in the Presence of Zinc in Spelter and in Zinc Ores. A. Pass and A. M. Ward (Analyst, 1933, 58, 667-672).—The metal is dissolved in  $2N \cdot H_2SO_4$  and the solution boiled with Fe nails to remove Cu, Bi, As, and Sb as metals and Pb as PbSO<sub>4</sub>. The filtrate is treated with 5 grm. of Rochelle salt, a few drops of SO<sub>2</sub> water, 40-50 c.c. of  $0.2N \cdot KI$ , and sufficient of a 2.5% solution of  $\beta$ -naphthaquinoline in  $0.5N \cdot H_2SO_4$  to give an excess of 5-6 c.c. The complex Cd precipitate is collected on an asbestos layer in a porous glass crucible, washed with a dilute solution of the precipitant and rubbed up with  $2N \cdot NH_4OH$ . The asbestos, &c., is filtered off, and the filtrate treated with HCl until N with respect to this acid, then with 5 c.c. of 10% KCN and a little starch solution, and titrated with  $M/40-KIO_3$  (1 c.c. = 1.405 mg. of Cd). In the  $NH_4OH$  extraction only the I<sub>2</sub> in the precipitate is removed; the titration is based on the action :  $2HI + HIO_3 +$  $3HCN = 3ICN + 3H_2O$ . Phenyltrimethylammonium iodide may also be used as precipitant for the Cd.-A. R. P.

\*The Use of Potential-Forming Systems Metal/Metal-Anion for Potentiometric Analysis. I.-The Precipitation Potentiometric Titration of Chromate, Molybdate, and Tungstate Ions as well as a Series of Metal Ions by the Use of Chromium, Molybdenum, and Tungsten as Indicator Electrodes. H. Brintzinger and E. Jahn (Z. anal. Chem., 1933, 94, 396-403).---W, Cr, and Mo in the form of  $R_2MO_4$  salts (R = an alkali metal or  $NH_4$ ) can be titrated potentiometrically with BaCl, at 95° C. using an indicator electrode of the corresponding metal. By titration at 95° C. with Na2MoO4, using a Mo electrode, Ba Sr, Pb, and Cd may be determined in neutral solution, and at 20° C. Cu and Mn may be determined similarly; C2H5OH must be added for Mn and Sr and CH, COONH4 for Cu. Ba may also be titrated at 95° C. with Na2WO4 (W electrode) or Na<sub>2</sub>CrO<sub>4</sub> (Cr-plated steel electrode). A. R. P.

S. Astin and The Determination of Copper by the Salicylaldoxime Method. H. L. Riley (J. Chem. Soc., 1933, 314-315).—A note on the method.—S. V. W. The Separation and Determination of Copper and Nickel by Salicylaldoxime.

H. L. Riley (J. Chem. Soc., 1933, 895).-A note on the method -S. V. W.

Solubility of Lead Chromate. Application to the Volumetric Determination of Lead H. Huybrechts and Ch. Degard (Bull. Soc. chim. Belg., 1933, 42, 331-346) -- CH<sub>2</sub> COOH and CH<sub>3</sub> COONH<sub>4</sub> separately augment the solubility of PbCrO, in high concentrations, but together their effect is less marked; the presence of  $Ca(NO_3)_2$  assists flocculation of the PbCrO<sub>4</sub>. In the volumetric determination of Pb by the chromate method the solution should contain a minimum amount of acetates and 0.6-1 g. of Ca(NO<sub>3</sub>)<sub>2</sub> per 100 c.c.; K<sub>2</sub>CrO<sub>4</sub> should be added to the cold solution and the excess determined in the usual way after removal of the PbCrO<sub>4</sub> precipitate. -A. R. P.

Determination of Magnesium by Means of 8-Hydroxyquinoline. н. Fredholm (Ann. Brass. Dist., 1933, 31, 43-44).-From Svensk Kem. Tidskr. 1932, 44, 79. To the solution containing 25 mg. of Mg in 100 c.c. at 75° C. are added 2-3 grm. of NH4Cl and 2 e.e. of 3N-NH3 aq., then drop by drop a slight excess of a 2% alcoholic solution of 8-hydroxyquinoline. After boiling for 3-4 minutes, the precipitate is collected and dissolved in 2N-HCl; N/10-KBrO3 is added until a yellow colouration is produced, and the excess of KBrO<sub>3</sub> titrated with Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>, using starch as indicator.-E. S. H.

Friedrich Detection and Determination of Small Quantities of Mercury. Cucuel (Mikrochemie, 1933, 13, 321-364).- A review of recent work.- A. R. P.

A Rapid Method of Estimating Phosphorus in Copper and Copper Zinc Alloys. A. A. Vassiliev and Z. W. Tchurilima (Zhurnal Prikladnoi Khimii (Journal of Applied Chemistry), 1933, [B], 6, (3), 563-566). -[In Russian, with German summary.] A modification of the molybdate methods of Lorenz and of Finkener is described by which complete precipitation of up to  $0.1_{0}$ P can be obtained in 1 hr.—M.Z.

Drop Method for the Approximate Quantitative Determination of Platinum. N. A. Tananaeff and G. T. Michaltschischin (Z. anal. Chem., 1933, 94, 188-192).-The method depends on the orange colour produced by adding 1 drop of SnCl<sub>2</sub> solution to a drop of H<sub>2</sub>PtCl<sub>6</sub> solution and a drop of TlCl solution on a piece of filter paper. The depth of colour is compared with that produced by a standard Pt solution under similar conditions. The results are accurate to 2-12% for quantities of Pt of the order of 0.1 mg.—A. R. P.

Determination of Potassium by the Cobaltinitrite Method. O. M. Kosman (Zhurnal Prikladnoi Khimii (Journal of Applied Chemistry, 1933, [B], 6, (2), 362-366).-[In Russian, with German summary.] The merits of the method are discussed and a new technique described. -M. Z.

ŧ.

2

Ē E,

ş.

15

10.10

ŝ

P

\*On the Quantitative Determination of Tin by Precipitation as Stannous Sulphide. Benedikt Linke and Heinrich Preissecker (Z. anal. Chem., 1933, 94, 238-239).—The solution containing the tin as  $SnCl_2$  and 4 c.c. of HCl (d 1-19) per 100 c.c. is treated with a rapid stream of H<sub>2</sub>S on the water-bath. The black precipitate of SnS yields  $SnO_2$  for weighing after ignition at a gentle heat, than at full redness. If the original solution contains the Sn as  $SnCl_4$ , it must first be reduced with Mg in a flask fitted with a Bunsen valve.

-A. R. P.

[Contribution] to the Knowledge of the Dithizone Reaction. Remarks on the Work of H. Wolbling and B. Steiger. Hellmut Fischer (Angew. Chem., 1933, 46, 517).—Cf. J. Inst. Metals, 1933, 53, 563. Oxidizing agents interfere in the Hg reaction, but their effect can be overcome by addition of 1% KCN solution. The Ag reaction is not affected by acids; by shaking the CCl<sub>4</sub> extract of the Ag test with 1% KCN the Ag colour changes to green, whereas that due to Hg persists unchanged. The Cu reaction is prevented by KCN in neutral or alkaline solution, so that traces of Pb in Cu may be detected by the test if KCN is added. The Hg reaction is also prevented by KCN, so that the method does not distinguish between the two metals.—A. R. P.

Application of Mercurimetry to the Determination of Silver. J. V. Dubsky and J. Totílek (Chem. Obzor., 1933, 8, 86-88).—See J. Inst. Metals, 1933, 54, 649.—A. R. P.

†Wulff's Foil Colorimeter for Determining  $p_{\rm H}$  Values. W. Kordatzki (Arch. tech. Messen, 1933, 3, (28), T135).—The indicator consists of a membrane, penetrable by water and aqueous solutions and containing adsorbed colouring matter; its application to the determination of  $p_{\rm H}$  values, especially of turbid or viscous media is described. In special adaptations of the indicator for high dilutions, and as a substitute for litmus paper, the  $p_{\rm H}$  value is indicated by the shade assumed by the foil, approximate values being quoted. An extensive bibliography covers industrial applications, including galvanizing.—P. M. C. R.

## X.-LABORATORY APPARATUS, INSTRUMENTS, &c.

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

#### (Continued from pp. 27-28.)

\*Manipulation of the Research Microscope. [Mechanical Stage Device for Microscopes.] Ralph Wichterman (*Science*, 1933, 78, (2021), 266-267).— Large areas may be examined under high magnification by moving the specimen in one direction on a mechanical stage, but difficulties exist in shifting the specimen by steps in a direction at right angles to the motion, so that the successive bands which are examined just overlap. A device made by the Spencer Lens Co., Buffalo, New York, enables the specimen to be moved over the required distance by one turn of a knob.—W. H.-R.

Advances in Microscopy. F. F. Lucas (Assoc. Internat. Essai Mat., Congres de Zürich, 1932, (I), 422–444).—[In English.] See J. Inst. Metals, 1932, 47, 96.—S. G.

Progress of Metallography. J. L. Haughton (Assoc. Internat. Essai Mat., Congrès de Zürich, 1932, (I), 457–468).—[In English.] See J. Inst. Metals, 1931, 47, 87.—S. G.

Recent Development in Research on the Constitution of Alloys. W. Guertler (Assoc. Internat. Essai Mat., Congrès de Zürich, 1932, (I), 469–483).— [In German.] See J. Inst. Metals, 1931, 47, 527.—S. G.

X-Ray Investigations of the Constitution of Alloys. A. Westgren (Assoc. Internat. Essai Mat., Congres de Zürich, 1932, (I), 484-499).—[In English.] See J. Inst. Metals, 1931, 47, 536.—S. G.

# 1934 XI.—Physical and Mechanical Testing, &c.

Discussion [on Metallography]. J. L. Haughton. W. Rosenhain, C. Benedicks. A. Portevin. O. Chlebus. A. Schimmel. G. Masing. F. F. Lucas (Assoc. Internat. Essai Mat., Congrès de Zurich, 1932, (I), 501-507).--[In English, French, or German.] The discussion centred chiefly on the optical theory of microscopic resolution, on the nature of transformations in steel, and of the  $\beta$ - $\beta'$  transformation in brass, and on the need for using very pure metals for the study of equilibria in alloy systems .--- A. R. P.

On the Use of Polarized Light in the Examination of Metal Sections. (Frhr.) M. v. Schwarz (Assoc. Internat. Essai Mat., Congrès de Zürich, 1932, (I) 508-517) .- [In German.] This paper has been published in full with colour photomicrographs in Z. Metallkunde, 1932, 24, 97, and in Metallurgia, 1931, 4, 180 (see J. Inst. Mctals, 1931, 47, 659; 1932, 50, 744). A. R. P.

\*The Attainment of Very Low Temperatures by Compression of Liquid Helium. W. Meissner (Wiss. Abhandl. Physikal.-Tech. Reichsanst., 1933, 17, 88-93).-Reprint from Z. Physik, 1933, 81, 832-837; see J. Inst. Metals, 1933, 53, 516.-M. H.

The Inspection of Interiors. P. Nettmann (Automobiltech. Z., 1933, 36, (23), 597).—A portable apparatus for the visual examination of hollow objects is described. The optical system can be adjusted to give a general view of the interior, or to show any desired portion of the walls. P. M. C. R.

Magnetic Apparatus for the Measurement of Thicknesses. P. Bricant (Technique moderne, 1933, 25, (10), 360)-Abstract of a note to the Academie des Sciences, March 6, 1933. The continuous and automatic measurement of the thickness of thin sheets, and the diameters of fine wires is made by measuring electrically the variation in the reluctance of an air gap in a transformer core caused by variations in the sheet thickness. The method can be used even when the magnetic permeability of the material is nearly equal to that of air, and it is particularly applicable to the measurement of small displacements of moving pieces such as in the dilatation of solids or the variations in thickness of a manometric capsule.-R. B. D.

# XI .- PHYSICAL AND MECHANICAL TESTING, INSPECTION, AND RADIOLOGY

# (Continued from pp. 28-30.)

\*Investigations on the Depth of Penetration of [Metal] Sheets in the Erichsen Test. Fr. Dörge (Z. Metallkunde, 1933, 25, 165-168, 210-214). An experimental and mathematical investigation has shown that the Erichsen test is merely a mechanical breaking process similar to the tensile test. The Erichsen number does not give information concerning the deep drawing capacity of a sheet. The experiments were carried out with 0.5 and 1.5 mm. sheets of aluminium, copper, 72:28 brass, 63:37 brass, and 93:7 coppertin alloy .- M. H.

+Fatigue-Testing Machine for Metals. Anon. (Schweiz. Tech. Z., 1933, 197-204).—A historical survey of fatigue-testing is first given and this is followed by descriptions of many types of machines in current use.-W. A. C. N.

Endurance. P. Ludwik (Assoc. Internat. Essai Mat., Congrès de Zurich, 1932, (1), 190-206).—[In German.] See J. Inst. Metals, 1931, 47, 472.—S. G.

The Present State of Knowledge of Fatigue of Metals. H. J. Gough (Assoc. Internat. Essai Mat., Congres de Zurich, 1932, (I), 207-227). --[In English.] See J. Inst. Metals, 1931, 47, 472.-S. G.

Stress Corrosion of Metals. D. J. McAdam (Assoc. Internat. Essai Mat., Congres de Zürich, 1932, (I), 228-246).—[In English.] See J. Inst. Metals, 1931, 47, 531.—S. G.

91

The Development of Fatigue-Testing in Germany. E. H. Schulz and H. Buchholtz (Assoc. Internat. Essai Mat., Congrès de Zürich, 1932, (I), 278-303).—[In German.] See J. Inst. Metals, 1931, 47, 492.—S. G.

Discussion [on Fatigue]. R. Kühnel. (Sir) Henry Fowler. B. Kounovsky. H. F. Moore. F. Bacon. T. Ver. O. Chlebus. F. N. Speller. C. Benedicks. A. Umlauf. M. Füchsel. W. Fahrenhorst. A. Gessner. H. A. Dickie. P. Ludwik. W. Rosenhain (Assoc. Internat. Essai Mat., Congrès de Zürich, 1932, (I), 305–328).—[In English or German.] The whole of the discussion deals with fatigue phenomena in steel.—A. R. P.

The Davos Fatigue-Testing Machine. Anon. (Machinery (Lond.), 1933, 43, 15-16).—A rotating-beam type of fatigue machine using 4-point loading is described. Special chucks are provided which obviate the necessity for tapping holes in the test-piece.—J. C. C.

The Endurance Strength of Structural Materials for Aircraft and Aero Engines. Kurt Matthaes (Z. Flugtech. u. Motor., 1933, 24, (21), 593-598: (22), 620-626).-[I.-] Adequate endurance testing must allow for constant static stress as well as for variable stresses arising in service from vibration and other causes. Endurance curves derived from alternate stress tests are given for 6 materials, and characteristic fractures are illustrated. Further curves show the influence of frequency on resistance to vibration in the cases of annealed copper, rolled aluminium, and mild steel. Tables show the influence of previous static stresses on 3 steels, on an alloy of the Duralumin class, and on a magnesium alloy. The relation between endurance strength and static strength is shown in comparative curves for steels and for aluminium and magnesium alloys, with analyses and tensile strengths. [II.--] Endurance strengths and the effects of corrosion are given for a variety of ferrous and non-ferrous semi-finished materials, which are further discussed with reference to special forms. The effect of stress concentrations at points where there are abrupt variations in cross-section is discussed, and is tabulated for certain common cases and materials. The influence of boring, notching, threading, riveting, and welding is considered in relation to the endurance strength of finished pieces. An appended note discusses the work of R. E. Peterson on Model Testing (Applied Mechanics, 1933, 1, (2), 79).-P. M. C. R.

The Inter-Relationship of the Rockwell, Brinell, and Shore Hardness Numbers. W. E. J. Beeching (*Met. Ind. (Lond.)*, 1933, 43, 641).—Equations which give the inter-relationship of Rockwell, Brinell, and Shore hardness numbers within  $\pm 10\%$  are as follows:

Brinell number

 $= 130 - \text{Rockwell Ball number} = (100 - \text{Rockwell Cone number})^2$ . Shore number

 $= \frac{1}{10} \text{ (Brinell number)} + 10 = \frac{K_1}{130 - \text{Rockwell Ball number}} + 10,$ 

where  $K, K_1$ , and C are constants.—J. H. W.

K

The Notched-Bar Impact Test Problem in Germany. M. Moser (Assoc. Internat. Essai Mat., Congrès de Zürich, 1932, (I), 342-355).—[In German.] See J. Inst. Metals, 1931, 47, 492.—S. G.

Impact Tests on Notched-Bars. R. Zoja (Assoc. Internat. Essai Mat., Congres de Zürich, 1932, (I), 356-364).—[In French.] See J. Inst. Metals, 1931, 47, 492.—S. G.

Impact Tests—Standard Test-Pieces. M. Schmidt (Assoc. Internat. Essai Mat., Congres de Zurich, 1932, (I), 365–371).—[In German.] See J. Inst. Metals, 1931, 47, 493.—S. G.

# 1934 XI.—Physical and Mechanical Testing, &c. 93

Meaning of the Notched-Bar Impact Test for Investigation and for Acceptance Test Purposes. R. H. Greaves (Assoc. Internat. Essai Mat., Congres de Zarich, 1932, (I), 372-378).--[In English.] See J. Inst. Metals, 1933, 47, 493.--S. G.

The Notched-Bar Impact Test as an Acceptance Test. A. Steccanella (Assoc. Internat. Essai Mat., Congrès de Zurich, 1932, (I), 379-387).—[In French.] See J. Inst. Metals, 1931, 47, 493.—S. G.

Discussion [on Resilience]. F. Körber. V. Jares. A. Hasch. M. Moser. A. Steccanella. (Sir) Henry Fowler. G. Stratilesco. Fr. P. Fischer. J. F. Cellerier. E. Dupuy. O. Hönigsberg. W. Rosenhain. H. Moore (Assoc. Internat. Essai Mat., Congrès de Zurich, 1932, (I), 394-405).—[In English, French, or German.] The discussion ranges round the adoption of a standard test-piece for determining the notched-bar impact strength of metals, particularly steel.—A. R. P.

Note on the Convenience and Ease of the Notched-Bar Test for Testing Welds. H. Dustin and D. Rosenthal (Assoc. Internat. Essai Mat., Congrès de Zürich, 1932, (I), 409-411).—[In French.] From experiments on welds in steel it is concluded that the notched-bar impact test is a suitable rapid method for the works testing of welds.—A. R. P.

Hardness Testing. E. E. Halls (*Machinery* (*Lond.*), 1933, 43, 121-124; 375-378; correspondence, 356-357).—The characteristics, advantages, and limitations of the following machines are critically discussed :—Shore scleroscope, Duroskop, Brinell, Baby Brinell, Firth Hardometer, Rockwell, Vickers diamond, Monotron, Rockwell superficial hardness tester, Herbert pendulum, Cloudburst tester, and Losenhausenwerk "New-type" tester. The relationship between various hardness scales is considered in some detail. The empirical nature of any relationship between rebound and indentation test results is pointed out. Such factors as machine accuracy, the flattening of Brinell balls, and the relation between hardness and tensile strength are discussed. The pyramid diamond test is considered to offer greatest promise for the future.—J. C. C.

The Drop-Hardness Tester. M. von Schwarz (Werkstatt u. Betrieb, 1934, 67, (1/2), 4-6).—An illustrated account, with bibliography, of a hardness test by combined indentation and impact methods. A standard weight falling through a standard height down a vertical tube strikes a ball of known size resting on the test-piece; the impression produced is measured, and conversion curves to Brinell figures are given. The method is applicable to metals and alloys of all types.—P. M. C. R.

Extensioneters for Strip Steel. E. Skerry (Aircraft Eng., 1933, 5, 239-240).—The Gerard and Lindley extensioneters are described. Both instruments are designed for commercial testing of metals or alloys when observations of the proof stress values are desired.—H. S.

Metals at High Temperatures. J. Galibourg (Assoc. Internat. Essai Mat., Congres de Zurich, 1932, (I), 134-142).—[In French.] See J. Inst. Metals, 1931, 47, 490.—S. G.

Materials at High Temperatures. R. G. Batson and H. J. Tapsell (Assoc. Internat. Essai Mat., Congrès de Zurich, 1932, (I), 160–167).—[In English.] See J. Inst. Metals, 1931, 47, 489.—S. G.

**Discussion** [on Papers on Materials at High Temperatures]. F. Körber. H. Dustin. C. J. van Nieuwenburg. R. Grandmaitre. (Sir) Henry Fowler. A. Pomp. H. J. Gough. O. Chlebus. W. Rosenhain (Assoc. Internat. Essai Mat., Congrès de Zurich, 1932, (I), 169–176).—[In English, French, or German.] Cf. preceding abstracts. Most of the discussion refers to the behaviour of steels at high temperature and to the relative merits of the short time creep test of Pomp and the more prolonged test of the National Physical Laboratory. C. J. van N. raised an interesting question by his statement that under high pressures metals may volatilize at relatively low temperature, thus when a copper tube is heated at  $400^{\circ}-425^{\circ}$  C. in steam at 300-350 atm. minute octahedral crystals of copper condense in the cool parts, and a similar behaviour is shown by silver. Under these conditions too, zinc is rapidly removed from brass leaving sponge copper, and silicon from steel boiler plate. O. C. quoted examples of fatigue failure of locomotive staybolts, and said that the endurance of metals at high temperature should be tested under bending and torsional loads as well as under static loads.—A. R. P.

The Behaviour of Metallic Materials at Temperatures at which Recrystallization Occurs even after Small Deformation. W. Rohn (Assoc. Internat. Essai Mat., Congrès de Zurich, 1932, (I), 177-182).-[In German.] At temperatures above which recrystallization occurs even after small deformation large differences are found in the creep limit according to whether this is determined by approach from a high or a low temperature, the limiting creep stress being much greater in the second case than in the first. Again, similar differences in the results occur according to whether the load is applied to the test before heating or after the testing temperature is reached, or at an intermediate temperature. These facts are illustrated by curves obtained for an alloy of nickel with 15% chromium, 15% iron, and 7% molybdenum. This alloy appears to be stronger at temperatures above 700° C. than any commercial alloy on a chromium-nickel-iron basis, but its limiting creep stress is only 0.8 kg./mm.<sup>2</sup> at 900° C. and 0.3 kg./mm.<sup>2</sup> at 1000° C. A peculiar feature of this alloy is that annealing at 1250° C. induces a higher creep limit at 1000° C., but a much lower yield point at room temperature than does annealing at 1050° C. or lower; similar effects of high annealing temperature have been observed with nickel and iron.-A. R. P.

Apparatus for the Determination of Rate of Creep and Limiting Creep Stress. W. Rohn (Assoc. Internat. Essai Mat., Congrès de Zürich, 1932, (I), 183–186).— [In German.] See J. Inst. Metals, 1930, 44, 597.—A. R. P.

\*On an Improved Apparatus for the Static Determination of the Torsion Modulus of Crystal Rods and Its Application to Single Crystals of Zinc. E. Goens (Wiss. Abhandl. Physikal.-Tech. Reichsanst., 1933, 17, 69-85).--Reprint from Ann. Physik, 1933, [v], 16, 793-809; see J. Inst. Metals, 1933, 53, 653.--M. H.

The Calibration of Testing Machines. H. F. Moore (Assoc. Internat. Essai Mat., Congrès de Zurich, 1932, (II), 482–491).—[In English.] See J. Inst. Metals, 1931, 47, 214.—S. G.

Accuracy of Measurement and Variability of Test Results. F. C. Lea (Assoc. Internat. Essai Mat., Congrès de Zurich, 1932, (II), 492–498).--[In English.] See J. Inst. Metals, 1931, 47, 215.-S. G.

Calibration and Accuracy of Testing Machines. W. Ermlich (Assoc. Internat. Essai Mat., Congrès de Zürich, 1932, (II), 499-514).—[In German.] See J. Inst. Metals, 1931, 47, 214.—S. G.

Discussion [on Calibration and Accuracy of Testing Machines]. F. Rinagl. A. Photiades. H. F. Moore. P. Santo Rini. — von Bohuszewicz. J. Basta. C. C. Teodorescu (Assoc. Internat. Essai Mat., Congrès de Zurich, 1932, (II), 515-527).—[In German, English, or French.] The discussion revealed the necessity for defining precisely the characteristics of testing machines, especially sensitiveness, accuracy, and reliability, and for drawing up a set of rules for the calibration of such machines.—A. R. P.

Theory and Experiments in Regard to Grain-Size and Fineness. A. H. M. Andreasen (Assoc. Internat. Essai Mat., Congrès de Zürich, 1932, (II), 437-442).—[In German.] See J. Inst. Metals, 1931, 47, 218.—S. G.

Present Status of Particle Size Measurement. L. Work (Assoc. Internat. Essai Mat., Congrès de Zürich, 1932, (II), 443–457).—[In English.] See J. Inst. Metals, 1933, 47, 219.—S. G.

# 1934 XII.—Temperature Measurement and Control 95

On the Size Determination of Free Grains. H. W. Gonell (Assoc. Internat. Essai Mat., Congrès de Zurich, 1932, (II), 458-468).—[In German.] An air elutriator for grading powders of sub-sieve size is described and an account given of some results on various materials obtained by its use. The apparatus separates grains of 60  $\mu$  down to 2  $\mu$  in diameter according to the sp. gr. Among the materials tested was tungsten powder, and photographs are given of grains of this material of diameter  $< 2 \mu$ ,  $2-5 \mu$ , and  $5-10 \mu$ .—A. R. P.

of grains of this material of diameter  $< 2\mu$ ,  $2-5\mu$ , and  $5-10\mu$ .—A. R. P. Discussion [on Grain-Size in Loose Materials]. M. Roš. K. Sandera. C. J. van Nieuwenburg. A. H. M. Andreasen. J. Basta. M. Spindel. G. von Kazinczy. O. Stern. E. Suenson. G. Haegermann. R. Meldau (Assoc. Internat. Essai Mat., Congrès de Zürich, 1932, (II), 471-479).—[In French or German.] The discussion showed the diversity of methods used in various countries and the need for unification. Collaboration is recommended to determine the accuracy of the various methods, the limits of the methods, and the relationship between the results obtained by the different methods.—A. R. P.

### RADIOLOGY

**X-Ray Diagnosis in Welding Technology.** H. Kochendörffer (Autogene Metallbearbeitung, 1933, 26, 230–235).—The importance of X-ray investigation in development research on welding is emphasized. Three important applications are suggested, viz., examination of the quality of welding rods, control testing of operators, and control testing of work in progress, in conjunction with bend tests. The last application is considered of great value; the testpiece is radiographed before and after bending and the nature of the cracks produced in bending is carefully noted. Examples of radiographed welds in steel are illustrated.—H. W. G. H.

**X-Ray Testing of Welds.** Ancel St. John (*Welding J.*, 1933, **30**, 52-53).— A brief review of radiography applied to welds is given. The great importance of proper technique is emphasized and the use of a thickness gauge to ensure correct penetration is explained. The location of defects by double exposure with reference markers is described.—H. W. G. H.

X-Ray Pictures of Weld Seams. H. Halberstadt (Autogene Metallbearbeitung, 1933, 26, 225-230).—An apparatus ("Metalix") is described, which fulfils the necessary conditions for industrial X-ray equipment, viz., complete insulation of high-voltage connections, efficient screening, ease of transport, and simplicity of manipulation. The principles of interpretation of radiographs are explained and typical faults in weld seams are illustrated.—H. H. X-Ray Examination of Welded Copper Vats. Anon. (Brewers J., 1933,

**X-Ray Examination of Welded Copper Vats.** Anon. (*Brewers J.*, 1933, 69, 617-618).—The methods used for radiographing welds are briefly explained and it is suggested that the application to large copper vats used for brewing is to be recommended.—H. W. G. H.

# XII.-TEMPERATURE MEASUREMENT AND CONTROL

#### (Continued from pp. 30-32.)

**†On Temperature Measurements.** W. Liesegang (*Oesterr. Chem.-Zeit.*, 1933, **36**, 60-61; discussion, 61).—Methods of measuring furnace temperatures with thermocouples and radiation pyrometers are described and discussed. For the protection of precious metal couples at temperatures up to 1700 C. the use of "Sinterkorund" (crystalline alumina) tubes is recommended. L. Hecht stated in the discussion that platinum metal couples are rapidly destroyed when used without adequate protection in electric furnaces heated by Silit rod resistance elements, owing to the carbon monoxide generated by oxidation of the Silit or to vaporization of silicon therefrom; both of these factors produce serious embrittlement of the couple wires.—A. R. P.

Temperature Measurements with Tungsten-Molybdenum Thermocouples. Bernhard Osann, Jr., and Ernst Schröder (Arch. Eisenhüttenwesen, 1933, 7, 89-94).—Experiences with tungsten-molybdenum couples in various types of sheath are described.—J. W.

Resistance Thermometers. Georg Keinath (Arch. tech. Messen, 1933, 2, (19), T8-T9).—The principle of the resistance thermometer is described. The application is mainly to the measurement of temperatures below 800°C., and especially of very low temperatures. Factors influencing the choice of conductor are enumerated and discussed. Metallic conductors are of most service. The temperature coefficients of 19 metals are given. Certain electrolytic resistance thermometers are described. A bibliography is appended.—P. M. C. R.

# XIII,-FOUNDRY PRACTICE AND APPLIANCES

#### (Continued from pp. 32-34.)

The World Foundry Congress, Paris, September, 1932.—V. F. Renaud (*Rev. Mét.*, 1933, 30, 382–395).—See also J. Inst. Metals, 1933, 53, 521. Summaries of papers by Rowe and Gingerich on improvements in quality in castings in aluminium alloys, by Hanson on defects in aluminium alloys, by Cazaud on fatigue properties of castings in aluminium-rich alloys, by Sonnino on melting of aluminium in electric or combustion furnaces, by Ballay and Thomas on silicon in cupro-nickel, by Renaud on precious alloys of gold, silver, and nickel, and others are given.—H. S.

of gold, silver, and nickel, and others are given.—H. S.  $^{+}$ Deoxidizers and Fluxes. G. L. Bailey (*Met. Ind.* (*Lond.*), 1933, 43, 561-564, 583-587; discussion, 587-588 and 592).—Paper read before the Midland Metallurgical Societies. A description is given of the action of deoxidizers and their affinity for oxygen, the removal of the resulting oxide, the action of phosphorus on tin and zinc alloys, and the formation of phosphate slag, the function of manganese as a deoxidizer, and the use of hydrogen and of carbon monoxide (Reitmeister's method) in the deoxidation of copper. The use of salt mixtures as fluxes for non-ferrous melting have a wide variety of uses. For high melting-point metals, glass is frequently used, and this may have a deoxidizing as well as a protective action. The use of degasifiers is discussed, and fluxes for aluminium and magnesium and of special fluxes, such as Thermit, are described; 22 references are given. In the discussion, the use of borax and a charcoal cover were advocated and the reaction of copper with phosphorus was discussed. B. replied.—J. H. W.

Aluminium Melting Losses. William Ashcroft (Metallurgia, 1933, 9, 42, 52).—The most important factors with regard to their influence on dross losses in the melting of aluminium and its alloys include the type of furnace employed; the melting temperature; the length of time required for melting and superheating to the pouring temperature; the length of time the metal is allowed to remain in the furnace after reaching the pouring temperature; the constitution of the furnace atmosphere in contact with the metal, method of firing and fuel used; and the volume of air and products of combustion passing over the metal in unit time. These factors are considered, and special attention is given to selection of melting furnaces, and the various types of furnaces suitable for melting for repigging or casting into rolling ingots; for general foundry practice; for modern die-casting practice, and for the melting of scrap and borings are considered with a view to the reduction of melting losses in practice.—J. W. D.

Silumin Chill-Castings.—Die-Castings. [A.] v. Zeerleder (Schweiz Tech. Z., 1933, 233-236).—Cast-iron and Silumin chill- and sand-castings are compared as regards cost and ultimate weight. Macroscopical examination of ordinary and modified Silumin is described and illustrations of typical samples are given. The physical properties of ordinary, modified,  $\beta$ ,  $\gamma$ , and modified y-Silumin are tabulated. Die-casting machines are illustrated. -W. A. C. N.

What is the Effect of Phosphorus as a Deoxidizer in Copper Alloys? E. T. Richards (Z. ges. Giesserei-Praxis : Das Metall, 1933, 54, 454-455, 471-473) .- The difficulties occasionally attending the use of phosphorus or phosphor-copper as a deoxidizer are discussed with reference to a number of specific examples of copper alloy castings in which the failures or flaws are shown to be due to insufficient or excess phosphorus in the castings or to its being incorrectly added or given insufficient time to take effect. To guard against possible ill effects, the casting should contain between a trace and, at the most, 0.02% of phosphorus. Above this amount, the phosphorus becomes an addition element to the alloy, and exerts a favourable effect only in certain alloys and for specific technical purposes.-J. H. W.

Bells] Music in the Air. Anon. (Tin, 1933, Nov., 10-11).-A brief descrip-

tion of the composition, casting, and tuning of bells is given.—J. H. W. Casting and Recasting Bearings and Bushes. Erich Becker (Z. ges. Giesserei-Praxis: Das Metall, 1933, 54, 491–493, 512–513).—The manufacture of cast bearings and bushes free from cold shot, porosity, blisters, and cracks, and made from iron, steel, brass, and white metal is described. Failures are usually due to lack of care in the preparations for the casting .-- J. H. W. \*Contribution to the Knowledge of Inverse Segregation in [Bronze] Ingots.

F Höhne (Giesserei, 1933, 30, 523-525).-Ingots of 10%-tin bronze were prepared by melting the metals in neutral, oxidizing, and reducing atmospheres, and the distribution of the tin in the ingot was determined by analysis. In metal melted in an oxidizing atmosphere little inverse segregation occurred, maximum differences of only 0.4% tin in various parts of the ingot being found. In metal melted in a neutral or reducing atmosphere inverse segregation was severe, differences of up to 1.5% tin being found between the outer and inner portions of the ingot. A high moisture content in the melting atmosphere increases the amount of inverse segregation, hence, by preventing hydrocarbons and moisture from access to the melt inverse segregation may be reduced to a minimum; this may be effected by using solid fuel or electricity and by keeping a feebly oxidizing atmosphere above the molten metal. The density of ingots melted in a reducing atmosphere is less than that of ingots melted in an oxidizing atmosphere; this difference is shown to be due to gas absorption, probably hydrogen. It is suggested that this hydrogen produces inverse segregation by forcing the still fluid metal in the inner part of the casting through the dendritic crystals first formed. A. R. P.

The Manufacture of Hollander Strips of Phosphor-Bronze. Anon. (Z. ges. Giesserei-Praxis: Das Metall, 1933, 54, 511-512).—Hollanders used for pulping in the manufacture of paper are made from zinc- and iron-free phosphor-bronze with about 93% of copper and 7% of tin. The zinc and iron must be absent, otherwise the sensitive pulp may be discoloured. The strip is best cast in sand, and then compacted and hardened in a cold-roll, chill-casting is not recommended. Rolling beyond 2 mm. (from 5 to 15 mm.) only increases the cost without improving the metal. Segregation, piping, and the formation of stannic acid are difficulties to be contended with in sand-castings. The moulding and the casting of the metal is described.

\_J. H. W.

Factors Affecting the Physical Properties of Cast Red Brass (85 Cu, 5 Zn, 5 Sn, 5 Pb). H. B. Gardner and C. M. Saeger, Jr. (Proc. Amer. Soc. Test. Mat., 1932, 32, (II), 517-534; discussion, 535).-See J. Inst. Metals, 1932, 50, 427. In the discussion H. M. St. John agreed that a coarse crystalline structure results in low tensile strength but pointed out that other factors than a high casting temperature can produce such a structure, e.g. the presence

57

15

-

50

11

10

-

1

1

1

of aluminium, magnesium, or silicon. The presence of nickel or sulphur tends to counteract the effect of these impurities by producing a close-grained structure.—A. R. P.

**Brass Pressure-Castings as Produced Economically.** William W. Serg (*Iron Age*, 1933, 132, 16–19).—The Polak die-casting machine is worked by hydraulic pressure of between 3000 and 6000 lb./in.<sup>2</sup>. When the die is closed, the brass, in a semi-molten or plastic condition, is ladled into the compression chamber and forced into the die at once opened hydraulically, all cones being pulled automatically. The composition of the brass recommended by S. is copper 60, lead 0.75, tin 0.50, and zinc 38.75%. The mean physical properties of 9 such bars cast in this manner were : tensile strength 58,400 lb./in.<sup>2</sup>, elastic limit 36,417 lb./in.<sup>2</sup>, reduction of area 7.6\%, elongation 6.7%, Rockwell hardness 45-2 at the surface, and 35.8 on the section. The castings are liable to be porous and to contain blow-holes, especially in heavy sections. The surface finish is not so good as that of a forging, but better than that of a sand casting. The processes of forging and of pressure casting brass and the properties and structures of the resulting products are compared.

-J. H. W.

Tough, Strong, Permanent Die-Castings. D. L. Colwell (Metal Progress, 1933, 24, (6), 19–23).—The results of exposure tests carried out by the American Society for Testing Materials are summarized, the analyses of the 9 zinc-base alloys concerned being given. The importance of using zinc of high purity is emphasized by reference to these results. A table gives the composition and properties of A.S.T.M. alloys Nos. 21 and 23; the results of mechanical testing show that Alloy 23 possesses greatly increased resistance to the combined effects of heat and moisture, as well as improved permanence of dimension, as compared with earlier developments.—P. M. C. R.

Die-Casting Metals Set New Standards. Anon. (Machinery (N.Y.), 1933, 40, 101-103).—A general review of the properties of the alloys used in diecasting.—J. C. C.

Electrolytic Process for the Fabrication of Metal Models. [C. O. Herb] (Galvano, 1933, (20), 23-24).—Translated from Machinery (Lond.), 1932, 39, 677; see J. Inst. Metals, 1932, 50, 712.—E. S. H.

European Synthetic Moulding Sands. C. W. Briggs and R. A. Gezelius (J. Amer. Soc. Naval Eng., 1933, 45, 462–485).—Synthetic sands, such as chamotte which is essentially a highly-aluminous clay suitably treated; German Industrial Extra, which is comprised mostly of quartz and chalcedony grains; and Cement Bond Sands, which contain silica sand and a good-grade cement, are compared with Downer sand, which is a naturally bonded American sand. The composition of these various sands and their physical properties of permeability, compression, shear, tensile, and sintering point, when made up with varying water contents into green- and dry-sand moulds, are discussed, and consideration is also give to their grain distribution and to their thermal conductivity.—J. W. D.

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

\*Removal of Non-Ferrous Metal (Copper-Zinc Alloy) Layer from Plated Iron Waste. W. A. Heifetz (Zhurnal Prikladnoi Khimii (J. Applied Chemistry), 1933, [B], 6, (4), 653-664).—[In Russian, with German summary.] Owing to the shortage of non-ferrous metals in Russia the use of bimetal (plated iron) has been greatly developed. Since in various manufacturing processes a high percentage (30-50%) of scrap is produced, the problem of recovering the non-ferrous metal (in the present case copper from a 10% zinc-copper alloy) has been investigated. An electrolytic method has been developed in which the bimetal is the anode, sheet copper the cathode, and a neutral copper nitrate solution the electrolyte. The iron portion of the bimetal becomes passive, and its potential is raised to  $2\cdot12 v$ ; the film is, however, destroyed by heating above  $65^{\circ}$  C. The electrolyte has a minimum resistance at molar concentration and its resistance is independent of the cation, so that no change occurs as the copper is replaced by zinc provided that the copper content does not fall below a certain minimum (35 grm./litre). Starting with 160 grm. of copper per litre, about 1 kg. of copper can be obtained per litre of solution, the energy required being directly proportional to the current density. The spent electrolyte is diluted to precipitate the iron as hydroxide, and treated with zinc oxide to precipitate the copper as hydroxide which is redissolved in nitric acid to produce new electrolyte. The zinc nitrate solution is treated with sodium carbonate, to produce zinc carbonate and sodium nitrate.—M. Z.

# XV.-FURNACES AND FUELS

The Design of Town Gas Fired Furnaces. F. L. Atkin (Gas World (Industrial Gas Supplement), 1933, 5, (11), 8-13; discussion, 13-14).—The following are briefly discussed: types and sizes of furnaces, heat loss to flue, heat required to maintain a definite temperature, total heat transfer, thermal conductivity of firebricks, efficiency of recuperation, heat required to raise temperature of furnace, maximum heat input and combustion chamber design, burner design, and furnace construction.—J. S. G. T.

The Performance of Thermostats on Gas[-Heated] Appliances. Harry W. Smith, Jr. (*Amer. Gas J.*, 1933, (3719), 7–10, and 12).—Classes of thermostats and their operating characteristics are briefly discussed.—J. T.

[Annealing Furnaces.] H. W. L. Evans (Sixty-Third Rep. Royal Mint (Lond.), 1932, 48-49).—In the Bates and Peard annealing furnace, the charge is drawn through a water-sealed heating chamber on a chain, the bars of which are found to bend away from the direction of travel. This has been corrected by reversing the direction of travel of the chain daily, and by driving the chain wheels at both ends of the furnace simultaneously, so as to equalize the tension on the chain.—J. H. W.

Industrial Furnace with Resistances of Molybdenum. F. Lauster (*Elektro-tech. Z.*, 1933, 54, 662).—Abstract from *Elektrowärme*, 1933, 2, 103. The molybdenum resistance wires are enclosed in highly refractory tubes through which a protective gas is conducted, *e.g.* a mixture of nitrogen and hydrogen or the vapours obtained by thermal decomposition of methyl alcohol. A heating chamber  $25 \times 25 \times 60$  cm. in size requires 800 c.c. of methyl alcohol per hr. or 30 l. of nitrogen-hydrogen mixture per day.—B. Bl.

Construction and Operation of a Coreless Vacuum Induction Furnace. Werner Bottenberg (Arch. Eisenhüttenwesen, 1933, 7, 233–236). From Mitt K.W. Inst. Eisenforschung, 1933, 15, 55–58; cf. J. Inst. Metals, 1933, 53, 575.—J. W.

Determination of the Maximum Carrying Capacity of Furnace Electrodes. Bruce L. Bailey and Raymond R. Ridgway (*Trans. Electrochem. Soc.*, 1933, 63, 283-298; discussion, 298-300).—For abstract of the paper see J. Inst. Metals, 1933, 53, 383. In the discussion E. C. Sprague, R. M. Hunter, R. R. Ridgway, and Colin G. Fink discussed the power losses at joints and the rate of oxidation of graphite electrodes under various operating conditions.

—A. R. P.

Electric Heat-Treatment. Oskar Ney (Werkstatt u. Betrieb, 1933, 66, 393-395).—The electric furnace is stated to be cheaper in operation and more closely controllable than fuel-heated types; the proportion of rejections is reduced by the even distribution of heat. The following types of electric

1934

1

ŝ

÷

r.

ę

furnace are described and illustrated: (1) a 6-fold quenching and tempering furnace for continuous operation, with interchangeable and rapidly removable heating units; (2) a tilting furnace for the hardening and quenching of small parts; (3) a furnace for the rapid but controlled heating of pieces prior to forging.—P. M. C. R.

<sup>†</sup>Heat-Resisting Chromium-Nickel-Iron Alloys for Furnace Construction. L. J. Stanbery (*Metals and Alloys*, 1933, 4, 127-135, 159-164).—A comprehensive and useful review of the preparation, properties, and uses of non-scaling and distortion-free alloys of nickel, chromium, and iron for use in hightemperature work.—A. R. P.

Canadian Electric Furnace Industry. Alfred Stansfield (Trans. Electrochem. Soc., 1933, 63, 259-281).—See J. Inst. Metals, 1933, 53, 383.—S. G.

The Electric Furnace and Its Products in the U.S.S.R. C. H. Vom Baur (Trans. Electrochem. Soc., 1933, 63, 305-308).—See J. Inst. Metals, 1933, 53, 524.—S. G.

### FUELS

Low-Grade Town's Gas. Anon. (Fuel Economist, 1933, 9, 113).—Facts with regard to the distribution of low-grade town's gas (cal. val. 200 B.Th.U/ft.<sup>3</sup>) are briefly referred to.—J. S. G. T.

Application of Gas Analysis to Industrial Problems. Morton Bermann (Gas Age-Record, 1933, 72, 211-214).—Charts for determining excess air, ultimate carbon dioxide, and potential heat due to the combustion of mixtures of coke-oven gas and carburetted water-gas of known composition are discussed.—J. S. G. T.

Recent Progress in Use of Pulverized Fuel. John Rogers (*Fuel Economist*, 1933, 9, (97), 36-41). General lines of progress are outlined. In metallurgical furnaces, about 40,000 tons of pulverized fuel are used per annum in the United Kingdom. Descriptions of coal employed, cost of grinding, burner development, and application to metallurgical purposes are briefly discussed.

-JSGT

Pulverized Fuel Firing and the Grid Burner. P. Howden (*Fuel Economist*, 1933, 9, (97), 46-49).—The technique of burning pulverized fuel is briefly discussed and the design and application of the "Grid" burner developed by the Department of Scientific and Industrial Research for the combustion of pulverized fuel are described. It is claimed that the "Grid" burner requires less refractory and a smaller combustion space than any other pulverized fuel burner for the same fuel consumption. Further, on most industrial furnace applications, a combustion chamber extension is unnecessary. The burner is available in sizes consuming from 30-3500 lb. of fuel per hr.

JSGT.

Determination of the Resistance of Coal to Pulverization. F. Mathieu (Assoc. Internat. Essai Mat., Congrès de Zurich, 1932, (II), 419-420). —[In French.] The method of G. B. Gould (Pouce, 1930, 72, 880-889) is outlined and briefly discussed. —A. R. P.

Reactions of Pulverized Coal Burners. C. Campbell (Colliery Guardian, 1933, 147, 525-526).—The size of particle influences the properties of the coal cloud, to which the ordinary gas laws do not in general apply: the regulation of the ignition point, and of the maximum temperature point, is considered. The coal cloud, though entailing a great loss of heat in the combustion chamber, has valuable insulating effects in certain liquation processes; its elimination in other cases is discussed. Observations of the flow and velocity of the cloud, and the composition of gases, at the point of combustion and subsequently, should be regularly recorded; methods are indicated. Other desirable forms of record are outlined, together with some principles of economical working.—P. M. C. R.

# XVI.-Refractories and Furnace Materials 101

Sampling of Coal, Coke and other Fuels, and of Clinker and Ash. Κ. Bunte (Assoc. Internat. Essai Mat., Congrès de Zürich, 1932, (II), 304-316).-[In German.] The precautions to be taken in obtaining an accurate sample of this type of material are enumerated and discussed at length. A. R. P.

Sampling Coal. W. A. Selvig (Assoc. Internat. Essai Mat., Congrès de Zurich, 1932, (II), 349-357).—[In English.] The methods of the A.S.T.M. are briefly described .- A. R. P.

# XVL-REFRACTORIES AND FURNACE MATERIALS

# (Continued from p. 35.)

Tercod-A New Refractory Brick for Electric Furnaces. G. S. Diamond (Trans. Electrochem. Soc., 1933, 63, 301-304; discussion, 304).-For abstract of the paper see J. Inst. Metals, 1933, 53, 524. In the discussion Frank W. Godsey pointed out that the resistance of silicon carbide bonded with a small amount of carbon falls with an increase in the voltage impressed so that with very high voltages large currents will flow through the material. -A. R. P.

\*Influence of Fireclay Dust on the Chemical and Thermal Properties of Firebricks. P. P. Budnikov and E. L. Mandelgrin (Zhurnal Prikladnoi Khimii (Journal of Applied Chemistry), 1933, [B], 6, (1), 1-11).-[In Russian, with German summary.] The influence of grain-size of the fireclay on the properties of firebricks was investigated. Large grain-size increases the porosity and thus lowers the mechanical strength and increases its thermal resistance. With a large proportion of fine material (less than 0.2 mm.) deterioration in the resistance to heat changes, slagging and deformation occur. Tests with fireclay made from Tchasoviar clay containing silica 53.96, alumina 32.45, iron oxide 0.85, titania 1.01, lime 0.31%, magnesia traces, alkalis 2.56, loss on ignition 8.86%, showed that increase of dust (less than 0.2 mm.) content raises the water requirements, which thus become directly proportional to the dust content. Contraction in volume on burning increases up to 30% dust, but falls thereafter. The density increases, whilst specific porosity and water absorption power decrease with increase of dust content. Mechanical strength increases with dust content, refractory properties and deformation under load remain unaltered, whilst resistance to thermal changes falls progressively. No relation could be established between dust content and resistance to slagging. 20% appeared to be the optimum figure for the fireclay in question. Linear expansion of the bricks is inversely dependent on this volume contraction. -M. Z.

On the Testing of Refractories for Industrial Fire Hearths. Georg Ising (Tonind. Zeit., 1933, 57, 812-813).- A test-piece made up of several bricks is subjected to the direct flame of a blast furnace.-B. Bl.

The Use of Standard Firebricks in Furnace Construction. Ernst Maase (Stahl u. Eisen, 1933, 53, 1156-1161). J. W.

The Manufacture of Slag-Resistant Crucibles for High-Frequency Induction Heinz Siegel (Arch. Eisenhuttenwesen, 1933, 7, 21-23) .-- J. W.

On Protective Coats for Furnace Repairing. Paul Müller (Tonind. Zeit., Furnaces. 1933, 57, 602-604).-The conditions under which refractory coats provide protection to the brickwork of furnaces are discussed.-B. Bl.

Silica Furnace Lining for the Burning of Big Silica Bricks. Gustav Octzel (Tonind. Zeit., 1933, 57, 249-250).—Fireclay and silica brick linings for furnaces used in burning large silica bricks are compared. B. Bl.

1934

P

d'

日田田田

0

10

3

Ú.

# XVII.—HEAT-TREATMENT

#### (Continued from p. 35.)

Improved Salt Baths for Duralumin. Anon. (Aircraft Eng., 1933, 5, 242).— The containers are made in mild steel with welded joints, the corners being rounded. Calorizing is applied in order to render the steel resistant to oxidation. Specially prepared paints which undergo distinct colour changes at definite temperatures are applied to different parts of the container to indicate the temperature.—H. S.

Salt Baths for Duralumin. Chas. E. Foster (*Aircraft Eng.*, 1933, 5, 265).— A letter criticizing the use of paints which undergo colour changes at definite temperatures to indicate the temperatures of salt-baths on the grounds that the walls of the bath above the salt will have temperature gradients and the temperature indicated will not necessarily be that of the salt. It is also contended that a pyrometer having a pointer moving over a temperature and gives information of much greater value. Cf. preceding abstract.—H. S.

\*The Heat Treatment of Aluminium-Coated [Light] Alloys. G. Guidi (Alluminio, 1933, 2, 323-326).—The outer coatings of aluminium-clad light alloys of high mechanical strength may be affected in various ways by heat treatment. Thus in the case of Alclad 17 ST, a high temperature, or prolonged heating before quenching, may change the mechanical properties or the resistance to corrosion owing to diffusion of CuAl<sub>2</sub> into the aluminium coating. Optimum conditions for heat-treating Alclad are given.—G. G.

# XVIII.-WORKING

# (Continued from pp. 35-37.)

Some Faults in the Working of Gold Alloys.—I. [Effect of Phosphorus and Oxides.] E. Raub (Mitt. Forschungsinst. Edelmetalle, 1933, 7, 104– 108).—In gold alloys, especially palladium white gold alloys, the presence of phosphorus results in the formation of copper phosphide; the cast alloys can be readily worked cold, but break up badly on hot-rolling, and the sheet usually breaks into small pieces when quenched after annealing. These troubles are attributed to segregation of the phosphide or a cutectic thereof along the grain boundaries. When low-carat gold alloys are melted under non-reducing conditions, oxides of some of the base metals are liable to be included in the casting other in solution in the constituents or as minute inclusions; in the former case brittleness is usually produced, and in the latter case imperfections due to scaling or opening-up of the sheet during rolling or annealing may occur, especially with zinc or nickel oxide.—A. R. P.

Note on the Working of Lead-Base Antifriction Metal Having High Copper Content. A. Ricard and H. Ackermann (*Cuivre et Laiton*, 1933, 6, 471-473).— A description of the theoretical functions of these alloys and of the special tools necessary in their transformation into bearings, &c., in order not to diminish their antifrictional properties.—W. A. C. N.

Effect of a Backward Pull Upon the Tension Required to Draw Wire. F. C. Thompson (*Wire and Wire Products*, 1933, **S**, 400-401).—Abstract of a paper read before the Iron and Steel Institute. See J. Inst. Metals, 1933, **53**, 667.—J. H. W.

Forming Aluminium and Brass Products by the Extrusion Process. J. B. Nealcy (*Machinery* (N.Y.), 1933, 40, 140–142).—A brief account is given of the operation and construction of a 4000-ton extrusion press, taking billets 12–16 in. in diam. and having an hourly capacity of 11 tons of aluminium alloy or 20 tons of brass. Billets are heated to 875° F. (466° C.) for aluminium alloy, or 1400° F. (760° C.) for brass in gas furnaces fitted with automatic temperature control. Special arrangements are provided for easy removal of the metal left in the pressure chamber after extrusion.—J. C. C.

Forming and Fabrication of Metals in the Construction of Aircraft. Harold Crary (Metal Stampings, 1933, 6, 244-246) — A general description is given of the equipment and processes employed in the forming and manufacture of aluminium and steel parts used in the construction of all-metal aircraft. — J. H. W.

<sup>†</sup>Pressing of Non-Ferrous Metals: The Extrusion Press. W. Brunnckow (Maschinenbau, 1933, 12, 539–542).—A review.—v. G. A New Form of Edge for Coins. H. W. L. Evans (Sixty-Third Rep. Royal

(Maschilenduz, Territoria, H. W. L. Evans (Sizty-Third Rep. Hogs A New Form of Edge for Coins. H. W. L. Evans (Sizty-Third Rep. Hogs Mint (Lond.), 1932, 51). — Although in this country the amount of counterfieting is very small, it is more serious in the East. Trial blanks have therefore been made with a deep groove in the edge in which round beads are presed up in relief. The blank was then struck up in a coining press in the ordinary way, using a milled collar. The effect of coining is to close up the groove slightly so that the beads are protected, whilst it is impossible to take a satisfactory mould of the edge of the piece by the usual methods for the purpose of making a cast replica.—J. H. W.

for the purpose of making a cast replica. J. H. W. The Machining of Aluminium and Its Alloys. A. von Zeerleder (Schweiz. Tech. Z., 1933, 225-230).—A discussion of the special methods which have to be adopted in machining, by a variety of processes, aluminium and its alloys. The cutting angle and rake of the tools employed in turning are particularly described, and the many different types of work which have to be performed reviewed critically. The conditions necessary for certain special alloys are tabulated.—W. A. C. N.

alloys are tabulated. —W. A. C. A. Briedrich Behaviour of Metals During Cutting Investigated at Length. Friedrich Schwerd (Iron Age, 1933, 132, 31; and Mech. World, 1933, 94, 890).—Abstracts of a paper read before the American Society for Testing Materials and the American Society of Mechanical Engineers. See J. Inst. Metals, 1933, 53, American Society of Mechanical Engineers.

668.—J. H. W. Getting Best Results from Chromium-Plated Cutting Tools. Charles F. Bonnet (Machinery (N.Y.), 1933, 40, 212-214; and (editorial) Machinery (Lond.), 1933, 43, 248).—The chromium plating of cutting tools is advan-(Lond.), 1933, 43, 248).—The chromium plating of cutting tools is advantageous, not in producing a hard cutting edge, but in providing behind the edge a hard, self-lubricating surface to which chips do not "seize." Details of the practice followed in chromium plating various types of tools are given. Reamers which are undersize may be reclaimed by a heavy deposit of chromium.—J. C. C.

# XIX.-CLEANING AND FINISHING

# (Continued from p. 37.)

The Cleaning of Metals. III.—Theory of Alkaline Cleaner (ctd.). IV.— Some Practical Aspects of Alkaline Cleaning. V.—The Electrolytic Cleaner. S. Wernick (Indust. Chemist, 1933, 9, 275–277, 308–311, 345–348).—(III.—) The degreasing of metals in alkaline solutions is discussed from the point of view of interfacial tension and pertization. (IV.—) After showing how the best procedure for a given application depends on the nature of the metal, the treatment it has undergone, and the purpose of the cleaning, W. discusses the practical features of caustic soda, soda ash, sodium silicate, trisodium phosphate, caustic potash, potassium carbonate, trichlorethylene, and carbon tetrachloride. (V.—) Existing practice in the application of acid and alkaline electrolytic cleaners is described.—E. S. H.

### XX.—JOINING

#### (Continued from pp. 37-45.)

\*Soldering and Brazing. Arthur S. Newman and R. S. Clay (J. Instruments, 1933, 10, 333-338).—A general description of the processes of soldering and brazing with many useful practical hints. The use of the different fluxes, the making of cylindrical or conical tubes, and the hard soldering of Manganin wires are dealt with in dctail. The construction of (a) a special tool for making "stitches" to hold the edges of sheet meta together, (b) a Bunsen burner giving a high temperature, and (c) various clamps for holding pieces together is described and illustrated.—W. H. R.

The Production of Solder. Anon. (Machinery (Lond.), 1933, 43, 73).—A note on the melting and casting of lead-tin solders.—J. C. C.

**Silver Solders** (Hard Solders). W. Stein (*Mitt. Forschungsinst. Edelmetalle*, 1933, 7, 80-87, 97-103).—Recent patent and journal literature on silver solders is reviewed, and the composition, melting point, and working properties of numerous types of silver solder, including standard German, English and American solders, are tabulated.—A. R. P.

†On the Use of Silver Solders in the Chemical Industry. Robert J. Snelling and Edmund Richard Thews (*Chem. Fabrik*, 1933, 6, 443-444).—The composition and physical properties of 17 ternary copper-zinc-silver alloys are tabulated. These solders may be divided into two classes, *viz.*, silver brasses and zinciferous copper-silver alloys. The melting point is determined in the first place by the zinc content. With a constant zinc : copper ratio the melting point is reduced by increasing the silver content. Alloys with 70% silver have a minimum melting point ( $750^\circ$ - $760^\circ$  C.) when the zinc : copper ratio is 1 : 2, and alloys with 65% silver when the ratio is 4:3 ( $720^\circ$  C.). Substitution of part or all of the zinc by cadmium has very little effect on the melting point, whilst addition of tin reduces the malleability. Addition of nickel to ternary alloys increases the strength and hardness and improves the resistance to corrosion without producing embrittlement. Iron and lead should never be present. Details are given of methods of using the solders with various metals and alloys.—A. R. P.

The Electric Arc-Welding of Aluminium. L. Anastasiadis (*Elektroschweissung*, 1933, 4, 166–168).—The main difficulties in arc welding aluminium are the great heat conductivity, the instability of the arc, and the rapid formation of alumina. These are overcome by preheating the parent metal and using electrodes with a suitable flux coating. The last is of great importance; it must be mechanically strong, produce a stable arc, and give a slag which will dissolve alumina and have a lower sp. gr. than the weld metal. The electrode should be connected to the positive pole and should be of slightly greater diameter than the thickness of the sheet to be welded. The current used varies from 60–100 amp. for 2 mm. sheet to 250–300 amp. for 7 mm. sheet, and the arc voltage is 20–28 v. Typical test figures are given in the article.—H. W. G. H.

Gas Welding of Aluminium and Its Alloys. Herbert Herrman (Welding Ind., 1933, 1, 303-306, 347-350).—A detailed description of good practice in welding sheet and casting.—H. W. G. H.

Aluminium Welding Technique. Anon. (Automotive Ind., 1933, 69, 705 706).—A summary of recommended practice for torch, arc, butt, and spot welding.—P. M. C. R.

Welding the Aluminium Alloys. G. O. Hoglund (Welding Eng., 1933, 18 (9), 28-31).—Practical information is given on oxy-acetylene, metallic arc, and resistance welding. For welding purposes, the wrought alloys are divided into two groups—"cold-worked" and "heat-treatable." For the former, pure aluminium is used as welding rod, and, for the latter, a 5% silicon alloy rod is recommended. For spot-welding the modern methods of 0

control-" shot-welding " or thyratron valve-are considered essential in most cases .- H. W. G. H.

Welding High-Chromium Alloys. Anon. (Machinery (Lond.), 1933, 43, 266).-A note. The use of a neutral flame and a flux of 3 parts of borax fused with 1 of silica is recommended.-J. C. C.

Welding Copper by the "Long-Arc" Method. W. J. Chaffee (Welding Eng. 1933. 18, (9), 20-23).—This newly developed method of carbon-arc "welding " requires a special filler rod, called " Hobronze," which contains tin and phosphorus. High welding speeds, minimum distortion, and low cot are claimed. Welding machines capable of delivering full amperage with a long arc of high voltage (up to 50 v.). Typical jobs are described. The process has been successfully applied to "bronze" welding and for welding , welding and for welding copper to steel .- H. W. G. H.

Welding Copper Piping for Process Industries. Anon. (Welding, 1933, 4. 468).—Three types of joint are used, according to the temperature conditions-welded, bronze-welded, and silver soldered.-H. W. G. H.

Welded Joints in Copper and Copper Alloy. Ira T. Hook (Machinist (Eur. Edn.), 1933, 77, 720-724).—The difficulties in welding copper are loss in strength of the metal near the weld, the redistribution of cuprous oxide in the weld, and the high heat conductivity of the copper. The more commonly used welding rods are copper deoxidized with silicon or phosphorus, phosphorbronze, or Everdur. The method of welding with the last is set out in detail, the carbon arc being preferred to the oxy-acetylene torch. The properties and the structures of the different types of weld produced are described.

J. H. W.

An Oxwelded Copper Tank. Anon. (Oxy-Acetylene Tips, 1933, 12, 227-228).—A vessel for acetic acid storage is described. It is 20 ft. high  $\times$  10 ft. diam., and is fabricated from  $\frac{1}{4}$  in. thick deoxidized copper, by oxy-acetylene welding. The importance of using deoxidized material is explained.-H. H.

Small Welded Everdur Tanks. Ira T. Hook (J. Amer. Weld. Soc., 1933, 12. (10), 14-21).-Domestic hot-water tanks were formerly made of coldrolled copper with soldered or brazed seams. Modern conditions of heavy duty make welded seams essential. Since, in copper, the strength of a weld is less than that of the cold-rolled material, the use of Everdur is recommended, and detailed instructions are given for welding it by oxy-acetylene, metallic are, carbon arc, and resistance methods.-H. W. G. H.

Re-Surfacing Parts Subject to Wear with Manganese-Bronze. Anon. (Soudeur-Coupeur, 1933, 12, (10), 8).-Such parts as the heads of Diesel engine pistons, distributing valves of petrol pumps, &c., may be repaired by applying a layer of manganese-bronze by means of the blowpipe. Two examples are illustrated .--- H. W. G. H.

Welding of Commercial Yellow Brass Pipe. Anon. (Ory-Acetylene Tips, 1933, 12, 245-248).-Detailed instructions are given for welding alpha brass pipe of 4-in. bore. A butt joint with a 90° vee is recommended and a special bronze welding rod is used with a slightly oxidizing flame Test and cost data are given and the article is illustrated by photographs, showing the technique adopted, and by photomicrographs showing the structure of the welds obtained. -H. W. G. H.

Oxy-Acetylene Welding of Brass and Bronze Sheets. Herbert Herrman (Welding Ind., 1933, 1, 207-210).-Also published in Met. Ind. (Lond.). 1933, 43, 145-148. See J. Inst. Metals, 1933, 53, 587.-H. W. G. H.

Welding of Nickel-Chromium Wires and Tapes. Anon. (Japan Nickel Rev., 1933, 1, 374-375).-[In English and Japanese.] A list of the chief difficulties met with in welding operations of this nature, and suggestions as to the means for overcoming them in the most efficient way. Conditions for arc welding and for oxy-acetylene welding are summarized. -W. A. C. N.

105

1

×

2

13

# XXI.—INDUSTRIAL USES AND APPLICATIONS

#### (Continued from pp. 45-52.)

Aluminium, the Metal of the Present and the Future. Anon. (Machinery (N.Y.), 1933, 40, 81-84).-Typical applications of aluminium, including its use in railroad stock construction, dragline excavators, and structural work are described and illustrated.-J. C. C.

Light Alloys in Commercial-Vehicle Diesel Engines. Anon. (Nickel Bull., 1933, 6, 153-154) --- A brief account is given of the applications of R.R. and Y alloys in the construction of commercial-vehicle Diesel engines .-- J. H. W.

Aluminium Cylinder Heads. F. F. Kishline (Automobile Eng., 1933. 23, 209-210).—A paper presented to the Society of Automotive Engineers (U.S.A.). See J. Inst. Metals, 1933, 53, 530.—J. W. D.

The Use of Aluminium in Shipbuilding. (Sir) Westcott Abell (Shipping World, 1933, Aug. 16, 23; Aluminium Broadcast, 1933, 4, (15), 13-20).-The application of aluminium alloys in ship construction is reviewed, with particular reference to the elimination of fire hazard, weight reduction. corrosion-resistance, and the construction of furniture and ships' equipment.

J.C.C.

Aluminium Radiators-The New Heating Units for Central Heating A. Eigenmann (Schweiz. Tech. Z., 1933, (17), 245-249).—The theoretical considerations involved in the transfer of heat from the primary heating medium through the material of the radiators to the outer air are discussed. The relative advantages and disadvantages of iron, steel, copper, and aluminium radiator elements are critically reviewed. In the newest designs of aluminium construction the heating elements are placed within the wall, usually below window level. Minimum loss of heat and correct directional distribution of heat are claimed for this arrangement.-W. A. C. N.

Aluminium and Chemical Industry Material. E. De la Rozière (Rev. Aluminium, 1933 10, 2219-2227).-The properties of aluminium which render it especially suitable for use as a constructional material in the chemical industry are described. Of these properties, those especially considered are the passivity of the metal and its alloys and the enhancement of the passivity by such processes as the M.B.V., and the behaviour of aluminium in the presence of hydrogen sulphide. The use of aluminium in machinery dealing with fatty products, and painting with aluminium powder are described.

-J. H. W.

The Application of Duralumin in Vehicle Construction. ---- Arntzen (Automobiltech. Z., 1933, 36, 628-629).-Abstract in extenso of a paper read before the Automobil- und Flugtechnische Gesellschaft, Berlin, Nov., 1933. The composition, cost, and applications of Duralumin are considered. Certain problems arise from its use, whether in engines, body, or superstructure; the economies effected depend, at the present high price of the alloy, on the readjustments by which these difficulties have been met.-P. M. C. R.

Effectiveness of Paints in Retarding Moisture Absorption by Wood. F. L. Browne (Indust. and Eng. Chem., 1933, 25, 835-842).-The protection against moisture absorption afforded to wood by coatings of primers and paints was studied by the Forest Products Laboratory method. Coatings of ordinary paint applied over an aluminium paint primer are more effective than those applied over a granular pigment primer. Primers highly effective against moisture movement can be made with aluminium powder provided that a finely divided grade of powder be used in a special varnish vehicle.-F. J.

# XXIII.-BIBLIOGRAPHY

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

# (Continued from pp. 54-59.)

\*American Society for Testing Materials. Book of A.S.T.M. Tentative Standards. Issued annually. 1933. Med. 8vo. Pp. xxviii + 1136. Philadelphia, Pa.: American Society for Testing Materials, 260 S. Broad St. (Paper, \$7.00; cloth, \$8.00.)

The term "tentative" is applied to a proposed standard which is to be published and distributed in order to elicit comments and criticisms for all who are interested. Because of their careful development by the A.S.T.M. committees and critical examination by the society prior to publication, these tentary standards have important applications and are widely used in industry. The volume contains tentarize specifications methods due to their careful development by the A.S.T.M. committees and the allied testing the society prior to publication, these tentary standards have important applications and are widely used in industry. The volume contains tentarize specifications and the society prior to publication of terms evering entire regiment and the allied testing in the society prior to publication of terms evering entire regiment and the allied testing in the society prior to publication of terms evering entire regiment and the allied testing in the first line dustry. The volume contains tentarize specifications and magnesium ingot and stick for remeting. New tentative test methods include impact testing of metallic materials, short time high temperature tension tests, and " creep revised : Aluminium-base sand-casting allows in most form a luminium-base alloy sandcastings; aluminium alloy (Duralumin) bars, root and shapes (aluminium-coppermagnesium-manganese); aluminium short and plate; aluminium alloy (Duralumin) sheet and plate (aluminium-copper-magnesium manganese); aluminium alloys; determination of phosphorus in copper base alloy discussing; chemical analysis of metallic materials for learned allows in most form for sand-castings; aluminum-base alloy discussings; themical analysis of metallic materials for learned heating, compression testing of metallic materials; Rockwell hardness testing of metallic materials; verification of testing machines.]

\*American Society for Testing Materials. Index to A.S.T.M. Standards and Tentative Standards. Med. 8vo. Pp. 124. 1933. Philadelphia, Pa.: 260 S. Broad St. (Gratis.)

This very us fulindex has been completely revised, and, while the method of indexing is essentially the same, the subject matter has been rearranged to enable references to be located even more quickly than heretofore.]

- Bachmetew, E. F., A. A. Botschvar, G. S. Shdanow, and J. S. Umanski. The Recrystallization of Metals. [In Russian.] Pp. 351. 1933. Moscow and Leningrad : Gosmaschmetisdat. (Rbl. 8.)
- \*Bacon, F. Fatigue and Corrosion-Fatigue, with Special Reference to Service Breakages, with a Summary of Discussion by the South Wales Branch and Written Communications. Demy 8vo. Pp. 32 + 685-736, illustrated. 1933. Newcastle-on-Tyne: Institution of Mechanical Engineers, North-Eastern Branch.

[This paper has been printed in the *Proc. Inst. Mech. Eng.*, which however, does not contain the valuable discussion here published at the expense of the North-Eastern Branch of the Institution.]

- de Belin, G. A., and E. E. Bradbury. Key Words to the Metallurgy of Steel. Post 8vo. Pp. 24. with 1 figure. [1934.] Sheffield: Greenup and Thompson, Ltd. (6d.)
- \*British Aluminium Company, Limited. Aluminium Sheet Metal Work. (No. 357; superseding No. 296.) 7 × 9 in. Pp. 68, illustrated. 1933. London: The British Aluminium Co., Ltd., Adelaide House, King William St., E.C.4.
- \*Childs, W. H. J. Physical Constants : Selected for Students. Post Svo. Pp. viii + 77. 1934. London : Methuen and Co., Ltd. (2s. 6d. net.)
- \*Dammer, Otto. Begründet und in erster Auflage herausgegeben von. Chemische Technologie der Neuzeit. In zweiter, erweiterter Auflage,

bearbeitet und herausgegeben von Franz Peters und Herm. Grossmann Unter Mitwirkung von — Alexander, — Arndt, — Baudrexel, — Baumhauer, — Beck, — Berdel, — Bergander, — Bertelsmann, — Börnstein — Brecht, — Bresser, — Brieger, — Brisker, — Brode, — Bujard, — Classen, — Cohn, O. Dammer, — Davidsohn, — Durst, — Eger Endell, — Engelhardt, — Evers, — Eyer, — Faust, — Ferenczi, E. J. Fischer, (Reg. Rat. Dr.) — Fischer, — Friedrich (Biebrich), — Friedrich (Stassfurt), — Geibel, — Gerhardt, — Geuther, — Goehring, — Graefe — Haegermann, v. Hagen, — Heiduschka, — Henkel, — Herzfeld-Hoffmann, — Herzfeld-Wuesthoff, R. Hoffmann, — Jaeckel, — Junkmann, — Kast, — Kausch, — Kissling, — Knigge, — Kolb, — Koschmieder, — Kreth, — Krifka, — Kühle, — Kuttenkeuler, — Leitner, — Lohmann, — Luhmann, — Meyer, Jakob Meyer, Alfred R. Meyer, — Muth, — Napthali, P. Neumann, — Perndanner, — Rammstedt, — Riemann, — Ristenpart, — Rocha-Schmidt, — Schauwecker, Erich Schmidt, Max Schmidt, — Schmitz-Dumont, — Schnegg, — Schauth, v. Schwarz, — Sembach, — Serger, — Springer, — Stahl, — Stephan, — Stooff, — Valenta, — Willstaedt, — Wipfler, H. Wolff, — Wulff, und — Wüstenfeld. Fürf Bände. II Band, 2 Teil. 4to. Pp. xvi + 888, with 343 illustrations. 1933. Stuttgart : Ferdinand Enke. (Geh, R.M. 93; geb., R.M. 98.)

- \*Department of Scientific and Industrial Research. Report for the Year 1932-1933. Presented by the Lord President of the Council to Parliament by Command of His Majesty, December, 1933. (Cmd. 4483.) Med. 8vo. Pp. iv + 189. 1934. London: H.M. Stationery Office. (3s. net.)
- \*Engineer, The. The Engineer Directory and Buyer's Guide, 1934-1935. Pp. 248. London : "The Engineer," 28 Essex St., W.C.2.
- \*Ephraim, Fritz. A Text-Book of Inorganic Chemistry. English edition by
   P. C. L. Thorne. Second edition, revised and enlarged. Roy. 8vo.
   Pp. xii + 873, with 85 illustrations. 1934. London and Edinburgh: Gurney and Jackson. (28s. net.)
- \*Glasstone, Samuel. Electrometric Methods in Physical and Analytical Chemistry. Demy 8vo. Pp. 39, with 10 illustrations. 1934. London: Institute of Chemistry of Great Britain and Ireland, 30 Russell Sq., W.C.1.
- \*Kroenig, W. O., and G. A. Kostylew. Corrosion of Magnesium Alloys. Part 11.—Corrosion of Cast Magnesium Alloys. [In Russian, with English summary.] (U.S.S.R. The People's Commissariat for Heavy Industry United Aircraft Industries; Transactions of the Research Institute for Aircraft Materials, No. 4.) Sup. Roy. 8vo. Pp. 60, with 15 illustrations. 1933. Moscow and Leningrad: State Technical Bookshop. (Rbl. 1 20 k.)
- Kroenig, W. O., and G. A. Kostylew. Corrosion of Magnesium Alloys. Part 111. — Influence of Heat-Treatment on the Corrosion of Cast Magnesium Alloys. [In Russian, with English summary.] (U.S.S.R. The People's Commissariat for Heavy Industry United Aircraft Industries; Transactions of the Research Institute for Aircraft Materials, No. 5.) Sup. Roy. 8vo. Pp. 31, with 55 illustrations. 1933. Moscow and Leningrad: State Technical Bookshop. (60 k.)
- \*Kroenig, W. O., and G. A. Kostylew. Corrosion of Magnesium Alloys. Part IV.—The Corrosion of Magnesium and Elektron in Contact with Other Metals. [In Russian, with English summary.] (U.S.S.R.

The People's Commissariat for Heavy Industry United Aircraft Industries: Transactions of the Research Institute for Aircraft Materials, No. 7.) Super Roy. 8vo. Pp. 25, with 17 illustrations. 1933. Moscow and Leningrad: State Technical Bookshop. (60 k.)

- Levinstein, Herbert. The Chemist as a Directing Force in Industry. The Fifth S. M. Gluckstein Memorial Lecture, 1933. Demy 8vo. Pp. 22. 1934. London: Institute of Chemistry of Great Britain and Ireland, 30 Russell Sq., W.C.1.
- \*Lundquist Eugene E. Strength Tests of Thin-Walled Duralumin Cylinders in P. B. ndi g. (Technical Notes, National Advisory Committee for Aeronautics, No. 479.) [Mimeographed.] 4to. Pp. 10. with 7 figures. 1933. Washington: National Advisory Committee for Aeronautics.
- \*Panseri, Carlo. La Fonderia d'Alluminio. Metallografia e Tecnologia delle Leghe Leggere da Fonderia. Roy. 8vo. Pp. xvi + 582, with 311 illustrations. 1934. Milano: Ulrico Hoepli. (L. 65.)
- \*Pilcher, Richard B. Alchemists in Art and Literature. Demy 8vo. Pp. 54, illustrated. 1933. London: Institute of Chemistry of Great Britain and Ireland, 30 Russell Sq., W.C.1.
- \*Pohl Ernst. Hilfsbuch für Einkauf und Abnahme metallischer Werkstoffe. Demv 8vo. Pp. viii + 143, with 88 illustrations. 1933. Berlin: VDI-Verlag G.m.b.H. (R.M. 8; VDI-Members, R.M. 7.20.)
- \*Whittick, G. Clement. Roman Mining in Great Britain. (Excerpt from Transactions of the Newcomen Society, Vol. X11, 1931-1932.) 4to. Pp. 28, with 2 plates. Newcomen Society.
- Med. 8vo. Pp. ix + 289, with 204 illustrations. 1934. Leipzig: Akademische Verlagsgesellschaft m.b.H. (Br., R.M. 12.60; geb., R.M. 14.)

#### THESES.

- \*Boss, Arno. Die deutsche Hüttenindustrie der Metallegierungen. Entwicklung und volkswirtschaftliche Bedeutung der Industrie der Aufbereitung von Altmetallen und Rückständen von Kupfer, Zinn, Zink, Blei und deren Legierungen. Inaugural-Dissertation zur Erlangung der Doktorwürde genehmigt von der Philosophischen Fakultät der Friedrich-Wilhelms-Universität zu Berlin. Med. Svo. Pp. 83. 1931. Berlin: Bibliothek der Friedrich-Wilhelms-Universität.
- \*Parks, Margaret Merriman. A Gravimetric Method for the Quantitative Determination of Vanadium. Dissertation submitted in Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy in the Faculty of Pure Science, Columbia University. Med. 8vo. Pp. 23. New York: Columbia University.
- \*Rosenberg, Ernst. Untersuchungen über Elektrolytische Metallabscheidung. Inaugural-Dissertation zur Erlangung der Doktorwürde genehmigt von der Philosophischen Fakultät der Friedrich-Wilhelms-Universitat zu Berlin. Demy 8vo. Pp. 31, with 18 illustrations. 1932. Berlin: Bibliothek der Friedrich-Wilhelms-Universität.

## NEW PERIODICAL.

Wire Industry. Vol. I, No. 1 (Jan., 1934). 5 Fetter Lane, London, E.C.4. Published every second Thursday in each month (£1 1s. per annum, post free).

109

# XXIV.—BOOK REVIEWS

#### (Continued from pp. 60-64.)

Praktische Metallkunde. Erster Teil: Schmelzen und Giessen. Von Georg Sachs. Med. 8vo. Pp. viii + 272, with 323 illustrations in the text and 5 plates. 1933. Berlin: Julius Springer. (R.M. 22.50.)

This important and welcome publication gives a survey of a vast amount of available information on melting and casting metals and the properties of castings. The treatment of the subject has been planned to make the book of service to those engaged in the technical field.

The author, who is well known for his own scientific work in metallurgy, shows an exceptional acquaintance with English and American publications on these subjects, and the numerous references to original papers add greatly to the value of the book.

The first main section (pp. 1–110) deals fully with the processes of melting and solidification assembles the data on the properties of molten metals, and clearly indicates the role they play in the manipulation and subsequent solidification of the cast metal. Frequent indications occur throughout the book of the limitations of existing knowledge, which should be stimulating to further work in this branch of metallurgy, for many years too much neglected.

The second section (25 pp.) treats of ingots and the moulds in which they are cast, but even allowing for the limitation of the work to non-ferrous metallurgy, rather fuller treatment would have been welcome.

The third section (about 130 pp.) is concerned with finished castings and their production. Here the following, amongst other matters, are dealt with: casting processes, casting properties of alloys, cracks and stresses in castings, dependence of strength on casting conditions, testing of castings. Finally, five plates give the constitution of the more important non-ferrous alloys.

All who are concerned with the control of commercial production should share with research metallurgists the advantage which they can gain by reading and using this book. Many engaged in the working of metals are already alive to the value of knowledge on the subjects here dealt with, but far too few of those who produce finished castings appear to be concerned with these fundamental data, on which improvement of their products so much depends. The publishers have succeeded in fixing a price which shows a welcome reduction on some of their recent achievements.

Metallurgical Analysis by the Spectrograph, being Some Experiences of the Application of the Spectrograph to the Analysis of Non-Ferrous Metals and Alloys. By D. M. Smith. With a Foreword by H. W. Brownsdon. Roy. 8vo. Pp. xi + 114, with 8 illustrations in the text, and 10 plates. 1933. London: British Non-Ferrous Metals Research Association, Regnart Buildings, Euston St., N.W.1. (10s. 6d.)

This is the first book about spectrographic analysis written primarily for the metallurgical worker; it is very welcome. It opens with an admirably concise statement of the principles and methods of spectrum analysis, and a cautious statement of what the method may be expected to do. The technique of various methods is then clearly described; the author wisely concentrates on methods which have proved their value in routine work, to the neglect of a few more complicated and specialized methods. All the essential facts and formulæ are given, and there are ample references to the methods of other workers.

The main part of the book deals with quantitative analysis, and includes many tables of spectrum lines for the analysis of the common metals, together with reproductions of spectra which help in the identification of the lines.

To test the utility of these tables the book was put in the hands of a beginner in spectrum analysis, an experienced chemist who has been using a spectrograph for a short time. He was asked to analyse a sample of commercially impure tin by the spark method, and one of fire-box copper by the arc. In the first case his results were disappointing, in the second they were satisfactory, and the criticisms which follow are partly based on observation of his work.

The section on technique for spark spectra would be improved by the inclusion of a short list of the more prominent lines due to air usually found in the spark spectra of metals, as these are often difficult to identify.

In a lecting pairs of lines for quantitative comparison the author has occasionally not been critical enough. There are some pairs of lines which appear equal when photographed with one spectrograph but cannot be made to appear equal when photographed (under the same conditions) with a spectrograph of different dispersion. Such lines are troublesome to identify, but they are even more troublesome to use, and some of the difficulties arising in the analysis of tim may be traced to this cause. Also pairs of lines are sometimes included which are so far separated in the spectrum that the choice of a different photographic plate by the analyst -

251

-

-

西田

may lead to amazingly large errors. The table for lead in zinc is the worst in this respect, those for copper in tin, tin and cadmium in lead, also contain dangerous lines.

A warning footnote might have been appended to the tables as to this point, and also the the tables for cadmium and tin in lead, iron in copper, which include some pairs of lines of which one is an arcline, one a spark line. Deductions from such lines are reliable only if the operator has been lucky as well as careful in controlling conditions.

The tables have occasional notes warning users of possible coincidences between lines of different metals, but directions are not given for detecting whether these coincidences have

occurred, which is usually possible by reference to other lines in the spectrum. On the whole, the tables are excellent, clear, and easy to use, and contain only one misprint The table for bismuth in lead is remarkable in that it gives instruction for differentiating between 0.085 and 0.09 per cent. of bismuth; elsewhere the accuracy to be expected is of the

order of 25 per cent. An adequate bibliography and index complete the book, the detailed information and ample illustrations of which make one grateful to the publishers as well as the author for a most valuable work -E. VAN SOMEREN.

Praktikum der chemischen Analyse mit Rontgenstrahlen. Von G. v. Hevesy und E. Alexander. Pp. iv + 80, with 17 illustrations. 1933. Leipzig : Akademische Verlagsgesellschaft m.b.H. (M. 4.80.)

New methods of supplementing chemical analysis by physical means appear from time to time, and the use of X-ray spectra, although discovered later than that of optical spectra, has already reached an equally advanced stage of development. This more rapid development is partly due to the fact that in the application of X-rays to analysis practice has marched hand in hand with theory, instead of preceding it by many years, as with optical spectra; also the field covered by the X-ray method is more restricted.

This booklet is essentially a manual for the actual user of X-ray methods; it wisely assumes little previous knowledge on the reader's part, and opens with a clear outline of the principles of X-ray emission, and its application to analysis. Then follow chapters on qualitative analysis, and on quantitative analysis. The materials dealt with include most of the metals, usually as compounds in powder form.

Half the book deals with apparatus and experimental technique; it gives complete instructions for carrying out an analysis, and many valuable tables. Besides the tables of wavelengths of lines and absorption-edges due to the elements, the authors give a table of the most useful line pairs for comparison in quantitative work. This is followed by a most instructive table setting out all the coincidences or overlappings which are likely to occur, and which may lead to errors or render certain analyses impossible.

Some text-books are like guide books, others are like maps, essential to the traveller in their field, but less interesting to the general reader. This book and that on spectrum analysis by Mr. Smith are in the map class .--- E. VAN SOMEREN.

Traite de Photo-métallographie. Par Louis Villemaire. Demy 8vo. Pp. 125, with 25 illustrations. 1932. Paris: J. Danguin. (21 francs.)

The title of the book might suggest that it would be of interest to metallographers and metallurgists generally. It is, however, concerned with the subject of photographic process reproduction, and while apparently a very useful and practical treatise, it is written for that industry, and its metallurgical aspect is confined to the use of the zine plates in the processes described .- O. F. HUDSON.

# Technique of Modern Welding. By P. Bardtke. Authorized Translation from the Second German Edition, with Additions and Revision by Prof. Bardtke, by Harold Kenney. Med. 8vo. Pp. xi + 299, illustrated. 1933. London and Glasgow : Blackie and Son, Ltd. (15s.)

The German edition was reviewed in J. Inst. Metals, 1933, 53, 429. The comments then made are applicable, almost in toto, to this excellent translation. It must still be considered a German text-book, and the defects of the sections on non-ferrous welding remain. It is to be regretted that the translator could not give of his own knowledge in that sphere of welding. Nevertheless, it cannot be denied that, as he claims in his preface, "the book will remain of valuable assistance to the student, engineer, draughtsman, and operative for many years to come." The book is well produced and an adequate index is provided.

-H. W. G. HIGNETT.

# The Use of Copper in Plumbing. By A. C. Martin. Post 8vo. Pp. v1 + 121 + xiii, with 41 illustrations. Manchester : Plumbing Trade Journal Co., Ltd., 9 Albert Sq. (2s. 8d., post free.)

The use of copper for water services is now so extensive that this little book, which has been produced for the benefit of plumbers, should meet a very real need.

1×

15

-

)È

四十四 四十四十四十四

After a brief review of the properties of copper in relation to its application in water services, the jointing of copper tubes, the welding and technique of welding, and the bending of copper tubes are dealt with and illustrated adequately, and in a practical manner. The book concludes with chapters devoted to the use of copper in cold-water service, in hot-water service, and in sanitary service.

The book is written in a clear and simple style and should prove a very useful little handbook.-O. F. HUDSON.

Les Bases Scientifiques de la Soudure Autogène. Par Albert Portevin. Conférence fait à la Société des Ingénieurs Soudeurs, le 27 Avril, 1933. Med. 8vo. Pp. 32, with 3 illustrations. 1933. Paris : Institut de Soudure Autogène, 32 Boulevard de la Chapelle.

This is a fascinating paper by one of the greatest of all metallurgical philosophers. One cannot usefully comment upon it; one can only recommend all to read it. It will profit even those who have no practical interest whatever in welding.

M. Portevin considers, in very great detail, the phenomena of welding, applying to each the known laws of metallurgy and illustrating each application. Autogenous welding is defined as a process by which local fusion, and usually addition of identical or similar metal, produces metallic continuity in a joint, in such a way as to realize, as far as possible, complete homogeneity of the useful properties of the material. The local fusion has three effects—the metallurgical reactions with surrounding media (atmosphere, slag, &c.). The influence of these effects on chemical composition, physico-chemical constitution, structure, and internal stress, is discussed in order to arrive at a definition of weldability. An expression  $C \times H$ , is deduced for the coefficient of weldability, where C is a function of the soundness of the joint, and H is a function of its homogeneity.—H. W. G. HIGNETT.

Handbook of Chemistry and Physics. A Ready-Reference Book of Chemical and Physical Data. Edited by Charles D. Hodgman. Eighteenth edition. Fcap. 8vo. Pp. xiii + 1818. 1933. Cleveland, O.: Chemical Rubber Publishing Co., West 112th St. and Locust Avenue. (\$6.00.)

The eighteenth edition of this very useful handbook of chemical and physical data appears as the book reaches its twentieth year of existence. As in previous editions, considerable revision of much of the data has taken place and new features have been incorporated. The most important revision is that of the table of physical constants of inorganic compounds. This table, in addition to the revision of the data concerning the substances previously included is extended by the addition of nearly one thousand fresh compounds. The metallic derivatives of organic compounds have been brought together in a separate table (pp. 398-433). The descriptive matter concerning the elements has been revised and rewritten. All the radioactive elements and the newly discovered elements have been included. New tables are introduced on (i) the volumetric primary standards, (ii) the efficiency of drying agents, (iii) liquids for the measurement of refractive index by the immersion method, (iv) density of solutions of hydrofluosilicic acid. The research of the current year on isotopes is included in a table which gives the characteristics of all the known isotopes.

The present edition of the handbook is, if this is possible, an improvement on the preceding edition; it is a work of reference which should be in the hands of all engaged in the study or practice of chemistry, physics, and engineering. The book may be whole-heartedly recommended.—JAMES F. SFENCER.

# Chemical Guide-Book. Ninth Edition. Pp. 600. 1933. New York: Chemical Markets Incorporated. (Price \$2.00.)

The book is divided into five parts: I, a catalogue of leading American chemical firms arranged alphabetically; II, an alphabetical list of chemical and allied products with brief notes of their properties and uses and a list of American suppliers; III, a geographical directory arranged alphabetically by state and town; IV, a buyer's guide for containers, packing and hupping applies and V chemical statistics showing comparative prices of important heavy and fine chemicals, mendiar, and allied products. The American purchaser will find herein all the information be requires on where to purchase a chemical product, how it is shipped, the various grades available, and tariff data.—A. R. POWELL.